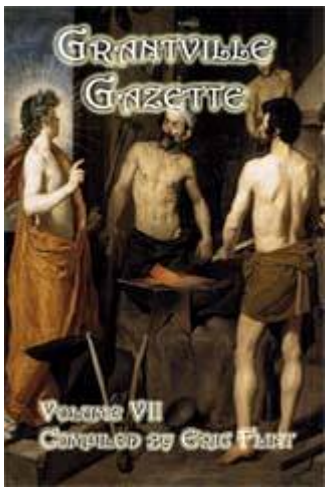
Grantville Gazette: Volume VII

Compiled by Eric Flint



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ASSISTANT EDITOR'S PREFACE

Eric said, in the preface to Grantville Gazette Volume Five:

"Sigh. Not*one* of these stories deals with Ye Big Picture. Not*one* of them fails to wallow in the petty details of Joe or Dieter or Helen or Ursula's angst-ridden existence.

Pure, unalloyed, soap opera, what it is."

And we continue in our grand soap operatic tradition with Grantville Gazette (count 'em) Volume Seven.

Is Jon and Linda Sonnenleiter's introduction of up-time style pizza to Naples critical to the war? Nope.

Don't think so. Neither is Mark Huston's quiet story about an elderly couple and their choices. But the fans don't much care, we've found.

Ditto for John and Patti Friend's crew of misfits who, somehow, make their way to Magdeburg. They're not important to the events we'll all read about in*1634: The Baltic War* , at all. Neither is Virginia DeMarce's Minnie Hugelmair or Tina Marie Hollister. They're just not at all the type to get involved in politics and war.

No more so is Russ Rittger's Chad, who manages to find himself as something of a laundry mogul, or Terry Howard's Jimmy Dick, who seems to drink himself into a philosophical mood with some regularity.

On the other hand, Rick Boatright's radio heads just might have an effect on that little altercation up in the Baltic, and there's just no telling what Kerryn Offord's Dr. Phil might come up with next. Kim Mackey's Colette . . . well, she's got this really, really rich relative who just might come in handy to know.

And, if you'd like to build a Victrola, explore the mass media implications, plan the route for a railroad—not to mention learn about the engines for the trains, well, this is the place. Chris Penycate, Gorg Huff, Carsten Edelberger, Iver Cooper and I will tell you what we know about those.

So, grab your coffee (or whatever beverage), load up on the chocolate bonbon's, kick back in the chair, and have a good time. We hope you enjoy reading it as much as we enjoyed putting it together.

Paula Goodlett and the Editoral Board
April 2, 2006

FICTION

Canst Thou Send Lightnings?

By Rick Boatright

In like manner the lightning when it breaketh forth is easy to be seen; and after the same manner the wind bloweth in every country.

(Deuterocanonical Apocrypha, The Epistle of Jeremiah:61)

To: The Provincial of the Society of Jesus in Rome
From: Adolph Wise S.J., University of Eichstaett.

Enclosed with this letter you will find an example of the 'Crystal Radio' that is being distributed throughout Thuringia. I enclose also instructions for the construction of more of these Radios as distributed by the American government.

I testify, of my own knowledge, further attested by the witnesses signatures hereto affixed and sealed, that anywhere within fifty miles of Grantville on most evenings, when you place your ear next to the opening in the box, you can hear voices and music and other sounds which originate

miles away in Grantville. These voices are sent through the air itself by the lightnings into the wires of the Radio. The Radio is delicate and fails to function with the least mis-adjustment. However, when adjusted properly, at the correct time of day anyone can hear the Voice of America sent forth from the great stone tower of the Radio Station in Grantville.

No one that I have spoken with here in the university can begin to understand how this works. The Americans insist that this is nothing but another of their mechanical arts, related to the "electricity" of which I wrote in an earlier letter. They maintain that there is nothing more involved than the proper arrangement and composition of mundane physical materials. If so, then, as with so many other devices to be found in and around Grantville, it is the knowledge they possess that is important.

I have spoken with the local clergy, and they inform me that the Radios are being built mostly by jewelers and others who are used to working with fine wires and small detail work. There are others who are working on the equipment to send the lightnings from the great tower to the Radios. Again, the local clergy tell me that this equipment, although considerably more robust than the Radios, is still remarkably delicate in some ways and requires the deft touch of jewelers and similar folk.

The Americans insist that they welcome students. They also are training workers to assist in building their next "Radio Station," which they plan to locate in Magdeburg. When completed, it will be placed at Gustav Adolphus' disposal. It is said that he intends to use this voice to promote Lutheranism.

I beg of you to find within our ranks a young man, skilled in the jeweler's arts and firm in the Church, and send him to us. Some one of us must take this training, in order that we may first gain the knowledge of how this art works, and second, perhaps in some way delay or prevent the establishment of Gustavus Adolphus' Voice of Luther. Simultaneously, we must work to produce a Radio Station that can bring to the people the saving grace of the Holy Mother Church.

Signed
Adolph Wise S.J.
(and 12 other witnesses.)

Father Nicholas Smithson lowered the letter, and looked at Father Andrew White, his superior in the Society of Jesus. "Do you believe this, Father Andrew?"

"It does not matter what I believe, Nicholas. The Father General of the Society may or may not believe it, but he has indicated it shall be treated as fact until it is proved otherwise."

"So be it. What the Father General orders shall be done." Nicholas nodded, then pursed his lips. "This is all very interesting, Father, but why is this letter here in London, and why are you discussing it with a humble parish priest?"

Father Andrew smiled. "Read the letter again. Paying particular attention to the skills of the workmen and the request made by Father Adolph."

When Nicholas set the letter down again, he was stunned. He could feel that his eyes were wide. He opened his mouth a time or two, but nothing came out. Finally, he coughed. "They have chosen me?"

"Aye, Nicholas." Father Andrew was sympathetic. "You are the son of a jeweler, trained in his craft, who is also a Jesuit. You are the very man that Father Adolph has called for."

"But . . . but what of my parish? Who will serve Mass, and catechism, and the rites to those hidden members of the true church if I leave?"

"My son." Father Andrew stood and walked to the window to stare out at the busy evening London street scene. "The situation in London—indeed, in all England—grows ever grimmer. Despite the fact that King Charles at one time did seem disposed to provide some little relief to those who follow Rome, since the advent of Grantville he is of no mind to tolerate dissent of any kind, even from priests. I am afraid he sees gunpowder under every chair. It may well be that we are returning to the dark times we walked under during Elizabeth's reign."

Turning back to the room, the older priest leaned against the window sill. "Nicholas, I do not doubt your courage. I am aware that if a martyr's crown called, you would respond willingly. The society has many brave, fervent men who can and will serve as priests in the darkness of London, perhaps to become martyrs if God so wills. But you, you are best suited to another task. You are called to a different work."

Nicholas sat quietly, staring at the hands folded in his lap. There was only one decision he could make, as much as he might desire otherwise. When he accepted that, peace descended. When he finally raised his head to look at Father Andrew, he felt calm.

"Adsum, Domine. Here am I, Lord."

* * *

For when the lightning lightens, the thunder utters its voice, and the spirit enforces a pause during the peal.

(Apocrypha, The Book of Enoch 60:15)

John Grover, head of Voice of America and de facto head of radio communications in the USE, rubbed his eyes and massaged his aching temples. This weeks' staff meeting hadn't gone any better than the previous meetings had gone. Oh, they were making progress on the mundane stuff, things that just needed the application of some brute force and some material, like putting up lightning arresters and lightning rods in various locations in town. Likewise, those issues that just required the application of money were going pretty well; witness the report of the purchase of two more video cameras and the completion of the second studio setup.

Even the weekly Murphy report, detailing the things that had gone inexplicably wrong—such as the episode where someone took a glass of water into the studio and inadvertently poured it into the primary beta recorder, or the Marine radio man who for some unknown-but-very-stupid reason elected to save his rifle and powder instead of the radio when he fell into a creek—wasn't too bad. Every Murphy incident caused rules and procedures to either be amended or created. But the ability of people and situations to be act outside of those rules and procedures was ever astonishing.

John rubbed his eyes again.

Bottom line—the local cable TV team, the communications team and the Voice of America team all had enough up-time resources to keep going for a few years, more or less, unless a major disaster occurred. The problem was preparing for what would happen when those up-time resources began to burn up, blow up, or otherwise quit functioning and the spares were used up.

John fingered the screwdriver he kept in his shirt pocket, thinking hard. Everything depended on tubes. Everything. The sniping and the infighting at the staff meetings was starting to move from sarcastic to vitriolic. If they didn't make some real progress soon, he didn't know what he was going to do, especially since his only real tube-head, Gayle Mason, was stuck in the Tower of London.

Opening a drawer, John rooted around until he found his aspirin. Dry swallowing three of them, he looked at the clock on his desk. Six p.m. Time to leave. Maybe something would happen tomorrow . . . correction, maybe something*good* would happen tomorrow.

* * *

Canst thou lift up thy voice to the clouds, that abundance of waters may cover thee? Canst thou send lightnings, that they may go and say unto thee, Here we are?

(King James Bible, Job 38:34-35)

Claude Yardley had been a power plant operator for a lot of years. He had torn apart his share of alternators and put the pieces back together. But he had never seen anything like this. He pushed back from the paper and debris covered table. "I'd say Murphy got to you again, John."

John snorted. "Yeah. He really got behind us on this one. This design should have been a non-starter. Look at this stuff." John gestured. "Wires stretched beyond their breaking points, coils ripped from their armatures, and we got what? 1000 Hz out of it?"

"Something like that." Claude looked at his notes. "3600 RPM router feeding a sixteen lobe alternator gives 960 Hz."

"We need seventy-five times more."

Claude pointed at what was left of the radio team's latest creation. "You won't get it this way. I understand why you came to me. Bill Porter and I probably know more about alternators than anyone else in the world at this point." He chuckled. "Not that that's saying much. But you need something like no alternator we've ever heard of. I think it was fictional."

John pushed the photo of the Brant Rock installation across the table.

Claude shook his head. "I don't care, John. Look, walk through it with me one more time. That thing is what? Five feet across?"

Nod.

"Okay. That makes it fifteen feet eight inches around. Times twelve is a hundred eighty-eight inches. Assume one inch coils around the rim. There's no way to modulate the coil less than it's full width, so if you assume that they alternate north and south, then you have eighty-four sine waves per rotation."

Nod.

"So, to get eighty thousand waves per second, you have to rotate the thing a thousand times per second, or sixty thousand RPM."

Nod.

"So, any one coil is going around a fifteen foot circumference a thousand times a second, or traveling fifteen thousand feet per second, or call it three miles a second, or something in the neighborhood of eleven thousand miles an hour. Just under mach twenty, in other words. And they say it was done in 1906?"

Nod.

"It's impossible." Claude shook his head. "It must have been a fake."

John pushed the photo across the table again.

"I don't care. I don't believe they had materials that would handle those stresses, and we definitely don't."

The room was quiet.

"John, I'm sorry," Claude said gently, "but I'm fresh out of ideas. I'm going home."

* * *

His lightnings enlightened the world: the earth saw, and trembled.

(King James Bible, Psalms 97:4)

Father Athanasius Kircher watched as John Grover wandered from one empty table to the next. For once, it wasn't that crowded in the Thuringen Gardens. John banged each table with his pewter mug. Curious, Father Athanasius began following him. Once he got close enough, he heard John mutter, "Too hard."

Now Father Athanasius was really intrigued. Most of the tables in the Thuringen Gardens were quite new, solidly built against the general gaiety of a popular tavern. Sturdy was not a description that did them justice.

John hadn't noticed the priest. He drained his mug and looked around the Gardens. "There!" He headed for a table in one of the back corners. Father Athanasius trailed behind.

The table was one of the up-time folding tables, matched up with metal folding chairs that were also up-time in origin. Having been around Grantville for some little time now, Father Athanasius was certain that they represented an unauthorized loan from a school, or church, or one of the "civic organizations" of Grantville.

John sat carefully in a chair and banged his mug against the table top. The priest saw that it was that strange wood-like substance called "masonite." Unlike the other tables in the room, it was not sturdy, and when struck by the mug, it flexed and boomed.

"Perfect." John carefully set his cup down on the floor, and centered his chair on the table. He pressed the center of the table firmly with the heel of his hand. It flexed.

"Yes." John leaned forward, and banged his head against the center of the table.

Shocked, Father Athanasius stepped forward and grabbed John by the shoulder. John stopped in mid-bang. "No, John!"

John looked up at him. "Oh, hi, Father A."

"Let me buy you another round, John." Father Athanasius sat down across from John. "We'll talk it through. Whatever the problem is, it should not drive you to self abuse."

"I've been beating my head against a wall at work," John said, somewhat truculently. "I might as well do it here as well. Maybe it will break an idea loose." Father Athanasius reserved comment, and just looked steadily at one of the men he thought of as a friend.

John slumped a little. His voice grew quieter. "You're a good man, Father." He sighed and his hand crept toward his shirt pocket. He started stroking the screwdriver he kept there. "But you can't bring Gayle back from the damned Tower of London, you can't bring all those jewelers back from Prague, and you can't push skills I don't have into these hands."

There was a moment of quiet. John shook his head. "It isn't Mike Stearn's fault. Gayle Mason is the best QRP CW operator in the world. I agreed that she had to go to London. But that means that the best source of knowledge about radio tubes is hundreds of miles away."

Father Athanasius picked up John's mug, and waved at a waitress.

"It isn't Morris Roth's fault that every jeweler in the world wants to be near the world's only source of knowledge about faceted gems. But that means that the people with skills in working with very small wires and parts that I need don't come to Grantville anymore.

"It isn't my fault that I have an associate's degree in business, not a masters in electronic engineering. I'm the best available for running VOA, but I don't know the background of the history and development of radio. No one in Grantville does."

The waitress arrived with two fresh mugs. John took his without even noticing it.

"It's nobody's fault. But you put it all together, and Murphy has arranged the world so that we cannot get Gustav's Radio station on the air. And I have to. Mike is counting on me."

"We have talked about this Murphy before, John," the priest said gently. "Most would blame Satan when faced with such adversity."

John shook his head. "It isn't evil I'm dealing with, Father. It's just perversity. It's like the bread always falling butter side down. If things can go wrong, they will. Wasn't that true when you built your water organs?"

Father Kircher nodded firmly. "It was. It is." He thought back to those days, and grimaced. "Everything that could go wrong did. Indeed. We just did not express it so compactly."

"Imps, daemons, gremlins . . . name them as you will, Father. But Murphy acts in the world as sure as God does. But he isn't evil." John took a swallow from his mug. "The best decisions have been made. I know that. Gayle being in London, Morris being in Prague, are absolutely for the best. Godly. But Murphy arranges that the Godly best causes something else to go wrong. We have the Voice of America running, but we can't make the tubes for Gustav's station."

Father Kircher nodded. "I know. The station manager has asked each religious leader in town to give the morning invocation before the dawn news broadcast. Yesterday was my turn! It is amazing to have your words carried by the lightnings across the heavens to say, 'Here I am!'"

John smiled at the nod to Job. He remembered using the line himself when defending his interest in getting his Ham license to his Baptist pastor thirty years earlier.*My sword* John thought.

John heaved a big sigh. He took his screwdriver out of his pocket and fidgeted with it. "The worst is the alternator."

"Alternator?" Father Kircher prompted gently.

"That's the most perverse of all, Father. It's a tease. We know that Reginald Fessenden and Ernst Alexanderson built an RF alternator in 1906. We*know* they broadcast voice to crystal radios without tubes. We*know* they were heard over a hundred miles away. We know all that. We even have a picture. A poor, dark, grainy picture, but a picture nonetheless. We can look at that picture of Fessenden's alternator at Brant Rock, Massachusetts. But that's all. We have no idea what was inside that round case. Just that it was 'an alternator.' I can't build a photo. It's a tease. We have to invent an alternator. And so I started, thinking, 'Gee, we have all the alternators out at the power plant, every car has an alternator, how hard can it be?'" John looked back towards the folding table. He looked back at Father Kircher. "So we pulled most of the people off Gunter's team, since working on tubes without Gayle was very slow going, and started in on the alternator. I know now how hard it can be. It can be very hard."

Father Kircher's hand made the beginnings of a gesture that he knew would be of no comfort to his Protestant friend. "I know, John. I will think on it. Perhaps we can find someone to help. Perhaps we can find a way to put Murphy behind us."

John shuddered. "No! Never behind you, Father. You always have to keep Murphy in front of you. Dead in your sights, never allowing him a moment to screw anything up. Out of sight, out of mind. We need a way to keep Murphy before us."

"A talisman, then. Something to help you remember to focus on the possibilities both good and bad, to keep at the work."

"Yes, exactly. Well, that and a jeweler with an interest in radio who can help with the wire and the forms and the work on the damned alternator."

"I will think on it, John, and I will pray."

"No one can ask more, Father." John drained his cup and stood. "Thanks for listening."

"You're welcome." Father Athanasius' "my son" was unspoken, but heard nonetheless.

* * *

The vision of dreams is the resemblance of one thing to another, even as the likeness of a face to a face.

(Deuterocanonical Apocrypha, 3 Sirach)

"Nick? Is that you?"

Nicholas Smithson froze. God in Heaven, how could this happen? How could it be that there would be someone in Grantville who knew him?

"Nick? Nicholas Smithson!" The voice was insistent. Nick slowly turned around, and almost groaned. Of all people. Father Augustus Heinzerling. What was Heinzerling doing here, and why hadn't that information been given to him? There was no possible way that he could convince Augustus that he was someone other than Nick Smithson. They had spent too much time together at the English college in Rome.

"Hello, Gus."

"It is you!" Heinzerling looked delighted, but then suspicion began to creep across his face. "It is you. What are you doing here?"

"I. . . ." Nick hesitated, torn between telling the truth and concealing his mission. "I cannot tell you that, Gus."

Now Heinzerling's face took on the appearance of a thunder cloud. "What do you mean, you cannot tell me?"

"I have orders."

Heinzerling's jaw tightened. He took a firm hold of Nick's arm. "You will come with me and explain yourself to Father Mazzare, then." He started off, and Nick perforce went with him. Father Gus in a mood was no one to trifle with.

* * *

Father Lawrence Mazzare looked at the young man accompanying his curate with some confusion. Father Kircher watched from the back of the room. "Okay, Augustus. What exactly is your problem again?"

"Where do I start?" Father Heinzerling ran his hands through his hair. "I see this man at the radio station this morning asking for work. I knew him when he was at the English College of the Society in Rome studying. We spent many hours together in Rome attempting to find an Italian who knew how to brew beer. I thought he was my friend." Heinzerling glared at the young man.

"Go on."

"I greet him as brother of the Society and as a friend, calling him by his name, and he refuses to tell me what he is doing. He is dressed in common garb, had not come to see you. I say he's a spy for the Jesuits!" Heinzerling looked confused for a moment, then surged on. "Or a spy at least for someone in the Society. I am the official spy for the Society in Grantville, not some upstart impudent Englishman!" His frown was truly impressive.

Larry repressed a grin. No wonder Gus had looked confused. He turned to the young man. "And you are?"

Nicholas looked at this up-time priest, Father Lawrence Mazzare. What little he had been able to find out on his way to Grantville indicated the man was very well educated, and could give lessons to a saint in propriety, probity and rectitude. However, no one had mentioned his gaze—that calm, straight gaze that seemed as though it could see through four inches of oak, much less his own flimsy pretenses. It reminded him very strongly of the Father General of the Society. Nicholas abandoned all hope of dissembling; forthrightness was the only course with a man like this.

"I am Father Nicholas Smithson of the Society of Jesus, late of London."

"Nicholas?" Are you named after Father Christmas or Saint Nicholas Owen then?" Larry calculated in his head. "You look a little old for it."

"*Saint*Nicholas Owen?" Nicholas exclaimed.

Larry walked over to the bookshelf and took down a volume of the Catholic Encyclopedia. "Here." Turning the pages, he found Saint Nicholas' entry. "In 1970, Nicholas Owen was, umm, will be, umm," Larry made that vague hand gesture that had come to indicate the other world. "Would have been canonized by Pope Paul VI among the Forty Martyrs of England and Wales. Their joint feast day is kept on October twenty-fifth."

He handed the volume to Nicholas who looked it over with astonishment, reading of the events and the names that rang with meaning to English recusants. Margaret Clitherow, Edmund Campion, Henry Walpole, and then . . . "Edward Ambrose Barlow? But I know Edward! We were at St. Gregory's in Douai together. He's alive. Or at least he was three months ago, chaplain to the Tyldesleys in Leigh."

Father Mazzare laughed. "Yes. Things like that happen a lot here. Remind me later to tell you the story of the name of this church." He put the book back on the shelf, then resumed his seat.

"But we were talking about you," Mazzare continued. "Are you named after Saint Nicholas Owen, then? And what are you doing in Grantville?"

"I am named after 'Saint' Nicholas Owen. I suppose I will have to change my feast day." Nick smiled. "My mother was reluctant to name me after a dwarf, but father insisted that Nicholas Owen did the work of three normal men and was a great champion of God. He met Owen while he was building some of his secret rooms at homes of customers of my fathers."

Larry lifted an eyebrow. "And your father was?"

"James Smithson. He is a jeweler, a specialist in fine metal work and elaborate braided wire pieces. He trained me and my brothers to follow in his craft." Nick shrugged. "That is why the Society sent me to Grantville. We have heard of the call for jewelers and metalworkers to work on the Radio. And we

know that this Radio is planned for King Gustav's use, for his 'Voice of Luther.' Thus my disguise. It is highly unlikely that a Lutheran king would want a Jesuit learning the secrets of his Radio."

"Nicholas, you have a lot to learn about Grantville, and not just our list of saints. Father Kircher will introduce you to John Grover, the head of Voice of America. Unless I miss my guess, he will be absolutely delighted to meet you. If you can make the coils he needs, no one here will care about your religion.

"You can also resume your priestly functions. Fathers Heinzerling and Kircher and I can use the help. You can stay here, and in return you will take your turn for the morning and evening masses.

"Father Athanasius will introduce you to the director of the radio project in the morning. For now, let Augustus find you a place to put your things, show you around the church, and you can try the local beer. It's not English ale, but I suspect it's better than anything available in Rome."

Father Mazzare stood and held out his hand. "Welcome to Saint Mary's."

* * *

Yet a man is risen to pursue thee, and to seek thy soul: but the soul of my lord shall be bound in the bundle of life with the LORD thy God; and the souls of thine enemies, them shall he sling out, as out of the middle of a sling.

(King James Bible, 1 Kings 25:29)

John presided over this weeks' staff meeting in a much better frame of mind than last week. The interminable list of reports didn't faze him. Even the bickering between Ken Butcher, Andrew Rogers and Jennifer Hansen didn't bother him. The final report was from Gunter Klein, the only down-time team head.

"The vacuum pump works, but is not yet good enough. We get a glow, we get a pretty light bulb, we do not get a tube. It is slow, but each week is better. You will have tubes before you need them. I swear it."

Ken opened his mouth to say something, but John forestalled him. "Drop it, Ken. They're doing the best they can, especially with Gayle gone." Ken sat back, and sullenly nodded.

"One last item. I need to introduce a new staff member this morning. This is Father Nicholas Smithson. He is not our new chaplain. Father Nick is a trained jeweler specializing in fine wire work. He is going to be starting on the alternator project with us immediately, so if he asks you for information or assistance, please try to make yourself and your folks available.

"That's about it for today, folks. No one ever got any engineering done sitting in a staff meeting." John stood up. "One last thought. We do have to think of everything. We're stretched way too thin. We need something to help us focus. We need some way to keep in our minds that we have to bust the problems before they happen. Father Kircher said the other night that we need a talisman. I think he's right. When you have a minute, try to think of something, a talisman, a touchstone, something to keep our minds on the goal and on the nitty-gritty at the same time."

John knew his people would try. He knew he would try. Still he thought it slightly unfair that Father A

had arranged for his special table to be returned to the Moose Lodge. He didn't belong.

* * *

Nicholas Smithson sat at the kitchen table in the St. Mary's parish house and looked at the collection of items spread before him. There was a coil of very fine wire, a magnet, a voltmeter, and a textbook.

He waved the magnet in front of the coil of wire. As the magnet approached the coil, the meter moved left. As the magnet retreated the meter moved back to the center and then to the right. He waved the magnet back and forth and the meter waved back and forth.

"Eighty thousand times per second. No one can move a magnet eighty thousand times a second."

He sat the magnet down and picked up the coil of wire. He waved the wire over the face of the magnet. The meter waved too. He set the coil down. He picked up the magnet again and spun it in front of the coil. The meter waved back and forth as the magnet spun, right-left-right-left for each rotation.

"Eighty thousand waves per second." He looked at the piece of paper where he had done the geometry. "If I spin this forty thousand times per second, I get eighty thousand waves, and the outside of the magnet is only going"—Nick looked down—"seven thousand miles per hour. I think not."

Nick picked up the "thing" John had given him. Eight magnets soldered together in the center. He spun it in front of the coil. The meter waved, but less. John had assured him that this was because the individual magnets were smaller, and that made sense. But still, eight flicks per rotation. The outside would be going only eighteen hundred miles per hour.

"I think not."

Moving the coil, of course, was worse. Coils are fragile things. And large. Much bigger than the magnet.

"Such a simple thing. August would understand it. My mother could understand it. Magnet back and forth, make electricity. Magnet and coil move, make electricity. Magnet and coil sit there, nothing gets made."

He picked up the drawing he had made of the Brandt Rock transmitter from the photograph, and reviewed his calculations.

"Thousands of miles per hour. Murphy would destroy it."

Nick thought about John's introduction to Murphy's Law. Everything that can go wrong, will. The son of a goldsmith used to working with heat and molten metal and thin wires and fluxes and solders knew all about Murphy and his imps even if he had not named them so. He sat, spinning the magnet.

Father Kircher came in. "Hello, Nicholas. How went your first day with the radio team?"

"I learned much." Nick waved his hand over the objects on the table. "I learned why John was banging his head." He spun the magnet again. "I may have to go find this 'Moose Lodge' to borrow their special table back."

"Now, Nick. None of that! And I have news, and an idea!" Athanasius removed a book from his habit and sat it in front of Nick. "Who are you named after?"

"Saint Nicholas Owen. Saint at least, here in Grantville."

Athanasius opened the book to a marked page. "And who is this?"

"Saint Elizabeth Seton, the first American saint."

Athanasius nodded. "Who will never be born, nor sainted by a Pope who will never be born nor elected to the seat of Peter. And yet, here, in Grantville she is a Saint."

Nicholas looked up. "So?"

Athanasius gestured to the volumes of the catholic encyclopedia. "What of all those other Grantville saints in their dozens or hundreds? Are they less saints because they will not live? Are they less saints because they were proclaimed so by popes who will neither live nor serve? I do not know. But I know that I have agreed that here, in St. Mary's, and in Grantville, we honor their days."

"Yes, Saint Nicholas Owen and the Forty Martyrs—a third of whom are perfectly well alive—is a mass I intend to celebrate myself."

"So, it isn't their realness that makes them saints here is it? Or who proclaimed them?"

"No . . ." Nick agreed cautiously.

"Then I offer you your talisman, and your protector for the radio team." Athanasius laid another book on the table.*The Warlock Unlocked* .

"I offer you Holy Saint Vidicon, patron saint of the Cathodian order of the church. Martyred in 2020 in service to the Church, sainted in 2030 by Pope Clement. Those of his order are dedicated to reducing the action of Murphy's imps and the control of the perversity of technology. His feast day is February twenty-ninth."

"February twenty-ninth? That's, that's . . ."

"Perverse?"

"A fictional saint?"

"A saint, who will never be born, named so by a Pope who will never be born, nor elected. Read the book. Then, we will talk again. In the mean time, I offer you this as well." He handed Nicholas a wooden handled tool.

"What is it?"

"Your talisman. The same one John carries. The some one most of the 'techs' carry. A 'little yellow screwdriver.'"

* * *

"No. You may not form an order dedicated to a saint invented by a science fiction writer in 1982." Larry Mazzare looked most firm.

"But . . ."

"Which part of*no* didn't you understand?"

"But . . ."

"You may distribute the talismans. You may use the story from the book as the inspiration for the talisman. You should use the terminology. God knows that Murphy certainly is perverse and acts in the world. If that weren't true then several of the parishioners' cars would quit breaking for no reason."

Nicholas saw Larry's look become stern. "However, if you need to call on a saint to assist you, I urge you to look to the saint most closely related to your talisman, not some fictional construct of an unchurched Episcopalian."

"Who?"

Larry picked up one of the screwdrivers from the box. "I note the appropriateness of the cross at the tip. I'm glad you didn't get flat bladed ones." He paused. "You ought to know who I mean. He was canonized not 10 years ago. A man known for his sense of humor. He ought to be able to help us laugh in the face of Murphy's perversity."

"But the talisman?"

"Oh, come now. He would have appreciated the appropriateness of it. By all accounts, he would have had the entire congregation laughing."

Nicholas just stared at Larry.

Father Mazzare opened a reference to a painting of a man. He grinned as he showed it to Nicholas. The man in the painting wore half a beard and was kicking a ball while leading a rag-tag group of people who carried household goods through a street. "Come now. The pun is even in your native tongue." He spun the book around. "Saint Phillip."

* * *

Thy life hast thou ordered in wisdom, and hast called understanding thy mother.

(Deuterocanonical Apocrypha, Esdras 2:55 (Ezra 4:55))

The hallowed halls of the Grantville National Research Library were far from Nick's idea of what a library was. First, there were far too many books. What had started out as the Grantville High School library had changed over the last months. Now, with the ceiling tiles removed and the shelves extended up to the metal ribs holding the roof, with more shelves tucked into every nook, and tables and chairs in every cranny, Nick felt that the services of his name saint would be well used. No master carpenter had designed this place.

And the books! There were more titles in this one room than existed in the rest of Europe. Books, pamphlets, magazines, broadsheets, newspapers. Surely the answer would be here.

It amazed him that the Americans had not tried this. He had asked John for the results of the library search and their notes. One page of notes, and one magazine article. It simply wasn't possible that there was not more information that that. He looked at the room again. There was a sign. Library research orientation class: 09:00. He saw someone standing in front of a small group of what appeared to be down-timers, and joined them.

"Welcome to the Grantville National Library. My name is Gladys Wood. I'm a senior researcher here. This brief orientation will help you to begin to find material in the library. We will cover several basic areas: Our fee structure, collections, indexing, annotation mechanisms, physical access . . ."

* * *

"Dictionary form. They organize information alphabetically. It is insane! Related material may be completely separated. Related people are not listed together. Related places are not listed together. It is completely arbitrary and utterly brilliant." Nicholas looked at his long list of words taken from the article he had. Dictionary form. "I can do this. It was what I was trained to do. They don't need a jeweler. They need a scholar."

* * *

Nicholas tapped his screwdriver on the table as he looked out across the desk, contemplating. "Brother Johann, Melville Dewey was a very great man."

"Yes, he was."

"The index, the 'card catalog,' was a work of genius. The subject coding, clearly the work of inspiration. But these . . ." Nicholas waved his hand over the pattern of three-by-five cards carefully arranged on the desk. "These are brilliant. Without them, glossing this library would have been the work of years. But this . . . this is wonderful. I make a note of the source, I list a topic, a comment and so on, and I can re-arrange, I can move the gloss from place to place. Cross references. Dictionary Form. Brilliance."

Brother Johann nodded. "I know." He looked at the cards, with a bit of irritation showing. "I only wish the stationer we ordered them from had not been so literal when we said we wanted him to duplicate the sample we provided. The "Recipe" printed across the top, and the drawing of breads doesn't actually assist in the work. But, we have only fifteen thousand left. They'll soon be gone, and we can get more. Plain ones this time."

Nick nodded. "That will help. But it is really no matter now. I just use the plain side."

"So," Johann asked, "have you found it yet?"

"No, but we are getting closer. I can feel it. With each additional source, with each additional reference, the quarry is that much closer to us. It won't be long."

With that, the two men bent their heads back over the books they were reading, and continued in pursuit of the alternator so desperately needed by their friends.

* * *

Nick's eyes widened. He sat back in his chair with a sudden jerk, and his chair screeched on the floor.

"Those idiots." Softly whispered. Brother Johann looked up in surprise.

"Those idiots!" No whisper now, but full voice and almost yelled.

"What is it, Father Nick?"

Nick turned to his fellow researcher.

"Brother Johann, have you heard the word 'sophomore' here in Grantville?"

Johann nodded. "Of course. They use it to identify a rank of their children in school."

"The word is Greek in origin, you know." Johann nodded again. "It means 'wise fool.' And I've just decided that it should be applied to all of Grantville. To have all this wisdom and knowledge available to you," Nick waved a hand to take in the stacks of books, "and not know how to use it makes one a fool, indeed."

"You found the answer?" Johann began to show excitement.

"Yes, I found the solution to problem of the alternator. It doesn't move."

"What?"

Together they bent over a volume from the Encyclopedia Britannica 1911 edition.

* * *

"So, I understand congratulations are in order." Nick looked up to see Father Larry and Father Athanasius approaching him.

"Not really, Father. I just found something they had lost, is all."

"Nonetheless, Father Athanasius tells me that John's ecstasy almost approaches hysteria. Good job. It will make a lot of people very happy. So, how long did it take you to find the answer?"

"The alternator? With Brother Johann's help, I had that in a little over two weeks. It merely took careful work, word after word from the encyclopedia, then more lists of words, and more encyclopedia articles. I cannot build them, you understand, neither the alternator nor the frequency doubler. That will take mechanics and such. But the solution was simple enough. John's team has the information and they have started building a model."

Nicholas laughed. "Saint Phillip be praised." He reached up to his breast pocket and touched his screwdriver. "The solution is both funny and perverse. It will require careful attention, and it will be difficult, but it can certainly be done. The Americans would never have thought of it."

"Why?"

"Because the secret of the alternator is in not*doing* . The alternator does not spin! It just sits there. The coils, the magnet, all of it, just sits there. It is very unAmerican. What spins is a plate of iron with holes that occasionally let the magnetic field through to the coils. The plate, unlike the coils or the magnets, can

be made quite strong, and large, and can spin fast enough to make the waves many, many thousands of times per second. Alexanderson was very clever. And the irony is, the Americans will not see the irony in it."

They all laughed at the joke, and the irony of the joke.

Father Mazzare surveyed the stack of papers and the mass of note cards scattered over the surface of the table. "So, what are you doing here—designing it for them?"

"No, I turned over everything we found to John a few days ago."

"So what's this, then?"

Nick waved a hand over the table. "I'm writing a guide to the study of up-time documents. A guide to the exegesis of up-time texts, and the application of their techniques to our writing and publishing. The Dewey Decimal System of course, the APA standard form for citations, the concept of 'Encyclopedia' and the differences between those and 'Dictionaries' and 'Gazetteers.' The power of organizing information. Why did we not think of it? Alphabetical organization is an insane way to arrange topics—except of course, that it works. Rules for sorting. Rules for indexing. All the tools that the up-timers have that they seemingly have not learned how to use."

Nick shook his head. "The alternator is a good example of why it is needed. The up-timers, most of them, simply do not think like scholars. Most of them, like John, tend to be doers, not thinkers. Do you know? Everything they needed for the radio alternator was in the encyclopedia. They simply didn't know how to look. They spent a half a year winding coils and breaking wires trying to spin the coils or the magnets because their first inclination when faced with a problem is to*do something* . They even have an aphorism about it. 'Those who do not know history are doomed to repeat it.' They all know this, but few of them grasp it."

"Yep." Father Larry nodded. "You missed the other saying, though. That one goes 'Don't just stand there, Do something.' I wouldn't want to say that no one in Grantville understands what you're talking about. Most of the folks just have never had to learn it. They're thinkers, but not scholars. If things don't work out the way they would expect them to from their experience, they can generally figure and tinker a way out of it. Heck.*I* do that. We all do."

"And thank God for that! But it means that we who have been adopted by them will have to be their link to what they know." Nick waved his hands at the stacks again. "Even their teachers are not scholars by trade. The Americans managed to make teaching into a job separate from scholarship. I, for one, would never have believed it, but it is true."

Nick tapped the papers in front of him. "So, I have been writing a guide."

"Do you have a title, yet?"

"I am still looking for a title. I am considering," Nick coughed. "*How Not to Think Like a Redneck*."

Father Larry looked amused, but his voice was very dry. "As one who would wear half-a-beard, I'm afraid you're not authorized to use that term. You're not a member of the group."

Nick grinned, and reached into his satchel. He pulled out a yellow Cat hat, which he firmly placed on his head. "John made me an honorary redneck, and told me to go for it."

Mule 'Round The World

By Virginia DeMarce

November, 1633, Wednesday morning before Thanksgiving

"It was well done of you, Henry. It really was." Enoch Wiley looked rather doubtfully at a pile of yellowish mush on the cracker in his hand. "What is this stuff?"

"Cora makes it out of mashed chickpeas. Some kind of a substitute for chip dip. Not bad—there's onion in it, I think. Anyhow, it has some zip." Henry Dreeson took a bite. He always felt a bit embarrassed when Enoch commended him for something so solemnly. He was eight years older. Not a lot, between old men. A generation, for children. He'd been an eighth grader the year that Enoch started school. It had felt a bit odd, at first, when Enoch became the minister at his church. That was what—forty years ago, now?

"I didn't really need it, anyway. I'd just gotten used to having it in my pocket. When Jeff Adams told me that the girl Benny adopted really was going to lose that eye—well, it just seemed the thing to do. The color's not too bad a match. Jim McNally said that he could re-grind it to fit her socket; it's easy enough, most of the time, to make something that's too big smaller. The trick is to make something that's too small stretch."

Henry's mind briefly contemplated Grantville's latest budget projections; then turned back to the reception. Several teachers and quite a few students from the remedial English for Speakers of Other Languages (ESOL) and special education programs located at the middle school were milling around. He had just presented Minnie Hugelmair with a framed certificate of valor for her defense of Benny at the riot in Jena last spring, along with his good luck piece. "Maybe it will make Minnie feel more like she really belongs in Grantville, having Uncle Jim's glass eye to wear."

Both men looked up toward the temporary platform at one end of the city council meeting room. Minnie certainly sounded like she belonged to Grantville. She was up there, singing "Bury Me Beneath the Willow," to Benny Pierce's accompaniment in a voice that could have come out of any one of the hollows that ran off of Buffalo Creek.

Henry had heard that she hadn't sounded so nice the day that Benny, coming back to winter in Grantville toward the end of October, told her she'd have to go to school.

Minnie was about fourteen or fifteen, they figured. More or less. Most likely more than less, since Doc Adams guessed that she had been badly undernourished when she was little. She was a foundling. Somehow, every master to whom her home village had ever bound her out had managed to avoid the obligation to send her to school. How many men wanted to pay school fees for a foundling not yet old enough to earn her keep? Henry realized that you couldn't work up a general answer from one example, but it was clear that in this case, the answer was none. Minnie had a seventeenth century small town's equivalent of street smarts, but she did not have any education.

She didn't want any, either.

Benny hadn't had much luck taking her to school.

Eventually Benny and his sister Betty, Betty's daughter Louise, Betty's daughter-in-law Doreen, Simon and Mary Ellen Jones who were the ministers from the Methodist church, Enoch and his wife Inez, Henry's wife Ronnie, and Henry himself had taken Minnie to school. Fussin' and fightin' it all the way.

Benny switched the tune to "John Brown's Body." Minnie really got into the spirit of it.

That girl is going to make some man a real obstreperous wife, one day, Henry thought.

* * *

Joe Pallavicino, director of Grantville's ESOL program, still wasn't sure what to do with Minnie Hugelmair. Yeah, she had to go to school. But the intake program and classes had been set up to teach English, first to refugees and then to other immigrants, who already had at least some experience with going to school in German, then to funnel the kids into regular classes. The Germans had spoken fifteen or twenty nearly incompatible dialects, but least three-fourths of the refugee kids who came into Grantville the first year already had basic literacy and numeracy under their belts when they showed up at the schools. Most of those who didn't, had not been German. So he hadn't felt the least embarrassment about resolutely tabling all suggestions about bilingual education programs. The illiterate ones had been from six dozen different places on the map of Europe, attached some way to the mercenaries, and there wasn't anyone in Grantville who could educate them bilingually, even if the Emergency Committee had been so inclined. Which it wasn't. Almost all of the immigrants who had come since then, since Thuringia and central Germany settled down, were looking for jobs. Both the adults and their kids just needed to learn English, just as the Grantvillers who showed up needed to learn some kind of standardized, homogenized basic German that the speakers of fifteen or twenty different dialects would have a shot at understanding.

Whatever else Minnie might need, she didn't need to learn English. During her months of wandering around Thuringia with Benny Pierce, she had learned English thoroughly. With a fine West Virginia twang. A little archaic, perhaps, since a lot of it came from folk songs, but perfectly functional English. It actually helped her talk to some of the down-time English people who came through town now and then, translating into modern American for them.

Temporarily, he had set her to spending her mornings with Ceci Jones and afternoons with Tina Sebastian. Not because their sections were better suited to her needs than any of the others, but because their families were both important in the Methodist church that Benny Pierce attended, so they felt obliged to put up with her.

Minnie needed to learn to read and write. She needed to learn to add, subtract, multiply, and divide. It didn't matter much to Joe whether she learned them in English or German; at the moment, she didn't know how in either language.

Minnie was not about to go to first grade. Joe sighed. Unfortunately, he could see her point. On the other hand, Minnie certainly didn't belong in special education.

Benny's fiddle switched again, to "The Mule 'Round the World."

"I was born about four thousand years ago; there is nothing in this world I do not know." Minnie grinned impudently, looking down at the teachers in the audience, and made her way to the verse about Adam, Eve, and the apple, "I can prove that I'm the man who ate the core."

She isn't a man, Joe thought, *but that's a good song for her. Whatever else, Minnie has attitude.*

* * *

What bothered Benny most about the whole deal was that he was eighty-two years old. Not that he didn't intend to live to see Minnie grown up, now that he'd taken her on, but it was always possible that he'd get to the point where he was beyond making the markets and fairs, even in the summer months. Then where would the money to keep them come from? Renting out part of the house brought in some, but not really enough. For that matter, what would become of her when he couldn't busk any more? She was the best fiddler he had ever taught, but a girl really couldn't go out doing that on her own. It was too dangerous. He couldn't see her settling down, though.

For all that they'd finally gotten her here, Minnie really didn't want to keep on coming to the school. She had only agreed to attend the reception in her own honor on condition that she could sing instead of socialize after the speeches. They had compromised. First, she would sing. Then she would go around the room, with Doreen next to her, and say one single polite thing to every person there. Something like, "Thank you for coming."

The compromise was possible because he'd figured out one thing that worked. Weeks that she didn't make too much trouble in school, Wynne Nisbet would give her a hammer dulcimer lesson on Saturday morning. Defining "too much trouble" could be a bit touchy, sometimes. There was always at least some trouble. Trouble followed Minnie around. But you had to grant that she picked her targets.

Benny grinned and shifted over to Mother Maybelle. No matter what else he played in a set, he tried to finish up with a Mother Maybelle Carter piece. This reception was really for Minnie and the other kids, though, for all that Henry and Enoch and Reverend Jones, Benny's family, and several of the teachers were here. Kids weren't crazy about ballads. They liked something livelier.

He rolled into "Worried Man Blues."

* * *

The steps up to the temporary platform didn't have a rail. Minnie didn't jump and run—she stayed right there, carefully handing Benny down. Joe Pallavicino, watching, thought that one thing was sure in life. Anybody who offered, or even seemed to offer, a threat to Benny Pierce would have to deal with Minnie.

Anybody who offered, or even seemed to offer, a threat to anyone whom Benny cared about would have to deal with Minnie.

Joe would put his money on Minnie, any day.

Benny went over and sat down next to Louise on one of the metal folding chairs. She had a plate of crackers and a root beer for him. Minnie and Doreen started to circulate. Out of the corner of his eye, Joe spotted someone who shouldn't be here, given that she wasn't in the ESOL program and the noon bell dismissing the kids for Thanksgiving hadn't rung yet. He started across the room, drawing in his breath, prepared to start a sentence with, "Denise." Behind him, a voice said, "Cool it, Joe. Princess Baby was determined to come, so I wrote her an excuse and took her out of class. Her and Minnie have gotten to be best friends."

* * *

Here came Minnie and Doreen; time to be polite. Henry Dreeson fished his cane out from under his chair; he and Enoch heaved themselves to their feet. Minnie and Doreen and—the two girls with their arms thrown casually around one another's shoulders—Denise Beasley.

You learned a lot of things, being mayor. Henry knew that, contrary to the general assumption, Denise's parents were married to each other. Had been for fifteen years. He looked around. Yep, there was Buster Beasley, all right, keeping an eye on his Princess Baby.

Now Buster—he was the one who ought to sing, "there's nothing in this world I do not know." He'd ridden with one of the big motorcycle gangs for years before he came back to Grantville and settled down. Part of the self-storage lot's business had been perfectly legitimate, with local people, but both Henry and Dan Frost had always suspected that part of it was an entrepot for—other things. None of it had ever come out into the community, though, and the last dozen years of Buster's tax returns before the Ring of Fire were impeccable. Dan knew. After it, well, Buster had called the Emergency Committee and opened a few of those down at the far end, where the lot fronted on the old dirt road. They knew that all those counterfeit-brand car and truck parts would come in real handy, so they hadn't asked what was in the others, right then. The 250 Club had cigarettes for sale long after everyone else in town had run out. What else? Who knew? Buster owned the lot free and clear.

All of which probably answered the question of where Buster had gotten the money that he plunked down to buy the lot in the first place, when he and Christin came back. He'd had backers.

But Buster wasn't a nasty guy, not the way his uncle Ken was. Standing there, leaning against the wall, his reddish hair balding and graying, his thumbs stuck into his belt below his beer belly, tattoos showing on his arms below the short sleeves of his tee shirt, he looked like he would be. Or worse. But Buster was good to his grandparents. And, boy, did he look out for Christin and Denise. Henry felt sorry for the boys who might try to date Denise. Buster really had been 'round the world, and he didn't intend for his Princess Baby to go there. He'd made sure that Denise could take care of herself, if he wasn't around to protect her.

* * *

Buster had been watching across the room. Denise and Minnie, tossing their hair back and giggling. Minnie and Denise, doing a little tap dance step in front of Ceci Jones and Paige Clinter, with Tina Sebastian clapping a rhythm for them. He was glad that Princess Baby finally had a best friend. She hadn't had a best friend since she got so sick in fifth grade and had to repeat a year. When she went back the next fall, a new class had moved up to be the first-year middle school kids and she didn't know them that well. And she was a bit fierce for the taste of most of the families around Grantville. He'd brought her up by his rules. First, do what needs doing; second, don't agonize about it.

The door opened. Chris had locked up the lot for lunch hour and come over. They'd take the girls and the Pierces out for lunch. Not at the 250 Club. She came over and leaned against him, saying, "I picked up Johnnie Ray and Julia and dropped them off at Cora's. She's put in some cushioned booths. They'll be nice and comfy, with people to talk to till we get there."

* * *

Chris stood there, watching Minnie and Denise. She was real glad that Denise finally had a best friend. Her mind wandered.

After a truly spectacular blow-up with her parents, she rode off with Buster on his motorcycle in September 1986. They covered most of the country the next year, Arizona, California, Montana, all sorts of places that she'd never expected to see, until her pregnancy advanced to the point that it got uncomfortable for her to ride and they stopped for the winter in Colorado Springs. They had a pretty nice motel room, on the outskirts. Somewhere, she'd heard that natural childbirth was good for the kid, so she did it. There had to be better ideas. Buster came to the hospital for the delivery; it was just a couple of weeks before Christmas. When the nurse put Denise into his arms, all wrapped in pink flannelette and trimmed with a sprig of holly, he got a strange, helpless, sort of look on his face and muttered, "Y'know, Chris, I kinda think we oughta get married."

The nurse, who considered this to be a good idea under the circumstances, arranged everything with the hospital chaplain before Christin was discharged. The guy had a whole set of forms for pulling it off in two days—must not have been the first case of acute fatherhood that the hospital had treated.

Buster also got a vasectomy while he was at it, saying that he didn't want to see Chris go through that again, ever, no way. It was close enough to the delivery that she hadn't argued a bit. They stayed in Colorado Springs for a year and a half, Buster handling the local end of a bunch of things for his pards, until Denise was old enough to ride comfortably in the sidecar and needed more space than a motel room to run around in. Then they came back to Grantville.

Buster had accumulated enough money, what with one thing and another, to open the storage business. He said that old Coleman Walker's chin had dropped right below desktop level when he'd handed over the receipts from the Colorado Springs bank and asked to have the accounts transferred.

She'd had another spectacular blow-up with her parents. They hadn't even asked if she was married to Buster, so she hadn't told them. She didn't intend to, either. Ever. Let them stew. She still went by Christin George, which really got their goat. The marriage certificate was in the safe deposit box, along with their wills and other business papers.

Chuck Riddle's jaw would have dropped, too, when they went to get the wills drawn, if they'd gone into detail. Instead, they just asked for plain mirrors—everything to each other and then to Denise. KISS. They'd just needed a lawyer to make sure all the formalities were right. That was one thing that Buster had learned from his pards; keep your paperwork in order.

* * *

Buster kissed Julia and shook hands with Johnnie Ray, then backed out of the booth. He loved his grandparents. He hadn't invited his Uncle Ken to lunch, but his cousin Everett was here. As many of them as could scrunched into the booth; the waitress pulled over a table and some chairs to extend it for eleven. Cora's was a nice place for a family-type party. While everybody else was sitting down, Buster went over and shook hands with Doc Adams. They'd been through a lot together. He'd never been so stinkin' sick in his life as he got that first winter after the Ring of Fire.

* * *

Jeff Adams was having lunch with old Doc McDonnell. H.M. had retired from practicing medicine nearly ten years before the Ring of Fire hit, but he'd come back to do what he could—he took the rounds at the extended care center and the assisted living homes—even dropped in on some of the old people who found it hard to get around. Even old Doc Sims, the dentist's father, from whom Jeff had bought the practice, and his wife, who were older than McDonnell, did well baby clinics at the Red Cross twice a week. Every bit helped.

McDonnell also doubled as coroner, at least for the obvious cases. Down-time, they hadn't had many exotic cases. It was mostly pretty obvious what people died from. The Beasleys, though-nobody knew yet what the Beasleys caught and died from, living out in that old farm house together. Johnnie Ray's brothers and sister, Ev, Hank, Dewey and his wife, Wilbur, and Dorothy—Sugar, everybody called her. Ev and Wilbur were widowers; Hank was an old bachelor; Sugar was a widow. Clinging together. Dewey's kids had all been left up-time; Wilbur and Sugar never had any.

It had been February, in 1632. Johnnie Ray and Julia got worried when none of them came in for groceries that week. It was cold, but not bad under foot and the telephone lines weren't down. When they didn't get an answer after two days, they sent Buster out to check. He found them all frozen solid. It looked like Sugar went last and had laid the others out all neat, turned the heat off, then lay down next to them to wait—no sign of foul play or poison.

The phone was working—Buster used it to call Dan Frost to send someone out—so it must have come on them fast. Or else, they caught on that it was something real bad, and contagious, and deliberately decided not to call. They'd found another body in the barn—a hobo, from the look of his clothes, with a plate of biscuits next to him. The house door was locked. Buster opened it with his key. He'd put the locks on himself, after the Ring of Fire; said that he and Everett, Ev's son, had split the cost. There wasn't anything missing or ransacked.

Dan had sent Fred Jordan out, since it was in the country. Town and country didn't make any real difference after the Ring of Fire, since the county government was gone, but Fred still did a lot of the stuff outside the town limits. He knew the people better.

Jordan had called his office; Leslie had taken the call and sent him out. The three of them had looked around. He'd suggested, pretty strongly, that it would be better just to bury them out there—not bring the bodies into town for an autopsy. Fred had agreed, and said that they should keep everybody else out of the house and barn, too.

Then Buster asked for a bit of privacy. They gave it to him, so they didn't know just what he'd said to Everett when he called the video store. But he came back and said not to bother digging graves in the frozen ground; if they left the house and barn standing, his Uncle Ken would rent it out the minute that Fred took the guards off it, or some refugees would just move in. No telling how long the germs for whatever it was would hang around.

He put the torch to it himself. Laughed and said, "This way, if Ken sues, at least it will be all in the family."

They'd quarantined everybody who had been out there. He, Buster and Fred got pretty sick, but they got over it, with fluids and more of the town's precious antibiotics than they had probably deserved and stuff to bring the fever down. Hell, tell the truth. He'd never been so sick in his life. If that, whatever it was, had reached Grantville without any advance warning, half of the town would have been gone in a month.

* * *

Over at the party table, Buster Beasley laughed uproariously at something Minnie had said. His gruff voice filled the whole café, "Oh, no, Minnie, girl, there damn well is something you don't know."

Minnie looked defiant. "What? Nothing that I need to know."

"Something I betcha' that you want to know. That would make the rest of it worth your while. You may not believe it right now, but it's important to know how to keep your paperwork in order. I had a time believing that, too, at first, but it's true."

"What?" Minnie persisted.

"You don't know how to ride a 'hog.' If you'll settle down and learn the grade school stuff as fast as you can, I'll teach you to ride, along with Princess Baby."

Minnie and Denise squealed with delight.

Benny Pierce beamed.

"And if you go on and learn the middle school stuff, there's something interesting in one of those triple locked sheds on the lot."

Three wide eyes and a piratical black patch stared at him—Doc Adams hadn't inserted Jim Dreeson's glass eye for Minnie yet.

"Two brand new 'hogs.' Never uncrated. For the day the two of you get your diplomas."

Jeff Adams and H.M. McDonnell flinched.

Von Grantville

By Russ Rittgers

Chad sat on the front porch swing staring blankly ahead. He held a tumbler of Kentucky's smoothest bourbon and water. It was like a cruel joke. I have some good news and some bad news. The good news is, those thirty-five new cars you have on your lot? You won't have to pay for them. The bad news? They're going to sit there and rot until you take them apart and sell them piece by piece. Or, you can sell them to the government for pennies on the dollar because nobody's got gasoline or money for cars except the government. Funny, yeah, Mr. Big Time Auto Dealer.

He'd never intended to live out his life in Grantville. When he studied marketing at West Virginia University, Chad wanted to go into international business. Then Dad had his stroke the day after Thanksgiving in Chad's senior year. He lived, but with the left side of his body partially paralyzed. Mom couldn't handle it mentally or physically at that time. Wes, his older brother, had a full-time job in Charleston working for the government. So rather than taking a few easy courses his final semester to pump up his GPA, Chad petitioned to graduate early because he had all his required courses completed. He received his diploma through the mail. Didn't even go to commencement. Three years later he bought the car dealership for a pittance. Lou Prickett had grown too fond of booze and was about to lose the franchise anyway.

Now, here he was. A businessman without a business. In Germany. Strange world we live in.

Debbie came over to the porch swing and sat next to him. "Penny for your thoughts, dear."

Chad smiled wryly and put his arm around his wife's small shoulders. "Just thinking. Never thought, heck, never imagined I'd ever get to Europe after I came back to Grantville. Much less live in Germany

with you and the kids."

Debbie pulled his arm a bit tighter by tugging his hand. "Have you thought about what you're going to do? Some of the Methodist Women have set up an assistance committee for those German people who've been wandering into town."

"Don't know." Chad took another sip of bourbon. "All the cars and trucks I don't sell to the government, I'm going to have to disassemble for parts. I'll get Bob Szymanski and my other mechanics to do it. Added to my current parts inventory, it'll be worth a fair amount eventually. Trouble is, in the short run, we're going to be hurting for money because I'll have all the costs of tearing those apart but damn little income. We'll probably have to sell some land just to buy groceries."

Debbie pulled away from him. "Don't you dare!" she snapped. "Don't you even*think* about selling a single lot!"

Chad stared wide-eyed at his wife. She never . . .

"I had an interesting talk with that nice Scottish cavalry captain after he brought over one of his troopers to interpret for us today. He asked who was the laird who owned the land outside town. When I told him that most of it was owned by individuals and coal companies, he looked at me like I was crazy. Then I told him Dad owned 160 acres and you had, here and there, over seventeen hundred acres with houses on some of them. He said you must be a laird to own so much and live in a huge mansion in town. After that, he started treating me as if I was some kind of nobility. He must have said something to his trooper because the next thing I knew, the Germans we'd taken in started bowing their heads to me when I approached them."

Chad grunted a laugh. "Oh, yeah, that's me, Charles Hudson Jenkins von Grantville. Senior."

"I'm not kidding, Chad. In that captain's mind, we're nobility."

Chad still laughed. "Oh, yeah. I suppose I'll have to fight duels to protect the honor of our noble family name, too. Uh-huh, right."

This time Debbie joined him in laughter and leaned back against him again. "Okay, okay it's silly but . . . Do you know how many houses and trailers we have dotted around the countryside?"

"What . . . forty? You're the one taking care of those books. Do we really have that much land?"

Debbie's smile was smug. "Forty-one rentals according to our last tax return. Got back a nice depreciation-based refund a month ago. Deposited it in the bank here in Grantville. Seventeen hundred acres, sure. Some of it is just hillside, of course, since you and your dad bought anything that came on the market cheap enough. We've got the creeks flowing through some of them but it's ours. We may have lost three parcels outside the Ring of Fire but we didn't lose any rentals.

"But what I'm thinking is that we don't have a mortgage on a single one of them any more. We always went through the Bank of Grantville but last year I refinanced them through a New York bank. Our trailer loans were all run through the Farmington bank. Do you realize we have absolutely no debt? None! Honey, we've got rent money coming in from thirty-one active rentals. Ten are empty right now, but that won't last long. Yeah, we've got taxes and maintenance expense. Some of those places are pretty old. But with Chip and Missy not going off to college, we could finance our own construction."

Chad considered for a moment. "Well, that's almost right. Most of our tenants were working in Fairmont, Morgantown or somewhere other than Grantville. In other words, where are they going to get the money to pay their rent?" He sipped his whiskey.

Debbie snorted. "That's a temporary situation and you know it, Chad. They'll have to buy their own food, too. They'll pay their rent or they can move."

Chad knew his smile was a bit twisted. Debbie might have gotten her degree in Elementary Education and taught until Missy was born, but running their rentals for the past several years had given her the same set of hard-headed business rules he had.

"Well, it's a cinch real estate's going to be just a bit more difficult to come by. Building materials are going to be just a bit more expensive as well. You planning on providing materials for the construction boom once it gets going?"

"We've got plenty of trees—maple, oak, ash, pine and other timber. We've never had any of those hillsides cut. I never liked the looks of the timber-cutters who came around. After the first one visited us, I checked out recommended timber-cutting best practices on the Internet. Then I started asking questions. Not a single one ever heard of a contract. So I said no thanks. Now we're going to have a lot of scrub trees and tree limbs for fireplace wood as well as logs for construction."

Chad took a sip from his glass. "Sounds good, I suppose. Doesn't get my blood pumping any more than selling auto parts does."

"Oh, I didn't figure it would." Debbie stood and stretched. "We can hire someone to oversee the day to day operation but you should be there to watch. To see everything is done to conserve the land. They won't pay attention to me. Anyway, there's no way I'm going to hike into the woods to supervise a timber crew. You, well, you ran the dealership garage as well as the sales room."

Chad nodded. It was a plan, at least. "Okay. Damn! I just had a thought. Where are they going to get the gas for the chain saws? Come to that, how are they going to haul the wood out of the woods?"

"The old fashioned way, I suppose. There's bound to be a few of those big two-man saws and buck saws rusting in barns and garages . . . not to mention axes. You can probably hire some of our unemployed tenants to do the work."

"Horses." Chad frowned. "Might be able to get tractors but we'll probably have to buy or rent draft horses or oxen to haul out wagons filled with firewood and the logs. Think your dad has any old horse collars lying about the barn? He's bound to have some saws from your grandfather's day. We can find farm wagons easily enough. Heck, just a few built-up wheeled axles with a tongue welded on. Won't even need to have tires, just the rims. Next question is, does Denny's Lumber still have its own sawmill?"

Debbie shook her head. "No. But I'm certain all the parts are there somewhere. Nathan never threw away anything. Thank God we got the electricity back. That'll power the sawmills."

"Well, looks like I've got something to keep me busy for a while. You can do the rentals and help the refugees with the other gals."

Debbie glanced over at him. "Um . . . it's a bit more than just helping. I got elected chairwoman."

Chad sighed. Every time she became a chairwoman, it cost him money.

* * *

The dealership had to pay its mechanics to take apart the cars and trucks so Chad joined in to save on labor costs. He received strange looks the day he came into work wearing coveralls. He shrugged and gave a twisted smile. "Times are hard and money's tight." They all nodded with rueful grins. They'd been there.

Two days later, after completely disassembling three cars, Bob Szymanski, Chad's lead mechanic stood up and put down his wrench with deliberation. "This is stupid."

"Huh?" Chad asked.

"Why are we taking these cars apart?"

"Because we don't have any gas."

Bob put his tongue to the side of his cheek and shook his head with a teasing smile. "Uh-uh. We don't have gasoline. We do have gas."

Chad stood slowly. For minutes his face contorted as he thought. "Using barbecue grill gas tanks?" he asked with wry smile.

"I made a couple of gas-powered cars using kits when I was still in high school. We can compress the local gas. You ready to assume the position?"

Chad nodded and Bob gave a shrill whistle. All the other mechanics gleefully surrounded the two men. Chad stood for the traditional reward for Jenkins management stupidity, a practice started by his father. *Whack!* Bob delivered the dope slap to the back of Chad's head.

"Okay, guys. New orders. Bob, you're in charge of engine conversions. We'll work together on the pricing. Automobile or power units. I want each of you guys to do your own cars and then drive around town. Wait. Buy a lot of pressure tanks and their connections first. That's what's going to limit production. Cars are everywhere but not pressure tanks. When they're gone, we're out of that business. Okay?"

"What are we going to use for money to buy them, Chad?"

He grimaced. "I hope you guys like eating beans more than I do. We're going to have a couple tough months before things turn around."

* * *

"I'm telling you, Denny, there just ain't enough logs coming in right now to keep that many guys hanging around." Donnie Lee Swiger was arguing with Denny Reilly who was in the midst of setting up a sawmill for his lumber yard. Donnie Lee stopped talking when he saw Chad walk into the pole barn. "Oh, hi, Chad."

"Hi, Donnie Lee, hi, Denny. How's it going?" Chad had only a nodding acquaintance with Denny, who'd bought his last car from Trumble and was originally from Bluefield.

"Fine, fine." A dozen years older than Chad, Denny spoke with confidence. "Getting the sawmill set up. I figure we're going to need it. Found a couple torn up blades and one good one from back before the lumber company started buying dimensional lumber. We'll be ready for business in a week. You planning on some new construction?"

"Not just yet. What with my stock in trade being rendered useless for the time being, I figured I might cut a little of my timber. Just me and a couple of my tenants. I figure a log or two a day, maybe less." Chad leaned back against a steel beam, vaguely wishing he'd taken up tobacco chewing. The good old boys always had a chaw or a whittling knife when they started talking business. Gave them something to do while thinking. The one with the most patience usually got the better deal.

He didn't bother to look at the avaricious gleam in Denny's eyes. Donnie Lee was behind Denny, grinning like a cat watching a mouse approaching a piece of tempting cheese. Chad had been selling cars to Donnie Lee since he got out of the Army. While Denny might know a lot about the lumber business, Donnie Lee knew he had a lot to learn about mano-a-mano dealing with Chad.

"Now that's interesting," Denny countered. "I reckon we could buy anything you cut. In fact, we could probably throw in kiln-drying any lumber you want to keep for yourself. Good, stable wood, won't split on you."

"Sounds good." Chad shrugged. "I figure I'd just cut enough to cover expenses until my rentals start producing a decent cash flow again. Most of them gotta get new jobs. Those who were inside the Ring of Fire. It was a nice day so some of my tenants were out of town."

"Sorry to hear that. Sort of. I guess they're happy that they're back in their time rather than disappearing like us. You know, you might have to do timber-cutting longer than you think, what with all your empty or non-paying rentals. Here's what I was thinking . . ."

It took four hours of hard negotiating but Denny finally "persuaded" Chad to go into the timber-cutting business in a big way, even financing two weeks pay for the lumber crew, just until they got their first payment for the logs from Denny. As was his custom, Chad deliberately left some money on the table for Denny, knowing that pigs get fat and hogs get butchered. Just like the car business, this wasn't a one-time deal.

Late February, 1632

The trouble at the Refugee Center erupted quickly. Two women were flailing at each other, pulling hair, kicking and using their fists. Fights between women cooped up in the old high school gym during winter weather were nothing new to Debbie. She and two of her assistants ran over to break it up.

One woman was far more vicious than the other. Debbie grabbed her from behind. The woman pulled back her arm and her elbow collided with Debbie's right eye socket. Debbie hung onto the woman as she tried to twist and squirm away from Debbie's assistants to attack her opponent again.

"Excuse me. Is this the fishmonger's shop?" Debbie's mother-in-law, Eleanor Jenkins' voice pierced through the clamor. The question was so inappropriate that the struggling woman stopped fighting. Then she almost collapsed and started crying.

Debbie was so disoriented by the blow she lost the train of events for the next several minutes. By the

time she understood what was going on, Eleanor had taken charge. She was sitting behind a long table on the announcement stage in her best imperial manner with two long-time friends, Nancy Reardon and Sandra Kip.

Eleanor tapped on the table with a small wooden mallet. "If you will all come to order, we'll get on with the hearing." Her tone was mild but firm. "There have been some strong accusations between the two combatants. FrauMaria Deschler, please step forward."

Maria was a sturdy dark-haired woman in her mid-thirties with a torn blouse and bruised face. Three children who looked to be between ten and two were standing around her, holding onto her apron.

"Frau Deschler, please make your statement before us and your peers," Eleanor pronounced in precise German.

"I don't know what happened, Honorable Frau Jenkins." The woman's chin shook. "I was about to wring out my washed clothing when this other woman came up to me, called me a thief and began hitting me. Naturally I fought back."

"What did she accuse you of stealing?"

"A wringer I bought from an up-timer a week ago."

"Liar!" the other woman screamed. She would have attacked Maria Deschler again except the men next to her held her back.

"Enough of that." Eleanor pounded her makeshift gavel on the table. "You may step back, Frau Deschler. Ursula Mitdorff, please step forward."

The brunette in her late twenties, her hair loose from her kerchief stepped in front of the stage. Anger was visible on her blotchy face and in every step.

"Frau Mitdorff,would you explain your actions and accusation?"

"It is Fraulein Mitdorff, Honorable Frau Jenkins. I am a laundress. She stole my wringer sometime last night. There are no other wringers here at the Refugee Center. I looked for it all morning and found her with it." The younger woman pointed at the other woman. "She is a thief!"

Nancy Reardon leaned over and whispered something to Eleanor. "Yes. Fraulein Mitdorff, we have the wringer in question. Can you identify it?"

The wringer was inside a box next to Sandra Kip and not visible to the young woman. "It is a Maytag. The cover is white. It has been modified so that it has a large wooden handle." Sandra looked down and nodded.

Eleanor's face was neutral and she breathed deeply, filling her lungs. "Thank you, Fraulein. Please step back. Frau Deschler, forward. Do you have anything to add to her description?"

"No, Honorable Frau." The woman was on the verge of tears. "But I bought it."

"From whom and how much did you pay?"

"I don't know his name. It was at the market. An up-timer. He wore a brown jacket and jeans. I paid . . . ten dollars."

"She is a liar!" The younger woman surged forward to the "witness position." She pointed at the mother. "I looked for weeks to find a wringer. None for sale! Anywhere!"

The older woman retreated. This time Sandra Kip asked the question. "If there were none for sale, exactly how did you acquire this wringer, Fraulein Mitdorff?" Her voice was ice in the cool and now silent gym.

The younger woman's face was pinched and white showed around her tight mouth. Then she lifted her head. "I paid for it with my body. An up-timer saw me wringing out laundry. For two weeks I visited him at night. Two weeks in which he . . ." Tears came to her eyes and she wiped them away after clearing her throat. "I did anything he wanted. He was at least honorable enough to keep his bargain."

The faces of the three women at the table were harsh. "Frau Deschler? What have you to say?" asked Nancy Reardon. One glance at the mother and it was obvious to everyone that she'd stolen and then lied about it. She shook her head in terror.

"I only wanted to dry my children's clothes quickly. I'd seen how well her wringer worked and knew it came from an up-timer. I didn't know how she'd . . ." The woman buried her face in her hands, sobbing.

Eleanor nodded to Sandra who handed the object to the young woman. "Fraulein Mitdorff, please take your wringer with our apologies. Apologies for this incident and for the way you had to pay for it." The laundress gathered it to her chest and, head down, quickly left the area.

Eleanor folded her hands together on the table and shook her head. "Frau Deschler. I shall not ask your peers what German law says should be your punishment. This is Grantville." Sandra and Nancy leaned over, hands concealing their words as they spoke to Eleanor. She gave a quick nod. "Frau Deschler. For your error you will first sincerely apologize to Fraulein Mitdorff. Then you will do community service for a month. FrauDeborah Jenkins will give you your work assignments. For the rest of you, do not attempt to bother either of these women about this incident. This hearing is finished."

Frau Deschler would have left but Debbie blocked her departure until Eleanor and the others joined them. Eleanor looked her in the eye. "Frau Deschler, I hope you understand that this hearing was not a legal court. Community service assigned by Frau Jenkins is not enforceable. But if Fraulein Mitdorff and the others here see you doing it, they will not want it to go further."

Frau Deschler was trembling as she nodded. "I hope so."

Debbie gently put her hand on the woman's arm. "Why don't you introduce me to your children?"

* * *

Camping during winter in Germany is damn cold, Chad told himself. One of Dad's old mechanics had told him about being constantly exhausted while slogging through France during the winter of '44-45 but it never sunk in until now. He could have walked the two miles each way to and from home every day but the days were short. If he wanted to make sure the land didn't get trashed, he had to be on site. Besides, the weather took it out of him. An extra hour or more each way, climbing over snow-covered hills and walking on icy roads was exhausting.

Money had been tight, damn tight even without the loan and mortgage payments because over half of their renters were looking for new jobs. Chad and Debbie talked it through and told their unemployed renters that they had a one month's rent moratorium. During those months the Jenkins family's only expenditures were for food because the utility and phone billings were in shambles. Chad's biggest source of pride during those months was that he hadn't missed a dealership payroll in spite of buying gas tanks. He hadn't failed his people.

Their tax refund and the few paying rentals barely covered expenses until the rental, engine conversion and timber money began to kick in. Once all his previous renters found jobs and he filled the open rentals, he finally had net income rather than losses. Then his stomach unknotted.

In October his timber crew built two bunkhouses that could be transported to each new site. They'd also found two potbellied stoves somewhere, so the bunkhouses stayed warm at night and during winter storms.

Once the logs had been trimmed and cut to proper length, they were hauled out of the forest down to the edge of the road. From there the logs went to the sawmill.

* * *

It was a late February Friday afternoon when the crew rode the wagon filled with firewood into town. Estes Frost, the experienced logger Chad had hired as his timber-cutting boss, would pay the crew its wages after the firewood wagon was emptied at the lumberyard.

"I'm home!" Chad unwrapped his woolen scarf before taking off his now-roomy insulated jacket. He had spent the past five days at the logging camp near the edge of the Ring of Fire. Not all of the extra forty pounds had come off his six-foot frame but he had a lot more muscle. Chad always had been the type of boss who didn't mind getting his hands dirty or in this case, wielding an axe. In the woods over the past several months, his rounded salesman's face had transformed into one with chiseled features, accentuated by a neatly trimmed full beard.

After hanging up his coat, Chad turned to see his short, fair-haired wife enter the hallway. His mouth fell open in shock. "What in the world happened to you?"

A huge black and blue bruise covered Debbie's right cheek and around her eye. She gave a crooked smile. "Tried to break up a fight at the Center yesterday. Caught an elbow. Doesn't hurt. Much." She gave a short chuckle and then started laughing. "Then your mom was there and oh, my God, took charge. She, Nancy Reardon and Aunt Sandra held a mock trial right there for the two women." Debbie shook her head as if in disbelief and then grimaced.

"Had to do with a converted Maytag wringer. One woman stole it. The other woman, a laundress, had paid for it by prostituting herself for two weeks. Imagine how much fun that must have been." Debbie's lips tightened and then she spoke again. "Apparently there are absolutely no wringers for sale at any price."

Chad sighed and shook his head. "What we take for granted." Then he gave a snort of laughter. "My wife, the five-foot, hundred ten pound bouncer." He lightly stroked around her bruised cheek. "Better give your mom and sister a call before they see you at church and jump to conclusions."

Debbie's lips tightened into a pucker and went to the side of her mouth. "Yeah. Aura Lee would love to believe it. I'll tell them to check with Aunt Sandra."

"Where are the girls?"

"Missy's in her room studying and Gertrude's at a dress rehearsal for a school play. The first showing is today but we've got tickets for tomorrow. Missy's got a date tonight. Make you think of anything, big fella?" Her mouth was slightly open in a smile and she ran her tongue across her upper lip.

"Hmm. I think after a long soak in the bath and supper, I'd like nothing more than a good night's sleep. It's hard sleeping in those stacked bunks." He answered with a bland face and slightly arched eyebrows.

"Why you!" Debbie laughed and pushed the much larger Chad against the wall. "If you think for one minute that I'm going to let you get away with that, you've got another think coming."

Chad covered her shoulders with his hands, his fingertips extending to massage her upper back. He gave her a teasing smile. "How soon is dinner? If I take a nice bath but not too long, do you think Missy would notice if we just happen to be in Chip's bedroom for oh, an hour or three?"

Debbie giggled. "Oh, really? You have some of those little blue pills squirreled away? I've heard about you lumberjacks and your long straight logs. We're having beef stew and it's in the slow cooker. I was already thinking along those lines."

Before dinner and again in the evening didn't quite catch them up but there was always tomorrow, Chad thought as Debbie snuggled under his arm. An idle thought came to him. "Honey, when were wringers invented?"

Debbie opened her eyes. "What? Well, not yet. Might be in the encyclopedia. Why?"

"It occurs to me that if one laundress in Grantville is willing to . . . you know . . . for one, then there must be one hell of a potential demand out there."

"What are you talking about, Chad Jenkins?" Debbie propped her head on one hand and looked at him in the dim light.

"We've pretty well logged out the valleys that are going to be flooded over the next few years. I'll bet I could start a company to make wringers. There have to be some in Grantville I can base one on. Sheds, barns, like that."

"I think Mom still has one back in a corner of the barn."

"Great. Now all I have to do is convince her to let me borrow it."

Debbie's mouth made a tight O. "Ooh, yeah. And she likes you*so* much . . ."

* * *

"Like hell you will, Charles Jenkins!" Vera Hudson snarled. She never used foul or abusive language but for Chad, she'd make an exception.

"Aw, come on, Vera! All I need to do is take it apart, get the measurements and tolerances. Then I'll put it back together. One of my old mechanics will do it, not me, I promise. I'll even make certain it's working properly before I bring it back." Chad looked at his diminutive mother-in-law, then back at the

dust-covered wringer and washing machine in the barn. It had been built sometime in the twenties or thirties, he figured because it had a gasoline engine attached. The electric lines had come out here in . . . He couldn't remember, but it was well before he'd been born.

"I said no and that's final. Don't think you can get around me by talking to Willie Ray, either." While her daughter Debbie might have forgiven Chad for his affair years ago, Vera never had. Or would, Chad thought. Willie Ray was smart enough to stay out of it.

"Tell you what, I'll give you a share of all the profits. Just like you owned the patent." Chad thought desperately. Vera was being so unreasonable! It wasn't like he'd sold her a lemon at any time. Come to think of it, they'd bought from Trumble ever since the episode with Noreen.

"Do I have to go inside the house and get the twelve gauge?" Vera set her jaw.

"No, I guess not." Chad sighed. He turned away from the barn. "Tell Willie Ray I said hi." Chad started walking down the driveway to the main road. *Well, as Rev. Jones said in his sermon the other day, when God closes one door, he opens another. There has to be another operable wringer somewhere in town. They couldn't have junked all of the old washers!* It seemed like all the really old ones had been scrapped in metal drives during WWII.

Then he brightened. Mom would know who still had one!

* * *

Two days later he received a call. "I hear you're lookin' for an old wringer washer," the old woman's voice said. "I got one in my shed iffin' you'd come out to look at it."

An hour later, covered with cobwebs and dust, Chad finally got the wringer-washer out. It was heavy but the weight was almost all from the oak wood. It was like moving a barrel on a wooden stand with a raised arm sticking out. Not enough metal to scrap.

Carmela Matheny had to be in her eighties, he estimated. Face wrinkled, body bent over and dependent on a cane to keep from falling over. "It's exactly what I was looking for, Mrs. Matheny. How much do I owe you?" Chad reached to pull out his wallet.

"Fifty percent," she croaked. "Fifty percent of all your sales and I want it on the first of every month."

Chad grinned and put away his wallet. "Well then, ma'am. I figure this is going to take a while. If you've got tea inside the house, I'll brew some for both of us."

"No, you ain't." Carmela's response was acerbic. "Anybody makes tea, it'll be me. This way." She gestured with the tip of her cane towards the screened-in back porch. "Don't you try helping me up the steps, neither. Wouldn't let my kids do it and I ain't about to let you." She gripped the galvanized steel pipe handrail with her free hand. "I may be old but I'm still spry enough to get around. Folks think that just because you're old and crippled up with arthritis, you ought to be living in a nursing home. Humpf! My mind ain't that far gone yet."

Once in the kitchen, Carmela put some water on to boil. "Ain't seen you up close since, must be 1960. Your mama brought you to the Kennedy rally."

"Sorry, I don't remember." Sales were all about patience. And knowing when to close. "How do you

know her?"

"She didn't tell you? Well, I reckon not. We're cousins. Our mamas were sisters, two of the Williams girls." The water began boiling. Carmela turned off the burner and dropped two teabags into the pan. She brought it over to the table and set it on a hot pad. "You like sugar?"

"No thanks, Mrs. Matheny. Learned to drink it without."

"Hmm. Reckon I'll have to get by with honey when this runs out." She stirred in a scant teaspoon of sugar from the pink plastic container. "Bet you never heard of the Williams girls neither, have you? Thought not. There was five girls. Anna, Bethany, Charity, Deborah and Esther. No brothers, so that was the last of that line. There's some Williams around but they ain't no relation. The Williams girls are why you're related to 'most everybody in town."

"Anna now, she was the oldest. She married Harold Stearns, that's Mike Stearns' great-grandpa. My mama was Bethany and she married an Atkins. Charity married Joshua Reardon, Phil Reardon's pa, but she died before they had any kids so he married Nina Curtis, as I recall. Deborah married William Hudson, Willie Ray's uncle and Esther, the baby, married Joe Newton, your grandpa. They're all gone now. Folks always joke about how West Virginians always marry kinfolk. In your case, it was hard not to."

"That's interesting." Chad set his cup down. "Mom probably has it all down in her genealogy records but I never took much of an interest."

"Well, you should. Talking about your mama, she used to be the wild one. Took after her fiddlin' papa, I expect. My little brother, Tommy, and her used to run around together." She stopped, coughed and dabbed at her eyes with a dish towel. "Tommy never got off Omaha Beach." She sniffed and wiped her eyes again. A moment later she cleared her throat and resumed. "She always swore she'd never get tied down by any man. I figured some boy would change her mind after the war. Course, your ma went from being a wild girl to as straight-backed and upright a woman as you can find after she married your pa. Reckon having a kid right off the bat can make some real changes in you." There was a knowing look in her pale blue eyes. Yeah, she'd counted the months.

"Oh, just to give you fair warning, Grandpa Williams was a horse-trader. I used to go around with him when I was a girl. I ain't going to be as easy a touch as that lumber yard boy, even if you are kin."

* * *

"You gave her*how* much?" Debbie's eyes were wide with amazement.

"Twenty percent of the profits," Chad answered glumly. "How she got me to agree to that number is beyond me. It was like she could read my mind every time I made a counter-offer. At the end, I thought I was doing well to hold her down to that number. Her husband probably never had a chance against her in an argument."

"What did she give you other than the wringer-washer?"

"Well, she said she thought she might have an older one her mom used around somewhere. That and some other things she brought in from the farm after her mom died. She said she'd look a bit and I should come out to help her do it. I think she just wants me to clean out the shed behind her house."

"Wouldn't surprise me." Then Debbie gave him a crooked smile. "Bet you could have gotten a better deal from Ursula Mitdorff."

Chad smacked his forehead. "Arrgh! Totally forgot about her. Damn!" He shook his head. "But I did learn you and I are kissing cousins. And we're related to the Stearns and the Mathenys as well. Almost to the Reardons. Huh! Mike Stearns and me. Who woulda thunk?"

"Well, it does explain why neither you or Mike gets the better of the other in making a deal. So how long do you have to pay that royalty?"

Chad sighed. "To her, until she dies. After that, I pay it into a trust that gives half to help support her daughter-in-law until she dies. Sylvia's got M.S. From then on it's split between her grandkids. The other half will go to support war orphans during their education. It stops twenty years after the war's over. She says she'll have it written up by tomorrow and I'll take it to a lawyer. I can live with it."

* * *

Two wooden rollers. Six gears. Spacers. All on the workbench in the service garage. Along with four bearings, several pieces of wood, housings for each side to hold the gears and bearings, a bent iron bar used as a spring and a long iron arm with a wooden handle.

"What do you think?" Chad asked his former lead mechanic. Bob Szymanski now had a nice little nest egg from the natural gas conversions and was gainfully employed by the Mechanical Support group.

"No problem to assemble them," Bob answered. "In fact, it's dead easy. Your problem's going to be getting the gears, spacers and the iron bar. Forget bearings, they're impossible for years. The rollers, distance separation and handle can all be made of hickory or another tough wood but the gears? For that you're going to need some machining. You might be able to make cast gears out of iron, one by one. Then cut the cogs with a file and match them up with the other cogs on the other gears." Bob rubbed his forehead with his palm. "I sure wouldn't want to, though. The down-time blacksmiths are supposed to be pretty good. You might give them a try."

"Thanks, Bob. Could we, I don't know, stamp them out?"

"Me? Nope. Anything I could stamp would bend every which way. But I'll bet a down-time blacksmith could hot stamp your gears out of cast iron. He'd finish them with a file until they're just right. If it was a master blacksmith, all he'd really need is to see how the thing works and he'd be ready to go to town."

"That's what I'm afraid of." Chad gloomily chewed on the corner of his lower lip. "I want him to be making them for me, not himself."

"Aw, come on, Chad, lighten up." Bob grinned. "You never made cars, did you? Your job's always been to sell the product, not make or fix it. Give him a share of the biz and that'd get you past all the guild problems at the same time."

Chad smiled as what Bob said sunk in. A broad grin spread across his face. "By George, I think you've got it! Now what I need to do is get some well-seasoned hickory and oak. Then find a good blacksmith. I don't really want to get him from Rudolstadt. The Count's just a little too sharp as far as I'm concerned and might start asking questions. I'll check with the refugee center to see if there's a blacksmith who hasn't gotten gobbled up by USE Steel and isn't already too busy. If not, Chip will know if there's a master or journeyman blacksmith in Jena who lost his forge because his town got destroyed. All he'll

need is metal. I think we can scrounge some from USE Steel. They're talking tons. We won't need much, at least not in the beginning. Probably never."

* * *

"Dad, I've got the perfect guy for you. I asked a blacksmith here in town who would be willing to relocate. He suggested Ulrich Dauer. The guy's an absolute genius. I watched him do things with iron you wouldn't believe. Trouble is, he knows it. Absolutely zero people skills and is an insufferable ass, which is why he hasn't been accepted by the local guild. Lost his wife and later his forge when his town was destroyed. He's got an apprentice he abuses and travels to work in nearby small towns like Cosberg or for minor nobility. They won't let him set up a forge in Jena.

"One thing you should know. This guy's an absolute suck-up to nobility. Worse than some Americans I could mention. Joachim talked with him. Told him you had even more money and land than his father, which may even be true. Anyway, he talked to me like I was the Emperor's son.

"Let me know if you want me to discuss a deal with him. Regards, Chip"

Chad refolded the letter and smiled. Not only an insufferable ass but was also desperate to associate with nobility? Piece of cake.

* * *

"Honey, I'm going to be hiring a blacksmith for the wringer business and I want to impress him, like we were nobility. A 'von Grantville' evening. So the best china along with the kind of meal only you can prepare. I want Mom, Missy and Gertrude to dine with us as well."

Debbie looked at him warily. "Do you want us to go formal, too? The dress I wore to the national sales awards dinner fits better than it did then. I'll talk with your mom."

"Great. The girls, well, as good as we can get them. Can't have you seen in the kitchen, so we'll . . ."

"Let me handle it, dear. You just worry about where to put him up."

* * *

"Herr Dauer?" The short, strongly-built older man with a mustache looked towards the speaker. Chad had gotten Veit Kruger, one of Gertrude's teenage German admirers to meet the smith. At the look from Dauer, Veit went on. "Herr Jenkins has arranged for you to stay in a private house with your apprentice." The sturdy adolescent apprentice was struggling with the smith's heavy work chest.

"If you will follow me? It is a short walk." Veit gestured to a small house two blocks away. "Herr Jenkins has provided what is called a 'dolly' to transport your chest." Veit pushed the dolly toward the apprentice. "Your apprentice can follow us."

Once inside the small two-bedroom house, Veit demonstrated how to turn the lights on and off as well as the toilet, sink and shower. "There is a kitchen here but no cook or maid. This was the home of a widow who died recently. Do not insert anything inside or allow water to enter these small double slots you see here." Veit pointed at the electrical outlet. "They can be most dangerous if not understood. If you accept Herr Jenkins offer, they will be explained at a time convenient to you."

"When will I meet Herr Jenkins?" Dauer's voice was stiff.

"I will come for you an hour after sundown. You will be dining with the family of Herr Jenkins, a great honor." Veit had been coached to answer that way.

* * *

"Good evening, Herr Dauer. So good to meet you." Chad welcomed him broadly. He'd decided to wear a navy pin-striped suit, brilliant red silk tie and an oxford blue buttoned-down shirt.

"I am happy to meet you, Herr von Grantville." Dauer began formally but stopped when he saw Chad lift his hand.

"There is no 'von Grantville.' Just Herr Jenkins. It is not our custom," Chad said mildly. "Will you join me for a sherry?"

"Thank you, Herr . . . Jenkins." Dauer took a small glass of sherry.

"*Prost.*" Chad toasted Dauer. One sip down, he continued, "Every now and then I insist my entire family dine together formally. I hope you don't mind."

"Oh, no, sir." Dauer was intimidated by Chad's easy familiarity and was uncomfortable wearing his best clothing. Dauer usually wore a heavy leather apron, leather trousers and a sleeveless linen shirt when he worked. Even so, he would never be willing to forego this opportunity.

"My son says you are a genius in iron, which is why I asked you to come to Grantville. I have a need for some iron to be cast and worked, really something I think would be elementary for someone of your skills. We will discuss it further after dinner." Chad ended his comments when Debbie came toward them.

Debbie was wearing a scalloped-neck, electric blue gown which fell to just above her shoes. "Good evening, dear." She took Chad's hand. "Will you introduce us?"

"Herr Ulrich Dauer, this is my wife, Frau Deborah Jenkins. Deborah, this is Herr Dauer, the master smith I told you about. A glass of sherry?"

Debbie smiled. "Thank you. I believe I will."

Ten minutes after Chad been expecting them, the girls came downstairs. "This is my daughter, Fraulein Melissa Jenkins and our houseguest, Fraulein Gertrude Wiegert who is continuing her studies in Grantville. She's originally from the Palatinate but the war . . . well, you understand. Her younger brother and older sister are currently living in Jena. I believe you've met her sister's favored suitor, Joachim von Thierbach."

Both girls were graceful in their dresses. Missy's was patterned on her mother's dress. Gertrude's was based on one worn by the daughter of Duke Johann Philipp of Saxe-Altenburg. Sewing machines and the proper materials in the hands of some of the older women in town could work wonders.

A few minutes later, Chad's mother, in a fashionable dark green suit, came into the room. "Sorry I'm late. I hope you'll accept my apologies." She smiled at Dauer and took her seat.

Debbie selected a Vivaldi CD for their dinner music. It would be followed by Pachebel and Bach. Dinner itself began with a white wine and green salad with shredded carrots in a vinaigrette dressing. Afterwards a bottle of merlot, some of the last in their cellar, was brought in. Chad poured the wine shortly before the sliced roast beef, baked potatoes and steamed green beans with the last of their slivered almonds were put on the table. Debbie had been in the kitchen all afternoon, much to the dismay of the German cook they'd hired for the evening. Then Debbie had gotten another woman from the refugee center to help their maid, Christina, serve the food.

Dauer, of course knew none of this. He watched as Chad and Debbie left their salad forks on the salad plate. Then how they used the dinner fork and knife for the rest of the meal. He knew of the potato but had never imagined that it would be eaten by humans at any time, unless in extremity. Upon tasting it, he found it to be, well, edible but rather bland, even with butter, salt and pepper.

All the while, Chad, Debbie and Chad's mother kept up a spirited conversation about the current political situation, business and music. They frequently asked Dauer his opinions based on his being native to these times. Also about his experiences traveling around the region. He easily recognized the primacy Herr Jenkins' mother had over the family, quite unlike his own grandmother. What threw him off the most was the easy familiarity Missy and Gertrude had, conversing with everyone including the grandmother. In all, Dauer was amazed by the high level of discussion and the total absence of gossip.

Then Missy asked, "How does your apprentice feel about coming to Grantville?"

"I don't discuss such matters with him, Fraulein Jenkins," Dauer responded. He was about to go farther but saw Chad's stillness and direct look. Not to Missy's question but to his answer.

A moment later, the crème brulèe was brought in. Smiles burst on Missy and Gertrude's faces as the bowls were placed before them. The creamy custard topped with a thin layer of sugar caramelized under the broiler was a rare treat.

"One of my favorite desserts but harder to make now that sugar is more expensive than I care to pay," Chad commented. His spoon cracked through the thin crust into the custard.

"It's exquisite," Dauer burst out. "Cream I've had, even flavored creams but never prepared in such a fashion. I've had sugar, of course, but I've never seen it melted and used as a crust."

"Our standard dessert at supper would have been ice cream, possibly with some fruit." Debbie smiled. "The fruit was often shipped in from thousands of miles away during the winter. We would get both the fruit and the flavored ice cream from a local market. We stored it chilled or frozen here in our home. All too soon the machine we use to keep it cold could break. We'll have to reinvent a method to keep things frozen some time in the future."

"Amazing." Dauer's mind circled. "To be able to put inventions on a time schedule. I used to make regular experiments but I lost my notebooks when my home was destroyed by raiders. I lost all my wealth at the same time. I . . . haven't experimented since my wife died in childbirth."

The entire Jenkins clan looked at him with sympathy. Chad spoke first. "I don't know that experimentation will be necessary for what I want. But it seems to me you might want to start replicating your experiments."

Dauer nodded.

* * *

After dinner Dauer accepted the chair Chad offered in his home office. "An amazing family you have, Herr Jenkins. I never imagined women could be so intelligent."

"They're gifted with as many brains as men are, perhaps even more." Chad gave a faint smile. "The difference you've seen is that the women in my family are allowed to grow in knowledge. *Kinder, Kirche und Kueche*are all very well, but not overriding. My wife and mother attended universities. One theory is that more educated mothers have more intelligent daughters. Personally, I don't think it's in the blood. If the child sees her mother doing intelligent things, she is encouraged to do intelligent things herself. If you had the opportunity to observe my son with women, I think you saw he does not dismiss them as mindless idiots.

"Likewise, I make the blanket assumption that everyone can learn. Some actually cannot learn due to limitations of their minds, some are only able to reason to a certain extent, but the rest try to live up to my expectations. I've been disappointed but not all that often. The reason I bring this up is because of your attitude towards your apprentice."

"What about him, Herr Jenkins?" Dauer looked stubborn. "His parents paid me money to train him and I'm training him. He is learning, even if I have to use the stick on him regularly."

"That's just the problem." Chad gestured widely. "Long before my time we found that while you can make a donkey go forward with a stick, once you stop hitting him, he stops moving or moves slowly. On the other hand, if you encourage him, praise him when he actually accomplishes something, he will want to keep moving faster and faster. Those are the classic carrot and stick approaches to education."

"Herr Jenkins! I have tried and tried to do that but he is like your donkey. I have to get his attention. My master beat me regularly until I spotted him making a mistake one day. I didn't tell him and the iron was ruined. I kept the pleasure of that knowledge in my heart. I then began to find out how much more I could learn that my master did not know or was doing wrong. Unknown to him, I began my experiments. I became a journeyman easily and then a master. Unfortunately, I found that I was still working with fools like my old master."

"I understand, Herr Dauer. It is difficult, so difficult, not to have excessive pride in your greater knowledge, isn't it? Life was good when you were in your own town where the people recognized your worth. But then in Jena? You only irritated them. Of course they knew your skills but if someone continually berates you as a fool, do you allow him into your own house?"

"I suppose I wouldn't, Herr Jenkins. But still . . ."

"No buts. Fortunately you're here in Grantville where the local blacksmiths cannot reject you. On the other hand, if you are to work with my people, I insist that you treat them with as much respect as they give you. They will not know as much as you do about iron but I guarantee the American workers will know scientific facts you never imagined. You know something, they know something. I also insist that you treat all German workers with respect, including your apprentice."

"You can't make me do that." Dauer's chin was lifted in bitter refusal and he glared at Chad. "He's my apprentice and I'll treat him as I see fit!"

"All right then, so be it." Chad shrugged and flipped his hand sideways. "The coach leaves for Jena

tomorrow morning at ten. Be on it." He couldn't enforce it but Dauer didn't know that. He did know nobles who could and would.

"You would throw me out of Grantville because I will not relinquish control over my apprentice?" Dauer gasped in shock.

"No. Because you are refusing to change!" Chad slapped his desktop. "You're refusing to even try! That's why! I have no use for someone who will not try. If Galileo Galilei was in my employ, I would dismiss him for the same reason. He may be a great scientist but I would not use him."

Dauer was aghast. Herr Jenkins would dismiss Galileo? How much brighter a star was Galileo than Dauer himself? It never occurred to him that . . . "It is that important?"

"My son and I have at least one thing in common." Chad spoke in earnest, his eyes boring directly into Dauer's. "The true worth of an individual is not based on his wealth or position. It is based on his heart and a willing mind. Of course there will be those who will attempt to deceive you. There will be those who cannot or refuse to learn. Let someone else worry about them. But most, most will try to learn.

"Explain in an orderly fashion to your apprentice why certain things happen. USE Steel can help with the chemistry aspect. I personally know very little about iron but let me show you something."

Chad lifted an old technical manual from the shelf behind him and put it on the desk in front of Dauer. He opened it to a page showing an exploded view of a carburetor. "See that?" Chad tapped the picture. "My father trained me how to take apart and put together that type of machine when I was younger than Albert. I had no idea how to make any of the parts but I knew how to put them together properly because he taught me their order."

Dauer was fascinated by the incredibly detailed drawing. "So many individual parts."

"That's nothing." Chad flipped the pages to one showing an automobile engine. "There are hundreds of parts in that, all made to a precision measured in hundredths of an inch. Thousands of people shared their knowledge and experience over less than a hundred years in order to build this. For one type of machine which had ten or more competitors. Do you understand?"

"I will have to think about this, Herr Jenkins." Dauer was apologetic. "I am willing to learn. I always have been. It's just that it's hard to change."

* * *

Chad closed the front door behind Dauer and gave a huge sigh of relief. He cupped his hand over his mouth to sound like a PA system. "His Most Serene, Glorious and Puissant von Grantville has left the building." Chad draped his suit jacket over the back of a chair, unbuttoned his collar and whipped off his tie.

Missy laughed as Chad sat down on the living room couch. "Dad, I knew it was going to be a 'von Grantville evening' but I hardly expected you to give him the whole 'von Grantville treatment.' I mean, we could hear you pounding your desk."

"Was all that necessary?" his mother asked.

Chad grimaced and rubbed his palm across his right cheek. "Unfortunately, yes. I hate being that

forceful. Chip wrote that he was abusive to his apprentice. I had to shut down that kind of behavior immediately. Might be allowable in any other part of Germany but I don't need anyone I'm doing business with getting arrested for assault and battery. The smiths in town probably wouldn't think of mentioning it."

"It occurs to me you were as arrogant as him," observed Eleanor.

"Yeah. But I have to psych myself up for it. I figure he's been working on it since he was an undersized kid in grade school. I'll bet he was apprenticed to a smith because the smith was the strongest man in his town. Might be a hell of a scrapper."

"Have some coffee." Debbie brought him a steaming mug. Cream and honey, the way he begun drinking it after the new coffee began arriving. She sat down next to him after he took his first sip. He put his arm over her shoulder. "So how did it go?"

"Good. Good. I've got him thinking along the lines I wanted. I'll close the sale tomorrow. Have to make it quick or he'll find just how much work he can get without me, even not having his own forge. Right now he's willing to change because he wants this job so bad he can taste it. He'll be unhappy once he finds how I conned him but he's smart enough to get over it fast. If nothing else, all his fellow smiths are doubling up or more in rooms while he has a whole up-time house to himself and his apprentice. That's genuine prestige these days."

"This is a sale?" Gertrude asked. Since Gretchen brought the attractive teen to Grantville from Jena last October, she'd become a member of the Jenkins family.

"Sale, agreement, contract. Whatever. In the car business, ninety percent of the time I only had one shot to make the sale. So I initially showed Dauer respect in front of all of you and the comforts available here. I'll bet he noticed every single one, from the music to the silverware. By the way, wonderful, just the perfect dinner, dear." Chad gave her small shoulder a squeeze and kissed the top of her head. "Then in private I had to get certain issues blasted through his arrogance."

Missy nodded emphatically. "Yeah, that bit about 'Oh, I never ask my apprentice for his opinion' got to me. I couldn't believe it. I mean, Mom would never teach kids like that. Right, Mom?"

Debbie started chuckling and then burst out laughing, joined by Chad. "No," she finally admitted, wiping tears from her eyes. "But there have been times. Oh, there have been times when I wished I could. Including you and Chip."

"Excuse me, but I don't see what was unusual in Dad's treatment of Herr Dauer," confessed Gertrude. "Dad's far more lenient and generous than any*freiherr* would have been towards even a master smith coming to work for him. I doubt Herr Dauer has eaten with any*freiherr's* family. He is a craftsman, they are noble. It just doesn't happen. Like you had Veit tell him, it's a great honor."

"True," Eleanor said. "But remember we're not like the rest of Germany. Chad, how many times have you had your salespeople or mechanics over for dinner?"

Chad wrinkled his brow in thought for a moment. "Here? Maybe a dozen times, mostly Christmas parties when times were lean. Normally we had them at Toothman's Restaurant in Farmington. We did have that party for Bob Szymanski so he could propose to Darlene." Chad snickered. "Then she almost swallowed the engagement ring he planted in her piece of cake. Most of our parties are for people from the church or the Lions."

Debbie looked at the mantle clock. "It's almost eight, girls. If you've got your homework done, you can watch TV. After you've changed out of those clothes."

Eleanor was frowning.

"What's the matter, Mom?" Chad asked.

"Just thinking. Perhaps you're taking this 'von Grantville' thing too far."

Chad gave a slight shake of his head. "I don't think so. I spent months in the woods with the timber cutters. While Estes Frost and the other up-timers all called me Chad, most of the down-timers still called me Herr Jenkins. This is after I was swinging an axe, eating the same food, sleeping in the same bunkhouse and going to town only a little more often than they did. I think the down-timer loggers thought I was like one of those eccentric English gentlemen and had a screw loose.

"Dauer's one of the few who ever called me 'von Grantville' and I stopped that right away. Once this contract is in place, I'm going to insist on Chad and Ulrich. Saying Herr all the time is boring. I admit I'm not as egalitarian as some people would like but as long as I've got you and Debbie standing next to me with sledgehammers, I don't think it's going to be a problem."

"Sledgehammers, huh!" Debbie snorted. "That's not at all lady-like. We ladies use hat-pins. Three inches long. You still have some around, don't you, Mom?"

* * *

Ulrich Dauer didn't get much sleep that night. Early the next morning he knocked on Chad's door. "Herr Jenkins, I will do as you wish on one condition. That I be allowed to learn what those men at USE Steel know."

* * *

Dauer and his apprentice, Albert, watched as Chad demonstrated the wringer later that morning. Then as he disassembled it onto the workbench. Dauer looked at the few parts and his forehead twisted, mystified. "I can hardly believe you brought me here to make these parts. They're child's play."

"I know. But I'm going to need hundreds of them. I think it's journeyman or senior apprentice work except for this." He picked up a bearing and holding the center, spun the outer portion. "The machine has four of these. See the tiny shiny parts in there? Each one is a metal ball called a bearing. They make the entire assembly roll smoothly."

"How are they made?"

"Frankly, I don't know. There were a number of them used in automobiles and they were not made around here. Don't even try. What I need you to do is to figure a way to duplicate their function in the machine. Or not. But it has to roll smoothly."

"Ahh," Dauer breathed with a smile. "A challenge." Then he gave an assured shrug. "It shouldn't take long. What will take much longer will be to set up my forge. First of all, I will need a building, one safe from prying eyes. I will also need additional tools. Given time, I can create most of them. The only tools I have are what are in my chest. It's too unsafe and expensive for me to keep a horse and wagon."

"Hmm, let's look at what's here in the service garage's back room." Chad unlocked the door. "I let the Mechanical Support group have all the highly technical stuff but I've still got a lot of my father's tools. There's something I'll bet you don't have in your chest," he muttered, pointing out a large anvil. "I've got a lot of old measuring stuff. Calipers and the like. They're covered with grease and grime but will still work. You'll probably need a big vise as well. Take anything you find here. My father used all this stuff at one time."

Dauer was disturbed. "Herr Jenkins, you mean, he actually worked with his hands? But how . . .?"

Chad looked over at him with a gentle smile. "Herr Dauer, you will find that all the Americans in this town either worked with their hands or had a job that required daily activity. We had no idle elite. My father repaired engines, like the ones I showed you last night. He required that I learn how to repair them as well. I wasn't very good, mostly because I didn't want to be. My skills were those of a tradesman, selling the completed self-propelled carriages, like those pictures I showed you before you left last night. With my profits, I purchased land."

"But I thought you were a . . ."

"A noble? In our time, we had no one who could be considered the equivalent of a noble, at least not living around here. I just happen to own more land and houses than anyone in Grantville. There were definitely none in our country who combined the land ownership and political power the nobles have here. Huh! Think about it, Herr Dauer. Would you rather have a noble who behaves like a criminal or a tradesman who behaves nobly? Now let's see what else we have."

Dauer couldn't believe it. He'd just had dinner with Herr Jenkins' family last night in an atmosphere of nobility, at least his ideal of nobility, the type he'd always wished to be accepted by. Music, good food, intelligent conversation and most of all, people who were interested in what he had to say.

"Herr Dauer? The drill press? I know it's old but it's electric powered and I have the metal cutting drill bits, taps and dies. You're welcome to use them."

"Uh, Herr Jenkins," Dauer gave an embarrassed chuckle, "I think I can figure out the drill press does but what are taps and dies? Are they something for a farrier?"

"Farrier?"

"Yes, the smith for horses, to shoe them." Dauer mimed bending over and tacking in a horseshoe.

Chad laughed. "Oh, no. No farrier work was ever done here. But now that you mention it, Grandpa Jenkins may have done some. Dad just never threw tools away. I moved everything that he had to this location when I bought the self-propelled carriage shop. The taps and dies are to, well, I'll show you later. We'll have to find a location for your forge, this place won't do at all." Chad paused to think a moment. "I've got it! There's an old brick building just outside town, built at least a century ago. It's where my Grandpa Jenkins had his first garage. Who knows, it might have originally been a stable or farrier shop."

* * *

Dauer reread the contract he and Chad had signed. The final paragraph required that his apprentice, one Albert Gunther Steinmetz, age thirteen, further his education by attending school in Grantville. That paragraph floored Ulrich when he first read it.

"But his education is complete except for his apprenticeship! I will need him in the shop to assist me."

"Complete?" Chad was sarcastic. "How much does he know about chemistry? Biology? General Sciences? Mathematics? Geometry? Physics? Can he speak, read and write fluent English? While you might not need these, I assure you, he will. There will be no charge to you for his education. He will be getting out of school every afternoon and will assist you then. In the evenings he can do his studies. Besides, he's required to go to school until he turns sixteen. That's the law here."

"Well, why didn't you say so to begin with?" Dauer was explosive then checked it when he saw Chad's silent glare.

Chad waited, deliberately staring at Dauer until he saw his eyes look away thirty seconds later. His voice was soft as he tapped his finger on the line in the document. "I do not want Albert thinking that the only reason he is attending school is because the government requires it. I want him to believe you insisted on it and I agreed. Do you understand why?"

Dauer glared at him. He could always get another apprentice but a position like this, working for Herr Jenkins in Grantville? Unlikely. In fact, unique. Having accepted that fact, he nodded. "All right. I agree." He surrendered grudgingly. "No wonder you made enough money to buy as much land as you have," he grumbled. Then his lips lifted in a smile.

Chad grinned. "There's only one man in Grantville I could never better in a trade. Fortunately, he's not a tradesman. Now let's go see Chuck Riddle and make this all legal."

* * *

Chad watched fascinated as Dauer hammered another piece of iron into shape and quenched it. He could see how it was done but damned if he would ever have the desire to do it himself. Of course, there were people who hated selling.

It'd been a month since Dauer arrived in Grantville. It took only a week before he was using most of the metal-working tools that were in the service center on a daily basis. When Dauer visited USE Steel and walked around town, he ran into a few smiths he'd known. To his surprise all were willing to tell him anything he needed to know about iron and steel. Especially after he mentioned he was working primarily for Herr Jenkins and wouldn't be much competition. A couple of journeymen smiths even hinted that when he needed some additional help, they were looking for opportunities.

Chad already had dozens of rollers and frames ready for assembly but hadn't thought of a proper name to put onto the top frame of the wringer. Dauer looked over at him, his face protected by a clear heavy plastic face shield. "Oh, hello, Chad. What brings you over here?"

Much to the relief of both, they'd dropped formality the day after they'd signed the contract. Ulrich and Albert had supper with Chad's family one day a week at Chad's heavy suggestion, usually Sunday dinner, to "accustom themselves to American ways." In Chad's opinion it also kept the girls civilized. Bringing Albert out of his shell around girls was another benefit.

"Ulrich, what would be a good German name for the wringer assembly?"

Dauer shrugged, sweat dripping on his shoulders. "Doesn't matter to me. Name it whatever you think best. Maybe the Cheerful Maid or the Laughing Laundress."

"The Laughing Laundress it is. How soon will Albert be back from school?"

"About an hour. I need him for the bellows on the charcoal to make it just right. It's much easier to work iron when he's here."

"Hadn't thought of that," Chad admitted. "Would you like to join me for dinner with the Lions Club tomorrow evening?"

"What's a Lions Club?"

"It's an organization, active all over the world, well, was. It's committed to solving health and social problems by accomplishing more as a group than as individuals. I'm a past president of this chapter. It's also the reason I put that clause about eye protection in the contract. Our biggest programs have to do with sight, including eyeglasses and testing for vision problems. We meet two evenings a month, have dinner and usually a speaker. This week it's Len Trout, the principal of the high school. I thought you might be interested because Albert will be attending school there."

"Why does he speak to you rather than you visiting him?"

"It's good business to get out and meet people he usually wouldn't come into contact with. Most of our speakers enjoy spreading their point of view to groups of people in the community. It's one way of gathering support for whatever their position is. A lot of our members are also members of the Chamber of Commerce but a lot aren't.

"Since the Ring of Fire we've had Mike Stearns, John Simpson, Rebecca Abrabanel, Frank Jackson and Greg Ferrera speak. We're planning on waiting until our German gets much better to invite the Count of Schwarzburg-Rudolstadt and King Gustavus Adolphus." Chad kept his face straight.

Dauer's eyes goggled. "The king? He would come to talk to you?"

Chad burst into a laugh. "Probably not, now that you mention it. Well, unless he makes a visit to Grantville which seems unlikely."

A moment later, Dauer assembled the pieces of the new wringer together once again. He clamped it to the standing frame and turned the crank. It turned smoothly. "Not bad, eh?" Dauer grinned. "You just have to lubricate the gears before you use it every day."

"Ulrich," Chad declared, "You're a miracle worker."

* * *

"Chad, can I talk with you for a minute?" Clarence Dobbs, a wiry, intense man was nervous. Ulrich Dauer stood behind him, clearly interested.

Chad was inventorying the load of completed wringers while they were being loaded onto the wagon. "Sure." Clarence did all the plumbing, heating, ventilation and air conditioning repairs for Chad's rentals as well as his own home. "What can I do for you?"

"Well, uh, I talked with Ulrich Dauer here and, uh, he said to talk with you. Well, what I want to do is branch out. The old HVAC business is going to go bye-bye in the next few years. Real air conditioning

repair's about gone. Now it's mostly maintenance and well, I want to start making old-fashioned cast-iron stoves. Ulrich says that he can easily cast the parts. Even make the molds. What I really need is money. I'd druther borrow it from you than the bank or the Abrabanels."

Clarence was normally self-assured and knowledgeable about every aspect of his business. His nervousness bothered Chad. "If you don't mind my asking, why me rather than the bank?"

Clarence looked apprehensive and rubbed the side of his jaw. "Well, it's just that I, uh, had some credit problems recently, what with it being a family business. Not being able to, you know, work like before. But I'm good for the money. It's just that uh, well, I'm damn near broke, what with not being able to get parts and refrigerant."

Chad eyed the man he'd known for years. "I'll have to think about it. What kind of accounting system do you use?"

"Bonnie, my wife, handles all that." Clarence seemed uneasy about that fact. "She suggested the whole idea to me. Said she remembered her grandparents' old cook stove with the water reservoir on the side."

"Uh-huh. Are you computerized or do you do account books?"

"Well, Bonnie tried using a computer but she and it didn't get along. So she went back to the tried-and-true pencil and paper along with a calculator."

"Okay." Chad sighed. "I'll need to look at your books before I loan you any money. Right now I've got a lot tied up in these wringers. Tomorrow I'm going to run up to Jena to sell the first batch. I'll look at your books when I come back. That all right with you, Clarence?"

"Oh, yeah, sure." A relieved smile came to Clarence's face, reverting to his normal behavior. "That'd be great!"

"All right, I'll talk with you then." Chad smiled and shook Clarence's hand.

A moment later Clarence was gone but Ulrich stayed. "What do you think, Ulrich?" Chad cocked his head towards his partner.

Ulrich shrugged. "I saw some pictures. Herr Dobbs says he can get me a stove to use as my model. I can cast the iron. The stovepipe will be more difficult but can replaced with round brick tile, like a very narrow chimney. Any tile maker can do it, I think."

He hesitated. "Herr Jenkins, could I . . . put money with you to loan, maybe invest for things like this?"

That puzzled Chad. Ulrich only had a few talers when he came to town. As far as Chad knew, he was spending almost as much as he brought in. "How much were you thinking about investing?"

Ulrich licked lips that were still close together. "It's a lot. But not right here. I'd have to go get it. It's in my home town. I hid it. After the town was raided. I couldn't bring it with me."

Chad's mind was on his cargo. "Sure. No problem. More money now means more money in the future. I'll go with you and we can pick it up after I get back."

Ulrich gave a relieved sigh. "Thanks, Chad. You won't be sorry."

* * *

The half-day trip to Jena in the hired wagon gave Chad plenty of time to outline the sales pitch. Chip had arranged for a pitch woman and assured him that there would be plenty of women who'd like to see the wringer demonstrated today. All of them had admired an early version of the wringer located in the Committee of Correspondence laundry or had other reasons to be contacted.

"Herr Jenkins, I don't know if I could stand up in front of people and sell anything." Maria Schreiber, the stocky laundress was almost trembling. Mathilde Wiegert, Gertrude's sister, had suggested Maria to demonstrate the ease of the new wringer.

Chad gave her a gentle smile. She wasn't the first salesperson he'd broken in. "First of all, Maria, each and every person you'll be showing the product to will be there because they know about the wringer at the laundry. They want to know if it's as easy as they've heard. Second, you've been using the wringer. You've experienced how much easier this one is. In fact, I'm giving this one to the laundry for your assistance."

"B, but . . ."

"Relax. We've gone over what you're supposed to say a few times already. Mathilde and I will be watching so if you have any problems, we can suggest things as part of the audience. Does that sound better? You'll be much better at this than I could ever be because you're someone like them." Chad wasn't certain Maria would work out, but Mathilde insisted she was normally outgoing, so this could work. He was fairly certain that her lack of confidence originated from a previous occupation. Now she'd be up in front of several "good" women. But he wasn't going to bring up the subject.

* * *

"Come in, please. Have a seat on the bench." Maria was nervously rubbing her hands together at the front of the room. Chad and Mathilde were in the rear of the room Chip had arranged near the bathhouse and laundry. All the women in the room were laundresses or maids in town.

"Good afternoon. My name is Maria Schreiber. I am here to demonstrate the Laughing Laundress wringer." Chad winced. She'd blurted it out in one breath. "I, I have two shirts in the water bucket here." She nervously pulled a linen shirt out with each shaking hand. "Uh, who is exceptionally good at wringing shirts?" There was no response. The thirty or so women looked impassively at her.

"Uh, all right, uh, well, I'll wring the first shirt over this empty bucket." Maria dropped both shirts back into the water. She drew out one shirt and began to wring it by hand. A cascade of water poured out of the shirt into the bucket. The longer she twisted it, water still came out. It gradually became less and less the more she twisted. Finally she stopped. "Is there anyone who thinks she can get more water out of this?" Again no response.

She put the shirt on the table. Then she moved over to where the wringer was on a stand above an empty bucket. "I will now demonstrate the Laughing Laundress wringer." She saw Chad making notes on a piece of paper and became even more nervous. Would he simply stop the demonstration before she messed it up too badly? But Chad looked up, smiled and nodded so she went on.

"Again, I'll take a shirt directly from the bucket. Then folding it so that any buttons are flat on the inside, I will insert the collar between the rollers." She was more confident now. "I'll hold it there until it is caught

by the rollers." She gave the handle a partial turn and remembering, abruptly faced her audience. "Watch how the water pours into the bucket." She began turning the handle. Water poured out of the shirt, onto the bottom wringer, onto a thin downward-slanting board and into the bucket.

"Now how many of you think this is dry enough to hang on the line?" Maria walked over to the first bench. She handed the shirt to first woman in the row, an older woman whose grim look and reddened hands indicated she was a laundress rather than a maid. The woman expertly flipped it out, felt it for moisture. "I've hung up some that were not as dry." Then she handed it to the next woman.

"So this would be dry enough for any of you?" The women silently nodded.

"Well, I don't think it's dry enough. I've been using an early version of the wringer at the laundry next door since the last fever. I always got my clothes drier than this. Now watch." Maria took the shirt back and made an adjustment to the rollers. She put in the collar of the shirt again and began turning the handle. It was no cascade but a steady thin stream of water fell into the bucket.

Maria gripped the shirt by the collar. She flapped it, opening the entire shirt and smiled. "Now see how dry it is? How much is it worth to you to have a shirt, dress or apron almost dry without wearing yourself out before you hang it to dry? Not only that but putting it through the wringer does not twist apart the fabric. I warn you, the Laughing Laundress wringer is not cheap but you will be able to double, triple the amount of laundry you do. How? First, your arms don't get nearly as tired. Second, the clothing will dry much faster. Your customers or the mistress of the house will appreciate how clothing lasts longer because you won't be twisting it, breaking its threads bit by bit. Well?"

From the back of the room Mathilde called, "Hanna, try it for yourself."

Hanna, the woman to whom Maria had first given the shirt stood up slowly and walked over to the wringer. She took a shirt from the bucket and leaned forward. As she began to crank she ignored her hair on as it came unpinned. Until suddenly she cried out. "Awk! My hair's caught! I don't want my hair chopped off!" She began struggling, squawking as her hair pulled, caught in the wringer. Chad stepped forward and then stopped. He stepped back, leaned against the wall again and made another note.

"Stop. Don't move." Maria gently put her hand on the top of Hanna's head before turning the handle in the opposite direction. "It's not the first time hair has wound itself around a wringer, including mine. All you have to do is turn the handle the opposite direction. There, see? Just something to watch out for, just as when you stand in front of the fireplace, you keep your skirts away from the fire."

Once Hanna was released she stood well back and looked at the wringer with a deeply suspicious frown on her mature face, her arms crossing her chest. "Now you all know how to get yourself out of this problem." Maria looked over to the audience and smiled. "As you can see, I do cover my hair. I also keep it well away from the wringer works." She looked at Chad and he nodded. Time for the close.

Glancing at the notes on the paper before her, she began. "Today only, all of you are invited to purchase one of these new Laughing Laundress wringers at a very fair fixed price of two talers. We have a limited number, far less that we could sell here in Jena but you're getting to an opportunity to purchase one today, right now, because a Committee member specifically invited each one of you or someone in your household. If you want to purchase one tomorrow, you may have to bargain for it. It is highly unlikely that you will obtain a lower price. In fact, I can guarantee you will pay more because there is going to be so much demand once the word gets out. Possibly a lot more because these are the last wringers that will be in Jena for a while. The ironwork is by a master blacksmith and you can see the quality.

"You can pay in cash right now and take it home with you. Or you can place your order with a deposit and come back soon with the rest of the money. Or if you really, really want it but won't have enough money available soon, the Committee's credit bank is standing by to loan the amount at the incredibly low interest rate of ten percent. Please, try it now. Assure yourself of the ease of this wringer before it's too late and all the wringers are sold."

Another older laundress, skepticism written across her face, walked over to the wringer, pulled out a shirt from the bucket. After a couple of false starts, she began to crank the shirt through it. After she finished the laundress frowned severely, her hands on her hips. "Well, I will admit, for as much as it costs, it does seem to work. My hands and arms ache as the day goes on. It's not magic but it's easier to turn the handle rather than wring by hand. Yes, I'll buy one."

Soon all the laundresses were standing in front of Maria and a couple other Committee women while they wrote sales contracts and took deposits. Meanwhile the maids were running home to get deposit money from the mistress of the house or the housekeeper. According to Mathilde, all the city council members, including the burgermeister had a senior maid in attendance. Sebastian Moser from the Committee Credit Bank was joyfully smiling while he took applications for loans, the type of small business loans the credit bank had been set up to make.

* * *

Three days later, Chad left the city with a box full of talers and an empty wagon. Empty, that is of wringers, the carter having picked up a wagonload of merchandise for sale in Grantville. Chad had extended the "sale" until the last wringer was sold. The market having been flooded for the moment, there would be no one to buy any wringers that anyone in Jena fabricated. Which was exactly what Chad wanted. He had nothing against a wringer monopoly as long as he was the man with the monopoly. Larger cities such as Leipzig would require a lot more preliminary work. He'd get Chip to arrange his introduction to the head of the Leipzig Committee of Correspondence well before he brought a wagon-full of wringers. The next batches were going to Rudolstadt, then Weimar and Erfurt, then the whole NUS.

Naturally, Chad left a few talers behind. The city government wanted a few just to let him sell in the city. Maria was delighted to receive two for her three days of work. Chad also made a significant contribution to the Jena CoC for its assistance and donated a wringer to their laundry. The first laundress to announce she'd buy a wringer purchased hers significantly below cost once her previously agreed "rebate" was figured in. Hanna, the woman who'd gotten her hair caught, also received a discount for her suffering. Chad hadn't taken many chances. He left Jena with orders for thirty more wringers.

He named Maria the local Laughing Laundress agent. The finished wringers would be sent up to her for distribution and collection of the balance of the purchase price. He was undecided if he wanted her to demonstrate in Rudolstadt as well. Perhaps Fraulein Mitdorff might be interested. He'd definitely arrange for a laundress to get her hair "accidentally" caught. Good, useful theater.

He considered the involvement of the Jena CoC and smiled. Just to buy a wringer, you had to come into contact with a member. Since most wealthy and middle class households had their clothes washed by a maid or a laundress, the Committee had access to, at least indirectly, everyone in the city. The poor came into contact with the Committee in so many other ways.

* * *

"East of Halle?" Chad gasped in shock. Ulrich had finally told him where he'd hidden his money. "I know

what I said, Ulrich, but no way can we go that far right now. Even the NUS government couldn't send out a party without serious questions being asked by whoever's currently in charge of those lands. If someone else doesn't find them first."

Ulrich was enormously disappointed and it showed. "But I thought . . ."

"I know. I'm sorry. You wanted to have your money right now to start investing and become rich. Right? We'll do it. I promise." He slapped Ulrich's back affectionately. "In the meantime, let's get rich the old-fashioned way, making and selling a lot more wringers. I brought back orders for thirty more and our next city will be Rudolstadt."

May, 1632

"Honey, I hate to ask you about your business," Debbie began one evening at dinner a month later. "I mean, our washer and dryer are still working."

"Go on." Chad put down his knife and fork. He rested his forearms on the arms of his chair and looked at his wife.

"I was just thinking. Now that you have the wringer, did you ever think about making washboards? I mean, wringers are fine but you can watch German women who can't afford to go to the laundromat down on the banks of the Buffalo doing their laundry on the rocks. I've seen a few makeshifts around town. I think there were at least two companies who tried to make them and went broke. There's even been a few old washboards hauled out from wherever but nobody's really making any right now. Like the men can't be bothered to make a product only women use. Make washboards at a reasonable price and I guarantee you won't be able to keep up with the demand once the word gets out."

"Hmm." Chad picked up his silverware again. Leaning forward, his mind worked quickly while he ate. "Hardest part will have to be getting the tin rolled. Well, that and getting enough tin to begin with," he thought aloud, his eyes unfocused. "Don't have the zinc to galvanize at a reasonable price. Ceramics, glass, brass. Could even make them with grooved wood, I guess. Might have a problem with splinters which would tear up the fabric, not to mention fingers. If it's tin, Ulrich can soften the tin and then it's only a question of rolling it to the proper thickness. Crimp the sheet tin between two star-shaped rollers to corrugate it. We'll have to get iron billets from USE Steel, then use either Nat Davis or Dave Marcantonio's shops to make the rollers. The wood is easy. Have to set up a new assembly line."

Tin was possible and impossible. It'd work but was both expensive and needed wood to back it. Glass was possible but in general too fragile. So it was back to easily worked wood, Chad thought reluctantly. It was too damned easy to copy so he'd have to go for saturation marketing and stress quality. But once he could hot dip galvanize . . .

* * *

Four days after Chad and Denny Reilly finished working out the kinks of washboard assembly, Chad began hiring.

"Easy work." Bernhard Kosberger, the supervisor for the wringer operation looked at the four German men standing around the table. In front of him were five narrow ribbed boards, a thin rectangular board and several sturdy lengths of wood.

"Watch closely or I'll be done before you know it." Bernhard grabbed one of the two long pieces, fixed

it into the bottom of a jig, then in succession began fitting in the other pieces of wood, lightly tapping them together into the groove of the long piece. He next fitted the matching long piece of wood on the opposite side then clamped the entire assembly together, leaving one short length of wood on the table. He flipped the assembly onto its bottom and fitted the short length across the top.

Bernhard smiled. "Right now, I could take the whole thing apart." He took two short thin nails and lightly tapped each into the top immediately over each leg piece. He flipped the assembly on one side. Taking two short dowels, he dipped them in glue then tapped them into the holes above and below the pieces of ribbed wood. He flipped the assembly over and repeated the process.

"That's it." He unclamped the finished assembly. "Except for stenciling the name 'Laughing Laundress' on the top panel. Took, what, two minutes? Easy, right?"

"What's it do?" The man asking wore a slight frown, his arms folded across his chest.

"It's a washboard. Take a shirt, put it in a bucket with soapy water, rub it against the ribbed wood to loosen dirt and remove any stains. Rinse it and run it through the wringer before hanging it up to finish drying. Much easier than rubbing the cloth between your hands, beating it with a stick or hitting it against a rock. Understood?"

Another man scowled and looked at the man next to him. "Doesn't seem to be real work to make these. I mean, man's work. Where's the skill, the need for strength? There's no craftsmanship, no pride in your work, just mindless assembly. Well, except for cutting and grooving all the pieces of wood precisely. Now that takes skill."

Bernhard looked at the two men impassively. "We buy the pieces of wood already cut and grooved. Using a hydraulic press to put the ribs into damp wood is the only woodworking we do here. No reason you have to do assembly if you don't want to. We're not paying for highly skilled work. So if you want to find other work, it won't bother me."

Ten minutes later, Bernhard walked into Chad's office. "*Mein Gott*! This is so stupid. Easy work and all of them say it's too easy, like it's unmanly. The wringers they do because it's at least mechanical and has moving parts."

Chad leaned back in his chair with a bitter smile. "Would it be better if we hired only women to do the assembly? After all, it's a product made for women." Bernhard's face showed how uncomfortable he was with the idea.

"I'll have someone else, a woman, as their supervisor. You know, the more I think about women doing the assembly, the better I like it." Chad saw Bernhard relax. Then he gave a quick grunt of laughter. "We'll have word of mouth working for us even before the first washboard is sold."

Finding women to do the assembly proved to be remarkably easy. In no time the number of washboards sold was twice that of wringers.

August, 1633

Chad wished he could go back to bed. After all, being shot in the lower back, even by an almost spent ball from a wheel-lock does not heal in a day or two, no matter how fast it appeared in the old westerns. Chad made a trip to Magdeburg a week after the Croat raid and came back with a lead souvenir. Doc Adams removed it with appropriate derisive comments.

No sooner was he home from that procedure than Debbie came to him. "There's trouble down at the shop. I received calls yesterday afternoon from Bernhard and Dorothea that the men and the women were yelling at each other. At least that's all they were admitting. Frankly, I think there was some minor pushing and shoving as well." Her lips were tightly pressed. "I thought it was over but Dorothea called here while you were gone, saying nothing had changed."

Chad gritted his teeth and looked at his watch. "Call up Bernhard and Dorothea. Tell them I want to see them here at eleven o'clock. They're also to tell their crews that I'm shutting down production until we get whatever the problem is resolved. A day or two without pay ought to cool down the hotheads."

* * *

"Okay, what's the problem?" Chad looked at his two supervisors, Bernhard for the wringer operation and Dorothea Bischoff for the washboard operation. "Dorothea, tell me your side of the argument first."

Dorothea was a stocky mature woman with a ruddy face whose auburn hair was held in place by a colorful headscarf. "Chad, it's these men. It's bad enough that we women have to work in the same shop with them without them trying to put their hands on us or make suggestive comments all day long. Besides, there's nothing that they do that we women couldn't do at least as quickly." She would have expanded on the theme but Chad held up his palm to stop her comments.

"Okay, Bernhard, what's the argument that the men have against the women?" Chad was rapidly tiring even if his head was propped up with pillows and the footrest of the recliner was up.

"It's like this, Chad. Those women, they don't understand mechanics, how things are supposed to go together. But they are always coming over to our end of the shop, making comments about how they could do the entire operation more efficiently. Besides, they refuse to sweep the floor in our area, even though that's part of the written procedure even if we crate the finished washboards."

"We wouldn't mind doing it if you men would do a decent job of crating the washboards and didn't just throw all your scrap onto the floor rather than in the waste barrels!" Dorothea interjected.

"Yeah? You women just want us to do the work that you're supposed to be doing!"

"Stop, stop, stop." Chad held up his hands wearily. "It's clear that the swapping of sweeping and crating duties isn't working. So from now on, the men will sweep their own shop and the women will crate their own washboards."

Both supervisors looked slightly mollified but Dorothea was still angry. "Tell him that we're decent women, not floozies for their convenience. If they want that kind of women, they can be found elsewhere. Keep your damn hands off us. Understood?"

Bernhard looked rebellious. "You just keep to your side of the shop," he spat back. "Nobody asked you to come over to our side and tell us you could do just as good a job as we do! Those women who come over to our side are just looking for attention from my guys and then complain because they get it."

"That doesn't explain your men coming over to where we're working, saying what baby work it is!" Dorothea snarled.

"Enough!" Chad could barely keep his eyes open. "Debbie! Get me the phone."

A moment later, Denny Reilly of Denny's Lumber was on the other end. "Denny, this is Chad. Yeah, it is a real pain but better than getting shot in the butt. Reason I called was that I need a wall built right across the middle of the shop, about eight feet high. I need it done as soon as possible. How much will that cost? Uh-huh. Okay, who does that kind of work? Johann Muelpfort's the master carpenter you recommend? Thanks. Could you contact him and tell him I want to see him as soon as possible? I'll be at home for at least a couple more days. Thanks."

"Okay, here's the deal." Chad was breathing heavily, his face slightly pale. "First of all, Debbie will meet you back at the shop. She'll draw a chalk line across the middle of the concrete floor dividing it equally. You two discipline your own people, keeping them on their own side of the shop until the wall is finished. Or all of you can spend your time at home without pay until it's done. Clear? Anyone who can't manage to stay on their side of the line will suddenly be switched to that work unit. One of that group will become a member of the other work unit. Also as of today, the men sweep their own shop and the women crate their own washboards.

"I'm also going to split up the lunch breaks. Bernhard, you've got a taler on you, right? You flip the coin and Dorothea will call it. Winner picks which lunch hour they want this week. Then the following week, the lunch hour will switch between groups. I'm going to keep both crews apart as much as possible until you learn to play together."

Dorothea won the toss and chose the later time because the week was almost over. Then the following week, her team would go to lunch earlier.

"Oh, and by the way, if you can't discipline your own people, I'll find someone who can, even if I have to fire you and hire someone else. Is that clear?" Chad fixed his eye on each in turn.

Both left, each distinctly happier at the other's comeuppance but not unhappy with the result to themselves. The heart of successful diplomacy is*schadenfreude* , Chad thought.

"I should have handled the affair, Chad." Debbie assisted him upstairs to bed. "Like boys and girls in the fourth grade, each determined the other has cooties." She smoothed the bed linen over his body and under his arms. "You just get your rest while I go over to the shop. I'll have Christina answer the door when the master carpenter arrives. She'll bring him to you."

After she left, the middle fingertip of one hand touched its counterpart across Chad's chest. *Perhaps I ought to put my hands together in prayer like all the funereal statues of the nobility do.*Chad's eyes were closed as his mind drifted.

He could almost hear the echo of the nasal guide's voice. "And here, ladies and gentlemen, is the crypt and depiction of Charles Hudson Jenkins, Senior, the first von Grantville." Yeah, right. Over my dead body, he snickered before falling asleep.

Burgers, Fries, And Beer

By John and Patti Friend

Julio sat with Odetta and Fenton. The Club was empty. None of the regulars were in and, as usual, Fenton was opening. It was early yet—just past two in the afternoon—and the three had nothing to do.

Julio Sanabria looked at his two co-workers. "For two bits, I'd get rid of everything and move away

from here! Lousy daughter and her kids, stinking mortgage . . . I should just leave them, and all the rest of this crap."

Fenton Mase nodded. "Grantville just ain't worth hanging around anymore. Hell, everyone except the regulars either won't talk to me or figures I'm just as big a racist as most of the crowd around here."

Odetta Thorpe spat tobacco juice into a coffee cup. "Look. It could be worse; you could be like me. Half the down-timers think I'm sick and the other half think I'm a whore. I sure ain't going to try to compete with the likes of Hot Pants Cooper or Angie for the few single men who come in here."

Julio growled something that nearly made Odetta swallow her wad of tobacco. "Sorry, Julio. I forgot!"

"Come on, Julio. You have to admit it. Angie has earned her reputation." Fenton snorted. "She has the twins and she has another bun or two in the oven right now. Besides, she was in here last night with Hot Pants before she took off."

Julio felt like he'd been kicked. It had been busy and he'd been stuck in the back. The regulars had been hollering about how it wasn't right, having all those Krauts on the police force. Then there had been an altercation between Ronnie Murray and someone else—it didn't matter who. Ronnie had been given the old heave ho.

Somewhere between the fight, his sixth burger and fries order, and washing the skillets again to make more fries, Angie and Hot Pants had left. Connie had, once again, been a no-show, leaving him to pull double duty.

Being chief cook and bottle washer in the Club 250 was no joke. He'd been stuck watching the fries so they wouldn't burn in the lard. Making French fries was a lot more work now that the cooking oil had either run out or been taken for some other use. Actually, Julio thought the fries had a better flavor, but to hear the regulars bellyache, you'd think they were being forced to eat shit.

Julio snapped back to reality when he heard the voices of Ape and Monkey Hart. It was time to get into the kitchen. The two jerks would want their standard burgers, fries and beer.

"Well, that's it." Fenton tapped out his pipe. "Time to earn our dollar."

Odetta spat her tobacco wad into the cup and handed it to Julio. "Damn it, Odetta! You could at least dump the thing out and rinse it."

"Got customers, Julio. You wouldn't want Ken to fire me, would you?" Odetta smirked.

"Forget it, Julio," Fenton said. "The way Ken has been losing waitresses—and I've had to do their work, too—I don't want Odetta fired."

Julio marched into the kitchen. Damn Fenton and Odetta! Like Fenton busted butt behind the bar. And Odetta sure didn't hustle. She spent more time leaning against the bar shooting the breeze with Fenton than serving customers.

"Hey! Git over here and take a payin' customer's order." Ape Hart yelled across the room.

It was just another day at the Club. Tonight, he'd have to go home, let the babysitter leave, and supposedly watch Angie's twins, Julie and Juanita. Hell, he was usually so tired he just collapsed. But the

poor kids only had the babysitter and him most of the time.

Damn Angie! Why couldn't she be like her sister, Amy? Now that girl had a future. Angie was pregnant again and didn't even know who this father was. What a surprise.

Julio checked the temperature of the deep pan of lard. At any moment, Odetta would yell for burgers and fries. He would be glad when Connie started her shift. Then he'd just have to wash the dishes and prep cook if it got busy. Things just kept getting worse at the 250. Since that crap with young Tommy, her brother-in-law, Connie just didn't work as many hours.

* * *

Julio scraped the charred tobacco from the clay bowl of his pipe. He'd broken two of them since he'd started smoking a pipe. He couldn't buy cigarettes anymore, something about not having decent paper for them. Besides, no one wanted to make them anyway.

He wouldn't mind if someone did, but he had the feeling that wouldn't happen any time soon. Besides, tobacco wasn't all that cheap and there was only one tobacco shop in Grantville. It was owned by a Dutchman and Spaniard.

It was break time. Connie Cooper had finally shown up. She watched the kitchen while Fenton had the bar and Odetta worked the tables.

The more Julio thought about it, the more he realized that he really had to get out of Grantville. It wasn't just Angie, the twins, or even the job. His life had gone to downhill when Juanita had had her accident back in ninety-two. It had been all he could do to cope with her injuries, much less try to raise three kids.

If his cousin, Sergio, and his wife hadn't helped out, the whole lot probably would have turned out like Angie. But John and Amy were good kids. That was Sergio and Janie's doing more than his.

The best thing he could do for everyone was to just sell out and leave. Go off somewhere and start over again.

It would serve Angie right if he dumped her and she had to fend totally for herself. Maybe someone would take the twins and give them a decent home. John and Amy could fend for themselves. They were both pretty self-sufficient as it was. They certainly didn't need him. He didn't have much of a relationship with either of them, anyway.

"Julio, your break is up! Get back in here!" Odetta yelled. Ken must have come in and she was warning him before the boss decided he was loafing.

Hell, he hadn't even started his smoke. He pocketed the pipe and headed back to the kitchen. He saw the back of Odetta's bean-pole shape, skinny butt, and chicken legs as she made for the main floor. Connie was flipping a couple of burgers and a pan of grease was spitting. He was going to have to peel some more potatoes and have them ready and soaking in a bowl for Connie.

He didn't have any dishes in the sink right now, so he was supposed to make sure she had things on hand for the burgers and fries. That meant slicing the bread, preparing the potatoes and onion slices. All that kind of crap had to be done between washing dishes. There was no lettuce or tomatoes this time of year, which made his job easier.

Tonight, when he got home, he'd have some of the shine he'd stashed in the pantry—if Angie hadn't found where he'd hidden it. He would give some serious thought about where to go and what to do while he sat back with a big tumbler of hooch.

* * *

Julio dragged in from the Club. Three thirty-seven in the morning and his house was a pig sty. Angie's babysitter was still here, crashed on the couch with the old crib next to her. The twins were asleep, which was good. If they would only stay that way until he got a few hours of shuteye himself. They were nearly into their terrible twos. He could still remember Angie at that age. She had been the worst of his three kids, but the twins were putting her to shame.

He felt like kicking Angie right out the door. Damn her staying out all night. If he didn't help pay for the babysitter he didn't know who would take care of her kids. He was too busy working and John and Amy had their own lives. He wouldn't expect either of his two younger kids to help him, and certainly not Angie. It was a good thing Juanita hadn't been able to see what her daughter had become.

Julio shuddered, headed for his room, and nearly slipped on part of a newspaper the babysitter had let fall near the couch. He picked it up, intending to wad it and throw the thing against the wall. His eye caught a bold headline about the rapid growth and opportunities in Magdeburg, the capitol of the CPE or whatever.

Hadn't Magdeburg been burnt to the ground? Well, damn! Julio headed for the kitchen to read the paper. Let the babysitter sleep. He looked around for the bottle of shine, which Angie hadn't found. He pulled the cork and took a swig.

He looked at the paper and, for the first time since the Ring Of Fire, saw news that wasn't filtered through people like the Coopers and Harts.

Maybe life would be better in a place like Magdeburg. It mentioned the planned navy base in the article. Julio thought about all the new service businesses that would be springing up around the base. Magdeburg might just be the place for him to go.

Julio laid the paper down on the cluttered table, took one more pull on the bottle, and hid it again. He walked past the babysitter and the twins. He'd sleep on the idea about getting away from here. Maybe things would be clearer in the morning.

* * *

It was absolutely dead in the Club. Fenton Mase and Odetta Thorpe wandered into the kitchen. Julio was kicked back, looking at a paper. "Horse shit! Julio, you know better than to bring anything German into the Club. Ken or one of the regulars see that, and all hell will bust loose."

"Look at this, Fenton." Julio held the paper up for him to see.

"You know I can't read that crap!" growled Fenton. "What's it say that's worth knowing about?

Julio translated as he read Fenton the article about Magdeburg's growth. "You know, the more I look at this, the more I think I'll just pack up and go."

"You have to be crazy to even consider it!" Fenton's voice was sarcastic.

"No. Think about it. I looked it up. Magdeburg is far enough away that I ain't goin' to have a bunch of people remembering me as one of the Club 250 trash; but it isn't that far away. At least it will be better than here."

Fenton snorted. "Hell! Julio, that place isn't America! It's full of foreigners and the US Navy Base there isn't American—even if that is what the paper says. They don't even got 'lectric or flush shitters there. Magdeburg ain't civilized yet."

"Well, I'm seriously thinking of going. What do I have here? A job washing dishes and flipping burgers for a bunch of shitheads nobody likes. They don't even like each other."

Julio stopped Fenton before he could say anything. "Don't give me any crap about the good old boys. You know as well as I do, the Club has been going downhill since that first election. And how many waitresses has this place gone through? Brandy quit; Marlene quit; and Angie isn't worth a hill of beans even when she does show. All the good ol' boys do is complain about how everything would be better if it weren't for all the Germans—or Mike Stearns, or the sky isn't blue today. I don't need this no more."

Fenton started to rebut Julio but thought again. "Read that to me again. But get the paper out of here before Ken sees it."

"Yeah, read it again, Julio," Odetta added, a look of wanderlust in her eyes.

Julio started reading the article once more. Two people seemed to think he had stumbled onto something.

* * *

A few days later, Julio had made up his mind and headed down to Grantville Homes and Land. He saw Huddy Colburn himself. He wanted to sell his home and fast. It wasn't a case of going for the best price. When Juanita had been injured in ninety-two, he'd pretty much given up on life. Since the accident, his rock and confidante couldn't give him the support he had come to rely on. It had almost been a blessing when she had finally passed away in 1632.

He hadn't been much of a father after Juanita's accident. His cousin and his wife were more parents to his youngest two children than he'd been. Maybe that was why they had turned out better than Angie. She'd been sixteen at the time and had just gone wild—too wild. Her life had been spiraling downhill ever since.

Huddy made an offer of his own for the lot and house. Some major work was going to have to be done to bring the place up to standards. Julio had allowed the house to fall apart bit by bit. Huddy had made sure he understood that he was going below market value on the place; but it was going to cost him to have the place repaired for later sale.

Well, it wasn't like Julio wanted to wait around for Huddy to put the place on the market and wait around for a bite. He'd decided to leave, and that was final.

"Two weeks enough time to vacate the place?" Huddy had asked.

Two weeks was more than enough time. The next day, Huddy had the contract and the check for the place ready. Julio had two weeks to pack up and go. Magdeburg or bust. So long, Grantville.

* * *

Julio had just finished telling his oldest daughter that he was leaving. And that she would have to find someplace else to live. It had taken two days to catch her and she now had less than two weeks to find a new place.

Angie Sanabria glared at her father. "What do you mean, you've sold the house and I'll have to find somewhere else to live? This is my home, too, you know!"

Julio looked at his daughter and smiled. "It was my home. You just live here. How much have you contributed to maintenance and food? Now it belongs to Grantville Homes and Land. I could have sold it for more, but I just want out of here. So I dumped it for the first offer. After the bank grabbed their share to pay back the mortgage, there isn't all that much left. Finally, if you'd ever been around, you'd have known what I was going to do."

"You can't do this, Papa! Where will me and the twins live now? And where are you going to live?"

"I don't know where you'll be living, to tell you the truth. You have your partying friends and can probably live with one of them." Julio pointed to himself. "Me? I'm moving to Magdeburg. So you'll just have to grow up and take care of your own life."

"You can't do this!"

He looked at her. "That's where you're wrong, Angie. I can do it and I'm going to. You have to learn there's more to life than just one big party."

* * *

Odetta listened while her two co-workers talked about moving to Magdeburg. They even had a plan for starting a business there. Both had something to put in, though most of the money and other things would be coming from Julio Sanabria.

"I can sell the trailer, even if I don't own the lot it sits on. That will give me some money. And I should be able to get something for the Bronco." Fenton had joined in the plan to move.

"How about letting me come along? I can wait tables." Odetta watched the sour looks invade both men's faces. "Okay, I can do fast foods, too. I've done the short order cook routine in Norfolk, Baltimore, and Akron. I can be of use and I want to leave, too."

Julio studied her like she was a dog with two heads. Granted, she didn't really get along with most people, except Estil Congden. But hell. She hadn't planned on making Grantville her home. It had been one of those stopovers before she moved on to greener pastures.

"Why the hell not?" Julio looked at Fenton. "Let's all tell Ken we're quitting at the same time. I really want to see the look on his face."

Odetta and Fenton both laughed, but it was short lived. The first of the regulars arrived. It was time to go to work.

* * *

Fenton counted the money he'd received for the rundown trailer he'd owned for the last umpteen years and smiled. For now, he was staying in the same flophouse the new Krauts stayed in. He'd stayed in worse, though not by much.

The Krauts weren't too bad. No worse than Freddie Congden or the Hart brothers. Fenton wasn't going to think about that scum bucket, Ronnie Murray. Actually, the Germans were better. At least they were polite and not ordering him around all the time. He had moved what he wanted to keep into the storage unit he had rented and sold the rest. For now, the money was going into the bank until he needed it. There was no use tempting fate and ending up blowing it on something stupid. Well, maybe he could tie one on and celebrate, but not at the Club 250. Crappola! He could start out at the Gardens and then move on to Tips.

Fenton was tired of being treated lower than dirt by most of the up- and down-timers. He figured Julio was right. There was no future in staying with the Club 250. Boy, had he enjoyed watching Ken howl when the three of them quit together. Let Ken do his own bartending. Damn! He'd thought Ken was going to have a heart attack right there on the spot! Oh, well. It wasn't his problem anymore.

He was going to go with Julio and Odetta. Maybe they could, finally, find someplace they could live where their pasts wouldn't haunt them. Grantville sure wasn't his cup of tea anymore. It was time to move on.

* * *

Angie had checked with her so-called friends. Papa was right. There was nothing here worth staying around for. Everyone thought she was a trashy whore and with Papa gone she would have nobody. She had alienated her brother and sister. Even her cousins had no use for her. She was going to take the twins and go with Papa, whether he knew it or not. Besides, she was pregnant again and she wasn't sure who the hell the father was. Just one problem after another.

Her so-called friend, Tiffany, said she could stay with her and her folks for a few days, but she would have to take care of her own daughters. No one at the Cooper place would baby-sit for her. Papa would be leaving in just over a week with Fenton Mase and Odetta Thorpe. For now she would just have to impose on the Coopers for a while longer than her welcome was for. Well, it wasn't like she would be around to have to mend any fences after she left Grantville with Papa.

She wondered what the people in Magdeburg did for fun. There was going to be a Navy base there and she'd heard sailors were really great for having a good time. She'd find out after they got settled there.

Grantville, January, 1634

Julio went through the things he wanted crated. There was a nearly thirty-year-old set of Encyclopedia Britannica; all of Angie's old Golden Books; his Louis L'amour books, all eight of them; and the home improvement book set Juanita had signed him up for.

They'd received almost half of the large card-like page inserts before they stopped the monthly installments to the book. Most of it was just not going to be of much use. How to apply vinyl flooring was just not going to be a big thing. Forget the special glue, where would he get rolls of vinyl flooring to start with? He flipped through the book and laughed. Here was a good one. How to apply wallpaper. Well, it might be useful. Didn't his grandfather use paper sacks to cover his walls and then paint them? He threw the home improvement book into the crate. Hadn't his grandfather made wheat paste to put the paper

up? How had he made it? The answer might be in the encyclopedia.

He placed all his power tools to one side. The circular saw and jig saw were going to do him no good without electricity. Those, he would pass on to Amy. John was off with the military somewhere, he thought. He'd lost track of him.

The bow saw and rip saw he packed. All four hammers went into the box. He thought he'd lost three of them. He had bought new ones to replace the lost ones. The old single jack went into a case along with three wood chisels. The tool box containing four combo wrenches, two pliers, a handful of screw drivers, and a socket set with a broken ratchet and half the sockets missing would also go to Amy. He hadn't realized that so much of his stuff was junk, but maybe she would have a use for it.

There was a camping hatchet he'd never used and an old Coleman lantern. The hatchet he pitched into the crate and he placed the lantern with the power tools. Two boxes of 30-06 shells from twenty years ago appeared among the junk. Into the crate they went.

Juanita's wedding dress took a moment for him to make a decision about. He didn't remember putting it out here. Hadn't he thrown it away with her other things? He folded it and placed it into the crate. Damn! He had to dig out one of the hammers he'd packed to nail the lid down and start a new crate.

Three coffee cans of screws and nails went into the next crate. Clothing came next. These clothes were made from synthetics and were still in good shape. Regrettably, the pants and shirts didn't fit him anymore, but they might again. Additional clothing went into another crate. If he couldn't use them, he might be able to trade them. The clothes filled the second crate. Juanita would have donated the stuff to the church long ago. He'd just tossed them into the garage like so many other things.

Juanita's sewing machine appeared once the clothing was moved. It was just one more thing he thought he'd gotten rid of. How much more of these reminders remained? The small Singer needed electricity to work. He would sell it because Amy probably wouldn't want it.

Julio found the trowel and masonry tools he'd invested in when he thought he'd be a bricklayer. The job had never panned out. He put the masonry tools into the third crate on top of the extra clothes. They could still be of use; though where he would get cement, fire clay, and lime, he had no idea. Sand wasn't a problem. It was everywhere.

He finally found their old hand cranked meat grinders. He carefully packed them away. They would be needed, along with the spatulas, and two old barbeques. Charcoal would be no problem. Everything needed to be taken apart, cleaned, and oiled.

By the time he'd packed five crates, he'd weeded through the entire contents of his home and garage. Julio took the discarded materials he didn't think Amy could use out into the drive after he shoveled the snow clear and laid out a blue plastic tarp to protect everything from the dampness. He hammered a sign to the black walnut tree in front of the house and sat back in his lawn chair. It was colder than a witch's tit; but with a beer and the heavy mackinaw coat, he waited as passersby stopped to buy those items useless to him. One man's trash was another's treasure—or something like that.

It didn't take long for people to wander up and start asking how much for this or that. His answer was always the same. "Make me an offer."

His yard sale quickly turned into an auction. Things like the toaster went for more than he thought it cost new. That was figuring for the value of the dollar now as compared to before the Ring of Fire. The

sewing machine went for a king's ransom, or so it seemed to him. He'd planned to spend the day sitting outside while bored neighbors went through his junk. Instead, it seemed like half of Grantville showed up to buy things he didn't want anymore.

What would he have made if everything had been maintained properly? He hadn't realized just how badly he'd let everything slide over the last twelve years. The only reason the house hadn't been the mess the garage had been was the babysitter, Barbara, had cleaned the place once in awhile.

* * *

Papa and his friends had two wagons filled with wooden cases. They had rented the wagons and teams from Old Man Bickrodt, promising to leave them with a friend of his who ran a stable and smithy outside of Magdeburg. Now Papa was going to find out she intended to go with him. Angie had already snuck her few plastic bags onto Papa's wagon while they had been inside having breakfast. They hadn't even noticed her things when Papa and Fenton had loaded the rest of his crates.

Angie made her way toward her father with the twins in tow. It was hard going because the girls were only toddlers, unsteady on their feet. Besides, she wasn't used to having them with her. It had been Barbara's job to take care of them. But without Papa paying most of her money, Barbara had found other employment.

Angie's mouth dropped open when Julio looked up. "Took you long enough. Well, get into the wagon and I'll pass Juanita and Julie up to you."

"But Papa!" Angie sounded more like a ten year old than a woman of nearly twenty-eight.

Her father shook his head. "If you thought I wouldn't find out what you were up to, you shouldn't have been smart mouthing Connie Cooper. Didn't you think that woman would track me down and start demanding I hurry up and get you out of town? She was so happy I was taking you away from her poor daughter, who you were corrupting with your whoring ways."

Angie started to protest but Julio glared at her. "Don't say a word, Angie, or I'll change my mind and leave you. If I can decide to start over somewhere else and get away from this place and everyone who knows me, I can give you the same chance. It's up to you whether you screw it up or not."

Angie climbed aboard and her father passed the girls up to her. Both were crying for Barbara. They didn't want to be with her. For some reason, it hurt. It hurt just the way her father talked to her. It had been a long time since anything had hurt like today.

* * *

Fenton had not been pleased about having Julio's daughter along. Angie was a waste of space. She was part of the party girl pack that included the Cooper girl. He didn't have much interest in them. There was no telling who they had been with and he didn't want to be pissing razor blades. No penicillin to get rid of that anymore. Three doses of the clap in his life had been enough for him. He had lived like a monk for the last two years. At least pretty much like a monk.

They'd brought their American weapons, but the up-time ammunition wouldn't last forever. They also purchased Struve-Reardon made musket-rifles and a set of the Hockenjoss and Klott revolvers each. Julio had misgivings about the revolvers. It was a matter of the supply of percussion caps.

That was why old Julio had also purchased a pair of flintlock pistols. He didn't want to be without weapons that would be easy to get the powder and lead for. Things wouldn't be all that safe on the road, even if the war was a long ways off and they were only traveling to Magdeburg. After all, they were leaving a place where real Americans were and heading deep into Krautland.

They had to travel through the snow and cold to get to Magdeburg. They were driving a treasure train with all their valuables aboard. Fenton smiled to himself. If they were attacked, maybe they could trade Angie off to the bandits and get them to leave the rest of them alone. No. It wouldn't be fair. The bandits would get the worst of the deal.

Fenton secured the last of the ropes. He checked the thirty-eight in the shoulder holster and prepared to climb into the wagon seat. Julio would lead out with his slut daughter and his bastard grandkids. Why the man wanted to drag them along was beyond him. It was just one more reason this trip was beginning to seem like a bad idea.

They had to face bad weather, days riding on a wagon, and finally starting over in Magdeburg.

Fenton pulled himself into the seat next to Odetta. He picked up the reins and followed Julio as he led out. Julio had come up with this hare-brained scheme. Hopefully, Julio knew what he was doing. Fenton no longer did.

Odetta spit a large brown stream of tobacco juice over the side of the wagon. Fenton shook his head. What a choice. Ride next to Angie and her screaming brats or the tobacco chewing human toothpick and her continual spitting.

It was going to be a long trip.

Fenton felt unsure about the outcome of their new adventure. What would happen if, for some reason, their plans didn't work out the way they hoped? Was this a new beginning for them, or was it the end of all their hopes and dreams?

Only time would tell. Farewell, Grantville. It's a nice place to be from.

* * *

Julio looked around their first night's camp. He had made a mistake in not stopping for the night in the last village. They were camping out in the shell of a hut of some type. This place had not been resettled for some reason. Whatever it was, it gave them some small amount of wall around their wagons and a break against the chill night breeze.

Already, Fenton had a fire going and Odetta and Angie had found the sleeping bags. With the exception of Fenton's bag, all the sleeping bags had come from him, left over from when Juanita had been healthy. There were four bags in all. There would have been a fifth, but he'd left it for Amy with the other things. The sleeping bags, like everything else that had been part of his life before Juanita's accident, had been thrown into the basement or garage. After the accident, there had never been another weekend of camping. The sleeping bags had been just another painful memory to be buried out of sight.

The twins screaming for Barbara had gotten on his nerves. They had finally stopped screaming for her by mid-day; but by then old, haunted memories had returned to add to his distraught nerves. Twice he'd started to pass the reins over to Angie and cradle his rifle at the ready as if it had been an M-16.

People in the villages they rolled through watched them from the sides of roads. It reminded him of riding as co-driver in a deuce with his M-16 pointed out the window while Dinks along the road watched their convoys roll by.

He had thought that he was getting a good job as a driver or co-driver on the convoys and not having to tramp through jungles and rice paddies of Viet Nam. He had been too young and dumb to realize that "convoy" actually meant "big target." Back then, he'd been a kid right out of Grantville and boot camp. When he'd been in convoy, he had never known who might wave as he drove by and then shoot at him or toss explosives into the deuce when they passed.

Here, the stares of the people they passed had brought back those old memories. It wasn't a good thing.

Julio knew they had nothing to fear in their present camp; but old memories were haunting him. He moved out beyond the shadows and squatted, his rifle at the ready. It would be a long night. He would take the first watch—maybe all night long—and let Fenton sleep. He could always switch places with Odetta and sleep in the wagon Fenton drove if he was up all night.

* * *

Angie made sure the twins were okay and rolled up the sleeping bags. Odetta was busy with a camp pot full of corn meal mush. The old blue speckled coffee pot Papa and Mama had used on camping trips was steaming with hot water. There was no coffee. But there was herbal tea, not the real stuff. There had been no Lipton for ages and coffee was an expensive luxury that none of them drank any longer. It seemed to Angie that with the remaining wealth from the sale of the house and personal junk, Papa could have well afforded it. But the past couple of years of doing without had had its effect. He hadn't even thought to purchase any. Besides, Fenton had brought along four cases of hooch. The last thing he needed was a shot of that right now with his nerves jumping as badly as they were.

Next Morning

Angie put the sleeping bags back into the wagon. She had even rolled up Papa's bag. He had been up all night. She hadn't seen him like that since Mama's accident—all wired up and lost somewhere. She had approached him when she'd first woke up and found herself staring down the barrel of his rifle. It was like he didn't recognize her at first.

She had been afraid he'd shoot her. But he snapped out of it. "Don't you never sneak up behind me on tip toes again!" She wouldn't.

"Come on, girls. Let's get something to eat." The two just gawked at her. "Come on. Don't make me come get you!"

Odetta looked at her and chuckled. "Them kids is too young to understand everything like they were already in school or something. They can't even walk all that good yet."

Odetta set down the brown plastic bowl and spoon she'd been using to have her breakfast and stood up. "I'll get them over here and fed."

Angie wanted to cuss her out for interfering. After all, the twins were her kids. But she bit back the response. For the last week now, she'd been finding out the twins took a lot of work, and Tiffany hadn't

been willing to help her none. In fact, Tiffany had razzed her about having kids and being pregnant again.

Damn! Why couldn't she have accepted Uncle Sergio and Aunt Janie's help, like John and Amy, instead of deciding that since Papa didn't care and Mama was so bad off, she was old enough to do what she wanted? At least she had listened well enough not to get knocked up while she was still in high school or until the birth control pills ran out.

She would have blamed Papa and Mama for ruining her life—she did quite often. But she had John and Amy to look at and see that they hadn't turned out like she had. She was the one who had become the town slut in capitol letters. Miss Party Girl. Mama hadn't had that accident just to ruin her life and Papa hadn't just given up on her, though it was easy to blame them for her own actions.

Angie watched as Odetta put up two more plastic bowls of mush and set out two more plastic spoons. "Don't touch!" The twins looked at her and at the bowls.

"Hot!" Odetta said.

"Ooo," the girls responded.

Feeling bitter, Angie sat down and poured a cup of hot water. She spooned some of the tea into one of the old tea balls Mama had used for her bead work decorations and dunked it into the cup. She hadn't seen one of the cheap metal things in at least twelve years. Like everything else of Mama's, it had just disappeared from the house.

When the mush had cooled enough for the girls to safely eat, Angie gave each of them a bowl. She ended up cleaning up a mess. She had forgotten the lesson she had been learning during the last week. The twins were really messy eaters and needed help.

It didn't help for Odetta to laugh at her when she got frustrated. Barbara had always done this for her. She usually wasn't even up this early.

* * *

Odetta Thorpe was happy. It had been a long time since she'd been on the road—too long. She had forgotten how good it felt to get up, make a quick breakfast, and breath open air.

It wasn't that she had traveled like this. She'd never before traveled in horse drawn wagons or camped out in burned out barns. But she hadn't always ridden the bus or caught a ride with a trucker, either. There had been times when she had moved on with just a backpack, her accordion, and what she could carry when the urge to move on had hit her.

It felt good being on the move again. And this was probably the last. She was forty-nine, going on eighty, judging from the stiffness and pain in her joints.

She enjoyed watching Julio's high-and- mighty daughter struggling to care for her kids. Julio had been right. Angie didn't know jack about taking care of kids. Odetta knew more, and she'd never had any kids of her own.

Fenton had asked her to take over for him on the reins off and on yesterday. She had a feeling that today her practice was going to be put to the test. Julio had been up all night. She had the feeling she would be driving his wagon. If that happened, Fenton would take the lead.

Julio had been up all night, guarding them while they slept. He would probably crash today. Actually, she liked the idea. She had spent nights on the road, her pocket gun in hand, trying to sleep in places she knew were less than safe when she'd been wandering.

One thing she had learned very well: never figure you're safe for the night. She'd been lucky not to be Jane Doe on a slab somewhere because of her own carelessness a couple of times. She had a few scars to prove it, too. Some things, like the tattoos, were courtesy of one- or two-year stints in prison for shop lifting; theft; and—once—knifing a guy who had tried to rape her. But that had been when she was young and stupid—younger than Angie even. She'd learned not to get caught at things like that later.

"Come on, girl," Odetta said. "Get them cleaned up. Your father's coming in to eat. You want him to see what a ditz you are?"

Odetta smiled when she was rewarded with a scathing glare. Nothing like starting the day right by ticking someone off, especially old Hot Pants' running mate. Those two girls had taken more than one decent man from her over the last two years. Any man who would chase those two wasn't getting a chance to come back to her afterward, either. She did have some standards. Odetta drank the last of her tea, pulled out some tobacco, and crammed it into her cheek.

It was going to be a longer day today than yesterday had been. A bit of cushioning on the wagon seat would have been welcome. She now wished she had been blessed with a bit more padding on her rear. Maybe Angie would loan her a bit. She had more than enough for both of them. Odetta laughed to herself as she spooned up a bowl of mush for Julio.

* * *

Fenton was glad when they were allowed to stop for the night again. This time, they had a dry barn in which to spend the night. Odetta had talked the villager in charge into letting them pay for the night's use. Fenton was glad for the dry place to stay. Between the cold drizzle and colder wind gusts that occasionally caught them during the day, it felt good to be under a roof, even if it smelled of livestock and wasn't heated.

He was also glad that he and Julio had let Odetta come along. She had picked up German palaver pretty well. He knew just enough German to run a stray Kraut out of the Club, if one was foolish enough to stick his head through the door. He now realized he needed to learn German if he planned to get along. And like the villagers who were letting them spend the night in his barn, Germans weren't all bad. They seemed like regular folk.

He would have been as suspicious as they had been, if a couple of wagons carrying armed people had rolled up in front of his trailer, women folk or no women folk.

Odetta pulled the thick blocky suitcase she'd loaded from the back of the wagon and opened it.

Fenton swore. She had a real, honest-to-god, polka-playing squeeze box—a fancy, mother-of-pearl-inlaid red beast. She broke it out, set the straps to her scrawny shoulders, and opened out the accordion.

Fenton didn't know what impressed him more: that Odetta had something that fancy or that she knew how to play it. He watched her fingers work the keys on one side and the buttons on the other as she opened and closed the bellows. Damn he knew that song—Daisy Polka. He reached inside his coat and

broke out his harmonica. Time to join the fun. He hadn't played with anyone for years. Just played in the trailer to entertain himself.

* * *

Julio watched as Odetta and Fenton started to play their music. It had been ages since he'd been around anyone playing anything. He hadn't touched his git box since Juanita's accident. So long that he probably couldn't play it anymore. Besides, he'd never been into that polka garbage. He was almost tempted to dig out his old hollow box Fender, but decided against it. It would be really embarrassing to mess up Odetta and Fenton's music by adjusting the strings and then not remembering how to play.

He joined Angie and the twins by the lantern as they listened to Odetta and Fenton start to play another piece. He thought he'd known all about his traveling companions, but apparently not. He hadn't known Odetta spoke decent enough German to be understood, and he hadn't known either of them played any instruments.

Julio saw that Julie and Juanita were both curled up in a sleeping bag with their heads on Angie's lap. Both girls were sound asleep. He hadn't realized how much they looked like Angie. It was the first time he'd really paid much attention to them. It was even worse that he had pretty much ignored them for almost two years. They had just been Angie's bastards to him, even if they were his grandchildren.

Julio did something he hadn't done in a long time. He put an arm around Angie's shoulders and gave her a fatherly squeeze. Angie actually smiled at him. They hadn't been this close since . . . well, since back then. Julio smiled back.

Odetta started to sing, "Roll out the barrel; We'll have a barrel of fun . . ." She wasn't half bad.

Julio looked up to see one of the villagers, with his wife and kids, at the barn door, watching and listening. Probably the first time they'd heard real American music.

* * *

Julio looked back on the trip from Grantville to Magdeburg. They had finally made it. During the first couple of days, he thought they would kill each other on this trip. Angie with the twins; Odetta with her sarcasm and abrasive comments; and Fenton either predicting gloom and doom or making the Kraut comments he spouted out of habit more than actual belief; and finally, his own flashing back to a time he'd rather forget. All had been irritants and causes for discord in their little group.

Today, they were turning the horses and wagons over to Herr Knaust, who would see that Herr Bickrodt was notified of their arrival. Apparently, they had an arrangement. These horse and wagons actually belonged to Herr Knaust and were just being returned to him.

Julio smiled to himself. Well what do you know? A German U-Haul system, horse and wagon style.

Herr Knaust was going to allow them to store things in one of his buildings, for a price. They needed a place to store nearly everything.

The idea had been, sell everything, move to Magdeburg, buy a place near the naval base construction, and open a burger flipping place for the sailors and Marines.

Well, they were here. The problem now was finding a place they could afford. From what Odetta had

found out from Herr Knaust, they certainly weren't buying anything with the money they had. But the old German was taken with Odetta. Why? Julio couldn't figure it out. The woman was gross with her anorexic, Ethiopian-famine-victim look. But, Herr Knaust had volunteered to help them find a place they could rent.

The old stable owner and blacksmith had recommended an inn where they could stay. Julio couldn't decide if Odetta was actually taken with the heavy set, gray bearded man or was just shining him on to get what she wanted. Odetta was much more complicated than she seemed.

* * *

Odetta had flirted with Georg Knaust for the last three days. The man reminded her of one of the old wrestlers. Not those tall, painted freaks who had been replacing the old wrestlers. He reminded her of men like Ivan Putski or Moondog Mane—big chested, massive armed, and a gut to go with it. His short, gray beard blended into his moustache.

Georg was a widower. He had lost his wife, children, and grandchildren when Magdeburg had been overrun by one of the German armies fighting in the area. Georg, himself, had nearly lost a leg and had been stabbed three times, according to what he'd told her. He had been left for dead with his family. Odetta could believe it. Georg certainly looked like a tough old buzzard, like a biker she had run with for awhile before the New York State Patrol arrested him for stealing cars.

The inn they were staying in was slightly rundown. But for having been rebuilt from a burned out shell, it looked pretty good.

Georg had found them a two-story building that had been an inn before it had been burned. After it had been rebuilt, it had been a warehouse for awhile.

She was supposed to meet Georg for dinner in a few hours. He had invited her to his house.

* * *

Angie studied the three sailors she was sitting with. One was cute. She had sashayed up to them and been invited to sit down. Papa would just blow a gasket if he saw her now. But he was watching the twins while she was supposed to be fetching their lunch.

That was how she met Josef, Michael, and Veit. Josef was the cute one. He was a petty officer, third class—a supply clerk. Michael and Veit worked with him, but both were only seaman. All three looked good in their uniforms, but Josef was the cutest.

"If you would like to meet me later," she said to Josef, "I'll be back this evening for awhile. Late that is, as soon as my friend gets back."

Odetta wouldn't stay long with the old coot she was having dinner with. Old Man Knaust looked like Santa on steroids, with a few scars thrown in for good measure. Even Odetta couldn't see anything in him. She was just buttering the dirty old man up to get his help.

"Yes, I would like to meet you again," Josef said. "Tonight, then. I'll be here."

Angie smiled. Magdeburg was going to be fun. She hurried to see if the food was ready to take back to her room. Now to convince Odetta she just had to get out and away from the twins for awhile.

* * *

Fenton had just come back from the dump Odetta's boyfriend had found for them. It would have to do. All they had to do now was go through the lawyer Knaust had recommended and get the papers drawn up. It was going to take most of their working capital to fix the place up, get the first two month's rent money paid, and stock it. They really hadn't expected rent and leases to be so high. But they*were* looking at property close to the navy base.

They could turn the upstairs into living quarters and cut down on expenses that way. The main floor was divided into three rooms. One was a large room, big enough for a bar and a dozen tables. There were two smaller rooms, one third the size of the main room. One small room was perfect to set up a stove, the barbeques, and the three ice chests they had brought. The other room could be used as a pantry and prep room.

Fenton figured they could set up the meat grinders and make hamburger in that room, as well as store homemade condiments from Grantville and things like the local mustard. But they had to get ketchup from Grantville if they were going to keep it.

The basement would be a good place to store kegs of beer and the cases of shine they'd brought with them. They only had one case of good stuff. It was more expensive than the stuff from the Five Hollows, but they might actually have a customer who wanted quality.

Julio had sent him to go over the place with a fine-toothed comb. He wasn't sure Julio wouldn't have been better at evaluating the place.

Fenton saw Angie coming from the eatery next to their inn. She sure looked happy. Maybe being away from Grantville was good for her, too. It sure was for him.

* * *

Julio looked at his notes. Things weren't going terribly wrong, but they weren't going like he'd figured a few weeks ago when he'd gotten this wild hair about moving away from Grantville and coming here to start over.

Well, he was starting over. Maybe he would look up an old friend who was supposed to be transferred here and John and Regina. He hadn't seen John for awhile and it was time to meet John's wife, Regina.

Fenton brought him the rough sketches of the warehouse, which was located a few blocks from the naval base. It would do. Julio was letting Fenton handle the actual lease and evaluate the building because, as much as Julio hated to admit it, he really didn't have Fenton's savvy when it came to business.

There was a reason he'd been a window washer, a dish washer, and a cook. He just didn't have a knack for much else. Oh, he'd tried a lot of other things, but he just didn't do very well at any of them. He was a jack of all trades and master of none.

They would establish the Greasy Spoon here, a few blocks away from the naval base; then make sure fliers were handed out at the gates. "Real American Burgers and Fries as well as Beer and Spirits." That should do the trick.

Office of Valentin Sheister, Magdeburg

"No!" Julio shouted at Georg's friend, Valentin Scheister, the lawyer he and Fenton had hired. "We don't have the money to be hiring a bunch of expensive workmen."

Scheister smiled. "I know that with the building boom going on in Magdeburg, labor is getting more expensive. Still, I think I might be able to work out something for you. Just give me a chance and we'll see what can be done."

"Yeah, go ahead. But remember we don't have a fortune to spend." Julio figured he'd better remind Scheister of that.

"I will keep it in mind," Scheister replied. "Also, there is the little matter of payment for arranging the rental and permission to alter the building in question. Will you be paying that soon?"

Julio pulled the leather pouch hanging down inside his pants from his belt and started counting out coins. Things weren't going well. The vast fortune he and Fenton had amassed was not as vast as they'd thought. Things were much more expensive than they'd anticipated and new expenses were turning up every day.

Julio paid the lawyer and headed back to the Greasy Spoon. It looked like the only thing to do now was wait on Scheister and get everyone together for a little music. That was about the only thing turning out good so far. It was funny. Before Juanita's accident, they'd spend time playing music and just plain having fun. It felt good to have it to fall back on again.

The Greasy Spoon, A Week Later

Odetta was installing the second meat grinder on the counter. Julio had insisted that the counters be separated for food preparation. It was going to be rough going without refrigeration. They would have to bring in fresh meat daily or risk poisoning their customers. As it was, she was leery of having to have hired help just to bring in water to cook and clean up the place. They would be using vinegar to sanitize, not a very satisfactory solution to the problem.

Angie was upstairs watching Julie and Juanita. While Odetta could have used her help earlier, the twins would have had to come down her with her. That wouldn't have been a good idea. The two girls could get into anything the minute no one was watching them. It made her glad once again that she'd never had children.

Thinking of children reminded her, she was still playing Russian Roulette with Georg. She might be forty-nine, but her plumbing wasn't totally shut down yet. She had better watch herself or she just might pull an Angie.

At the present, Julio and Fenton were out visiting the leech, Scheister again. Actually, Valentin wasn't all that bad; but every time they turned around, something was coming up that required his help.

Odetta made sure that the wooden waste barrels were in position and that the lids fit securely. She looked around. Everything looked good for the opening next week. The opening had to go off on

schedule because Julio said they were getting low on funds. If the funds were low enough for Julio to mention, things were really tight. They needed to get the Greasy Spoon opened and start making money. They had rent coming up in less than a month, as well as other overhead expenses.

Julio refused to touch what he called the "fall back" money—the money they would need to return to Grantville if everything fell apart here. But that wasn't about to happen. Even the oracle of disaster, Fenton, was sure they would succeed now.

Odetta wondered if Georg would leave the stables to one of his underlings and come to listen to them jam tonight. If he did, they could sneak over to his place for a bit of grab and tickle. Maybe a bit more than that.

The guy was really growing on her.

The Greasy Spoon, Grand Opening, One Week Later

Angie looked at her figure. It required a hard look to see the slight bulge that was beginning to develop. She adjusted the ankle length dress and was nearly ready to go to work. Veit had promised to bring a bunch of his friend's from the base tonight. She couldn't wait to see him.

Her raven black hair was pulled back into a long ponytail and tied with green ribbon. She applied her lipstick sparingly since she didn't know if she'd ever get another. She applied blue eye shadow and then the eyeliner. She was ready.

The girl they had hired to watch the twins while she worked was busy playing with Julie and Juanita. Angie had already arranged for her to spend the night so that she could have some time with Veit.

It was time to go downstairs. They had hired two extra serving girls and she was in charge. This was the first time Papa was really trusting her with anything important. For once, she was going to make sure she didn't disappoint him.

She moved away from the makeshift vanity and headed for the door.

* * *

Fenton was behind a bar again. This time, though, he had an assistant. The barrels of beer were set up, the tankards were all stacked neatly, and the metal pitchers were ready to go. The only thing they needed now was customers.

Angie came down the stairs and walked over and talked to the two other waitresses. Julio was in the back with Odetta and the new cook.

Fenton watched as Angie lifted the bar locking the entrance door and opened it. The first customers through the door were sailors. Fenton recognized the one who grabbed Angie and put a lip lock on her. It was the same one she had been seeing for the last month. Maybe the girl was going to finally settle down. Better the stupid sailor than him, though. Tigers don't change their stripes and he was sure Angie wouldn't.

More customers started filing in. It looked like they might have a success, not that he hadn't known they

would all along.

As the evening wore on, things were going pretty well until some Marines entered. From that point on, things deteriorated rapidly. It wasn't the Marines who caused the problems. The trouble was started by some sailors who had already had a few too many.

Fenton grabbed his baseball bat from under the bar and waded into the fray. He didn't even get a chance to bust heads. Some tough looking characters moved in and the fight was over.

Fenton listened while one of the tough guys said, "No trouble or the Military Police will be in here and put the place off limits." Fenton hadn't thought of that possibility. Off Limits? Something like that would ruin them for sure.

"Thanks."

"Think nothing of it," the man said. "Besides, I think I'm gonna like this place. I'll come around when I'm not busy."

Fenton returned to the bar. His assistant had been running his butt off, trying to keep the beer flowing. There had even been a few orders for the Revenoo-ers Rue he'd brought from Grantville.

Serving liquor had been another problem handled by Scheister. The man actually had an interest in the Greasy Spoon now in lieu of fees. It gave them a mouthpiece on call, but it had also cost them a twenty percent interest. Scheister was really a shyster.

* * *

All night long, Julio had been trying to get Christian Grosch to work the skillets of fries. The man refused to do it. He would work the meat grinders, even clean them. Grosch would fry hamburgers or prepare sausages, anything to do with meat; but he refused to touch a vegetable one!

"I'm a journeyman butcher," Grosch complained. "It's bad enough I must prepare the meat as well as do my proper job. I'll not peel your potatoes, cut them up, or prepare them."

In a whining voice he added, "If only my guild master hadn't recommended me for this job."

Julio wanted to strangle the young man. It had cost him a pretty penny to get the Butchers' Guild off his back. He'd been saddled with hiring a journeyman as part of the deal Valentin had brokered.

He had learned more about operating a business than he had ever thought existed. And he was also sure there were things he'd missed. But he was confident that nothing could go wrong.

The Greasy Spoon, Two Weeks Later

"See?" Odetta waved the ledger in front of Julio, Fenton, and Angie. "See what I've been trying to tell you all morning. Yes, The Greasy Spoon is making money! But, we're spending money not just for the supplies of which we are going through a lot, but look!" She pointed to a line in the ledger. "Fenton has made personal withdrawals three times, Angie twice, and Julio once. That doesn't count the cash withdrawal I made. We're in the red after our employees salaries, supplies, and Scheister's twenty

percent of the gross." Odetta glared at the others. "And whose great idea was it to give Scheister a twenty percent interest and pay him from gross profits?"

She watched as Julio swallowed.

"Aha! I thought so. At this rate, we'll end up in debtors' prison—if Magdeburg has one."

The first meeting they'd had since the Greasy Spoon had opened wasn't going to be a good one. Odetta knew if something didn't turn around soon, they would be in the shit neck deep. The Greasy Spoon had customers; but as a business it was already sinking.

"I have an idea," Fenton began. Odetta picked up the cup of Willie Ray's finest next to her and took a drink.

Another Two Weeks

Julio finally knew they were beaten. Two weeks ago, they had made a deal with Georg Knaust. He provided the money to pay the rent for the next two months and salaries for the employees while things got straightened out.

Georg had taken a thirty percent interest in the Greasy Spoon.

Things had started to look good until now. They received a tax notice today that nearly brought on heart attacks. It was time to talk to Scheister again.

But first Julio would have to call everyone together. Their business venture wasn't going to work. It wasn't because everyone hadn't been doing their part, and then some. They'd all worked hard. But they just weren't business people.

The Greasy Spoon was popular, it pulled in money, but they just couldn't seem to make it work. The employees were trained. After he had threatened to march Grosch back to the guild request a replacement, even that jerk had straightened out and became a model employee in the kitchen.

Angie was showing pride in herself and staying with the same guy, as far as he could tell—a vast improvement. She had even begun dressing more conservatively. She wasn't a walking billboard for 'free love' any more. He was proud of her, as proud as was possible at this time.

But he could see the writing on the wall. They were not going to succeed.

One Day Later, Scheister's Office

Six people were crammed into the small room Valentin Scheister used for his office.

"I've drawn up the paper work," Valentin said. "All it needs is my signature,*Herr* Knaust's signature, *Herr* Sanabria's, and*Herr* Mase's signature to make it legal."

Julio studied the document before he picked the quill up from the desktop. He dipped it into the ink and

awkwardly scrawled his name on the bottom of the document.

Fenton muttered under his breath before taking the quill from his hand and signing.

Georg and Valentin had agreed to take over the Greasy Spoon; however, there were a few stipulations they'd all had to agree on. First, the name was to be changed to the American Greasy Spoon, even though it was owned and operated by down-timers. Second, the up-timers all stayed on for awhile longer. That had made Odetta and Angie happy.

Their time in Magdeburg had been a lesson for them. While they might not be the new owners of the Burger King or McDonald's of the USE, they did function well as a team. They just didn't do it in the restaurant/tavern industry. They didn't have great heads for business.

One thing they were extremely good at was playing music. They had gained a lot of confidence over the past few months. They no longer worried about what they were going to do.

They had a new plan. They were going to run the American Greasy Spoon for Valentine and Georg. They would also provide entertainment. They would form a band called Greener Pastures. One day they would leave Magdeburg. If they could please the customers at the Spoon, they stood a good chance wherever they went.

Julio watched Odetta move toward Georg as the big German took the quill to add his signature. Maybe it would be better if they stayed around Magdeburg for awhile. They might even learn how the German guilds worked.

He watched as the lawyer added his signature. The deal was done.

"That seals the contract." Valentin chuckled as he returned the quill to the table. "I'm glad you chose to stay. It will add an American touch to the American Greasy Spoon."

Julio momentarily felt like the main attraction at a zoo. He smiled to himself. He had better get used to being watched if he planned to play his gitbox on stage. They wouldn't be returning to Grantville any time soon. Staying would give Odetta and Angie a chance to make decisions about their romantic conquests. Now they didn't have to say good bye to friends and, in some cases, loved ones.

It was time for them to try their hand at something new. This time, he didn't just think they would succeed; this time he knew they would.

Grantville's Greatest Philosopher?

By Terry Howard

Ken looked up when the door opened. When he saw the men who were entering, he moved down to the cash register. Once there, he put his hand on the sawed-off shotgun that hung in a rack on the underside of the bar. "Julio," he called.

"Yeah?" Julio Mora replied.

"Nine one one,*now* !"

"On it." Julio left the sink of dirty dishes and headed for the phone in the back room.

Three men walked through the door. Each was well dressed, one more so than the others. They were armed but that was common enough. Two of them had that air of 'trouble on a short leash.' Muscle, Ken thought. Bodyguards, competent, deadly, dangerous. They were also down-timers. Under the big "Club 250" sign on the door a little sign read "No Dogs and No germans Allowed." All down-timers were "Krauts" as far as the denizens of Ken's bar were concerned.

If it had been a bit later in the day Ken would have told them to get out, knowing there was enough firepower at hand to make it stick. It was, after all, that kind of bar. At this hour, though, the "I want a drink for lunch crowd" was mostly gone. There were only three patrons left. Ken knew they were nothing but three more targets. It was time to stall and pray that the police came quickly, so Ken waited nervously for the down-timers to speak first.

After standing inside the door for half a minute the trio consulted briefly and one of the guards spoke in fairly understandable English. "We have read the sign."

*Uh oh*Ken thought.

"We are not staying," the guard said.

Relief swept through the owner of the bar. Ken had never killed anyone in the bar and didn't want to start now. For that matter he had never been killed and sure didn't want to start that now, either.

"We were told that the great philosopher, Herr Head, always had lunch here."

James Richard Shaver, Jimmy Dick, often referred to behind his back as Dick Head, a name he richly deserved for being a jerk of the first water, actually managed to blush. Ken, from long practice, managed to swallow his laughter completely. Some of his patrons were a mite touchy, especially when they were drunk.

"Herr Krieger wishes to converse with him," the guard continued. "It need not be here, where we are not allowed. Over dinner tonight, at the newly opened salon, perhaps?"

Ken let out the breath he was holding and took his moist hand off the shotgun. The tension flowed out of his muscles and evaporated without leaving any residue on the floor. Politely, he answered the trio with complete honesty. "There is no one here right now who answers to the name Herr Head. Can I ask who sent you?"

"We sought the gathering place of the local philosophical society at the . . ." The guard did not quite pause, "'front counter', where we took lodgings. We were directed to the . . ." This time he did pause while he wrapped his tongue around a more difficult, recently learned, word phrase, "'Police Station.' They directed us to the . . ." Again a new word. "'Post office.' There we were told that the only fulltime, practicing philosopher in town was Herr, excuse me, Mister Head, and he could be found here having lunch, since there was no longer a Cracker-barrel in town."

"Did the post office say Mister Head or dickhead?" Ken inquired.

"Yes, Dick Head is the name we were given."

The other two patrons snickered and James blushed again.

"Where are you staying?" Ken asked. "If Herr Head comes in today, I'll give him the message. And then, if the greatest of Grantville's philosophers wishes to talk to you, he can send a disciple to make arrangements."

All the while Ken spoke, Jimmy Dick was thinking hard. He was never going to live this down. He knew it. People who hadn't spoken to him in years, if ever, would hail him on the streets of Grantville at the slightest of excuse, just to have the opportunity of addressing him as "Herr Head." The more polite of them would seek the opinion of Grantville's greatest philosopher. Small towns can be quite cruel that way.

It was almost a relief when the door opened and two cops walked in.

"Is there a problem, Mister Beasley?" one of them asked.

"No. No problem at all. These gentlemen were just leaving."

One cop looked at the other and tilted his head slightly towards the door. The second nodded ever more slightly. Then Hans, the down-time cop, went out with the three strangers to make sure they didn't have any complaints that should be addressed.

Lyndon approached the bar. When he reached the cash register he asked, "What happened, Ken?" Officer Johnson was probably the only cop that ever addressed Ken Beasley by his first name. He once briefly dated Ken's step-daughter, and Ken still thought well of him.

"Sorry about that, Lyndon," Ken said. "When three armed Krauts came through the door looking dangerous, I thought I had a problem. Turns out someone down at the post office sent them here on a wild goose chase; just to get rid of them, I suspect."

Lyndon worked so hard to swallow his laughter that he almost choked on it. "Sorry about that, Ken," Lyndon apologized. "I guess that's our fault. When the three wise men came wandering into the station looking for our philosophers so they could commune with them, the person behind the desk tried to explain that we didn't have any. She finally got rid of them by sending them to the Post Office. After all, they have everybody's address. Well, someone thought it was funny, I guess, to let them chase their tails all over town and called the post office and suggested Jimmy Dick."

"Thanks a hell of a lot!" James added from the sidelines.

Lyndon continued. "If the post office had given them his home address they never would have come here."

"Hey?" Jimmy Dick called out. "Hello." He waved his hand in a big "bring on the train" wave. "I'm down here. If you can't talk to me, you could at least not talk about me as if I ain't here, damn it."

"Oh, I'm sorry, Jimmy," Lyndon said. "When I didn't see you talking to them I figured you weren't here."

"Why the hell should I talk to them? And why was it funny to give them my name?" James demanded. Then before that could be answered, if indeed it could be, he also asked, "And just who do I thank for that anyway? And why would I want them poking around my house?"

Lyndon started to answer the first or second question and then bit his tongue. He didn't answer the third question either but he did reply to it. "Jeez, Jimmy, I'm not sure who made that call."

* * *

In truth, Lyndon knew exactly who made the call. He knew it had been discussed for almost three minutes and everybody in the office, including the chief, knew about it and thought it was funny.

The conversation started out with someone suggesting that they call the post office and have them send the three wise men down to the stables to look for Don.

"Don who?" someone asked.

"Donald Duck," someone else suggested.

"That would do, but I was thinking of Ma Quixote's oldest boy."

The people in the room had chuckled. Then someone had showed his age by saying, "If they want philosophy, we should send them to Ma and Pa Kettle."

"Who's that?" At least two people asked.

As he tried to explain who Ma and Pa Kettle were and then what a cracker-barrel philosopher was, the name Dick Head came up.

The truth was that they were, perhaps, just a little embarrassed that they did not have a Philosophical Society in town nor did they have anybody they considered a philosopher. So they sought to hide the embarrassment in humor. Pain turned inward is depression. Pain turned outward is anger. Pain turned sideways is humor. All three can be destructive.

* * *

"If there's no problem I'd better get back to work," Lyndon said. Ken noticed he hadn't answered the fourth question, either.

The other two patrons were out the door behind him before it shut all the way. The closing of the door seemed to trigger a wave of laughter.

"Ken, bring me a bottle of whatever you're calling whiskey these days," Jimmy Dick said. "That story is all over town by now. Looks like I'll be doing my drinking at home for a good long while."

"Shoot, Jimmy. That won't help and you know it. The only thing you can do is make it your joke on the Krauts and ride it out."

James picked up his beer and took a long slow sip and thought for a minute. You can't talk while you're drinking and you can't talk while you're thinking. Or is it you can't think while you're talking? James mind went back to junior high school. If someone insulted you it was best to turn it back on them; it was almost as good if you could turn it on someone else, then you were doing the laughing instead of being laughed at.

"Oh, come on, Jimmy," Ken said, "why do you think I told them you'd have a disciple come to their hotel? You can have the whole town laughin' at you or you can have the town laughin' at them."

"I don't know, Ken."

"Go have a free dinner. Order two of the most expensive meals on the menu. Hand them some bullshit. Then tell everybody in town what saps the puffed up highbrow Krauts are."

"I don't know, Ken," James said, again. The answer came a bit slower this time.

Ken knew he was coming around. "Well, why not?" Ken pushed.

"That interpreter he had was hard on the ears," James said. It was lame and he knew it. He also knew that he would be taking Ken's advice. He just couldn't give in without arguing. It wasn't in his nature.

"So when you send the messenger tell 'em you're bringing your own. Better still, tell them you're bringing two, so it'll be three on three."

Julio brought half a tray of glasses to add to the stack under the bar. The only time he ever brought less than a full tray was when he wanted an excuse to come out front. "I'll get my grandson to deliver the message," he said.

"He's in school, ain't he? I want to get this over with." James said.

"I'll call over there and get him out," Julio said.

"Why don't we just call the hotel?" James asked.

"Naw! It ain't dignified enough. Grantville's greatest philosopher would send a formal note. While we're waiting for the boy, I'll call home and get a blank card. Don't just stand there, Julio," Ken said. "Call the school and get the kid over here."

* * *

When Matthew got back to school he had missed one class and was late for the next. When he entered Mister Onofrio's math class he handed the teacher a note from the office. The note said simply "Matthew Bartholow was excused and may be admitted to class at this time."

After forty years of teaching, Emmanuel Onofrio knew a rat when he smelled one. "You will speak to me after class, young man. Do you have today's assignment?" It was the last class of the day and Emmanuel knew Matthew's shift as a bus boy didn't start until dinner time. The lad had tried, once, to use it as an excuse for not having his homework done.

When the room was empty except for the two of them, Mister Onofrio asked, "Just where were you, young man?" in his well practiced "I can see your soul so don't mess with me" voice.

"My grandfather sent for me to run an errand," Matthew replied.

"And what was this errand that was so important that it couldn't wait?"

"They needed a message delivered." The boy's answer sounded rather lame to the old man.

"And what was this important message, that had to be delivered, by you, before school was out?" The mathematician wanted to know. The boy blushed but did not say a word.

"Come, come," the gray beard said. He knew he was near a confession when the lad blushed. "Speak up."

"Well, they didn't tell me not to read it," Matthew said.

"So you read it. What did it say?"

"Dick Head, along with an interpreter and an associate, will be pleased to except Herr Krieger's dinner invitation tonight at seven. Please make reservations for six at Grantville Fine Foods."

At the name Dick Head, Emmanuel Onofrio started to dismiss the whole thing as a bad joke. But the name Krieger caught his full attention. "Krieger?" He almost gasped. "Not Wilhelm Krieger?"

"That's the one. I got his first name at the counter when I delivered the note," Matthew said.

"Why would he want to see that idiot Jimmy Dick?" Emmanuel asked the universe, all but forgetting that there was another person in the room.

"All I know is that the post office sent 'em lookin' for Dick Head and they found him where Grandpa works afternoons," Matthew said.

"The post office?!" The puzzled teacher nearly yelped. "Why would they send him there?"

"I don't know."

"That will be all."

* * *

Shortly after Matthew left, Emmanuel was on his bicycle. He was heading for the post office and determined to get to the bottom of it all.

* * *

The gray haired man stepped up to the window to be promptly told, "Sorry, Emmanuel, there isn't any mail for you. I'd send it on to the school anyway."

"No, I'm not expecting anything. I was wondering though . . . Well, I heard something improbable from a student and thought I ought to check before I called him on it. You didn't see Wilhelm Krieger today did you?" Emmanuel asked.

"Not that I know of," she answered.

"Thank goodness. That's a relief. I was told you sent him looking for Jimmy Dick," he said.

"Oh! The three wise men. Yeah, I sent them to Club 250 to see the Dick, ah, Jimmy Dick." Even grown ups can be intimidated by an old teacher.

"Why?" Emmanuel practically shouted.

The post mistress must have "got her back up" at his tone of voice, at the implied criticism, and at being made to feel like a naughty little girl. "'Cause the cops called over here and told me to. If you got a problem with that go and talk to them." With those words she turned away from the window.

* * *

Shortly thereafter, Emmanuel found himself at the police station. Shortly after that, he found himself in Chief Richards office. Oddly, it was the chief who was uncomfortable.

"Chief Richards, do you know why one of your people sent Wilhelm Krieger to speak to Jimmy Dick?"

"Well, Mister Onofrio, what can I say? It seemed like a good idea at the time."

"Chief, you just sent the biggest jerk in the whole town to represent us to the greatest intellectual mind that Germany is likely to produce this century."

"Never heard of him," Chief Richards replied.

"He probably didn't live long enough to make it into our history books. Beyond doubt, he will be in the ones we're writing now. His published work on philosophy guarantees that, even if he never writes another word. We can't have him thinking that jackass, Jimmy Dick, represents Grantville. You've got to stop it." Chief Richards knew Emmanuel must be a very flustered academic. He wasn't just speaking forcefully, he was nearly shouting.

"I don't see what I can do about it. Having dinner isn't a crime. If you feel that strongly about it, go talk to Jimmy Dick. Now, is there anything else I can help you with before I get back to work?" Chief Richards was getting a bit annoyed. He wasn't used to being yelled at in his own office.

* * *

Emmanuel put his kickstand down outside of Club 250 within a few minutes of leaving the police station. As he read the sign, 'No Dogs And No germans Allowed', his mind corrected the missed capital letter. Then he realized it had been done that way on purpose. He took a deep breath, squared his shoulders and entered the den to bait the lions.

* * *

Ken looked up as Emmanuel walked in. Emmanuel could see that Ken didn't immediately recognize him. Then he apparently decided that Emmanuel was obviously an up-timer, probably okay. The old man approached the bar and Ken asked, "What can I get ya'?"

"I'm looking for Jimmy Dick," Emmanuel said.

"He ain't here," Ken answered.

"You're Ken Beasley, right?" Emmanuel asked.

"Yeah," Ken answered.

"I'm Emmanuel Onofrio," Emmanuel said.

"Ralph's uncle?" Ken asked.

"Or his brother, depending on which Ralph you're referring to. Perhaps you can help me. I need to convince Jimmy Dick to not keep that dinner date tonight."

"Why?"

"Mister Beasley," Emmanuel started to explain but was interrupted.

"Call me Ken," Ken said. "The only people who call me Mister Beasley in here are cops here on official business."

"Ken, Jimmy Dick is the butt of a horrible joke. A joke that's in very bad taste, I might add, perpetrated by the police department."

"Manny, we knew that when we sent the note accepting the invitation," Ken said.

Emmanuel ignored being called Manny. The old man detested that nickname, but was dealing with a shock of his own at the moment. "You knew?"

"Sure," Ken said.

"Then why did he accept?"

"Well, Grantville is going to be laughing about this for years to come. We decided we'd rather have them laughing at some damned Kraut stuffed shirt than at one of our own," Ken explained.

"But, Mister Beasley, Ken, that Kraut stuffed shirt is Wilhelm Krieger. He's here to research our philosophy before he writes about it for all of Europe to read." When it came to Herr Krieger's purpose Emmanuel was guessing. Correctly, as it turned out, but still just guessing.

"Really?"

"Do you actually want all of Europe to judge us by Herr Krieger's impression of Jimmy Dick?" Emmanuel asked.

Ken looked taken aback for a moment. The stakes were a lot higher than he had realized, apparently. Still, he asked, "Do you really want Jimmy to spend the rest of his life being laughed at over this?"

Emmanuel started to speak and paused with his mouth open. He hadn't thought of that. He was angry with himself. In an argument you take the time that your opponent is speaking to plan your next point. In a discussion you listen to the other party and think about what was said before responding. He hated arguing and was annoyed with himself for having slipped into one. Still, he had to try. "Mister Beasley, this is important. Way too important to leave in the hands of Jimmy Dick Shaver."

"Well, the cops should've thought of that before they set him up to take a pratfall. Shouldn't they have?"

"I can't agree with you more. Their behavior is reprehensible. But what can you do, report them to the police?" Emmanuel asked.

Ken actually laughed. The hostility that had been building was, provisionally, set aside, though it was

ready to hand and could be easily put back in play.

"Where is Jimmy Dick? Perhaps I can reason with him," Emmanuel said.

"I doubt it." Ken smiled. "His mind is pretty well made up. Have a seat and a beer on the house. Jimmy will be back shortly. He's gone out to nail down his interpreter for tonight."

That caught Emmanuel's curiosity. "Who is he getting?"

"He wants Old Joe Jenkins."

"That old hillbilly?"

"Yep." Ken nodded. "Jimmy said he heard him translatin' sermons, German to English and English to German right down to the emotional slant of the preacher and was never more than one word behind. He also said that Old Joe Jenkins was the smartest man he had ever met."

Emmanuel was shocked to find that he was angry or jealous and chided himself for it. Why should he care about the opinion of the biggest jackass in a town half full of petty, close minded people? Besides he had never really met Jimmy Dick, so the poor man didn't really know what a smart man was. Then he chided himself for being overly proud and again for being uncharitable to the village he grew up in and had chosen to retire to.

"Who's his other second?" Emmanuel asked.

"Huh?" Ken looked confused.

"Jimmy has been challenged to a duel of wits. He's taking two seconds. One is Joe Jenkins. Who is the other one?"

"I don't think that's been settled yet," Ken said. He knew for a fact that Jimmy was assuming he would be the third member of the party. He wasn't thrilled with the idea. Fresh organic fertilizer had a way of splattering anyone close by when it hit the fan and he didn't want to deal with it. A thought grew in his mind and a smile grew on his face. "But I think it should be you."

* * *

Fritz Shuler was ecstatic. On a week night his struggling restaurant, Grantville Fine Foods was booked to capacity. He hadn't had a night like this since the opening rush. The crowd was almost all up-timers, for a change. There was one reservation from a down-timer. Then the calls started trickling in. The trickle steadily increased until he was turning people away.

Fritz was frantically putting the final touches on the new policy that he hoped would be the salvation of his investment. He had researched up-time dining before he opened. He found a paper maker who would make paper plates and napkins. His niece bought plastic flatware and cups at school from anyone who would sell them.

He had set out to provide an authentic West Virginia dining experience. He featured catfish, Kentucky style chicken cooked in a very expensive "pressure cooker," and beef grilled to order, on top of a full menu. The down-timers found it charming but up-timers didn't come back.

Someone finally explained the difference between fast food and fine food. After tonight when diners arrived they would be asked, "Paper or cloth napkins?" But tonight, except for the one table, everyone would have real linen, silver flatware, fine china and glass. He hadn't planned to start that until next week but when the river floods, it's time to float the logs.

After a hard day of frantic preparations the night was not going well. People who arrived at six were lingering over coffee and wine, as if waiting for something. People who had a seven o'clock reservation were arriving early, as if they were afraid they would miss something. Customers were piling up in the waiting area. There were no open tables except for the one set for six with paper and plastic. Fritz was not going to put an up-time patron there. He gritted his teeth and started passing out free wine.

The down-timers arrived a bit early. Oddly, no one in the waiting area objected to being passed over. Fritz showed them to the table where they immediately examined the place settings in detail as was typical of a first time down-timer diner. Fritz was shocked when the rest of the party arrived and were up-timers. Well, it was too late to change things now.

Fritz showed the new arrivals to the table. Before they could seat themselves one of the down-timers stood up. Fritz was startled and just a bit worried.

In passable English the standing man said, "Herr Krieger suspects that he is being played for a fool." From the look on his face the interpreter was completely convinced of it and was more than a little pleased about it for some reason.

Emmanuel's heart dropped. He had hoped he could take the conversation into Latin, the language of scholarship, and control the night. Now the game was lost before it started. All he could think to do was apologize profusely. Before he could start Joe Jenkins spoke up.

"Why does he suspect that?" Joe asked.

It was a fair question, Emmanuel thought, but something about the way Joe said it was . . . Latin! It was Latin; accented but understandable Latin. Where did a dumb hillbilly learn Latin?

The interpreter looked perplexed. Emmanuel guessed that he didn't know Latin, just his native dialect of German and the passable English he had picked up somewhere. Herr Krieger, on the other hand, was suddenly focused completely on Joseph. He motioned for the interpreter to sit down.

"My man here claimed to have overheard a conversation leading him to believe Dick Head is not a name but an insult," he said in crisp Latin. His voice was quite tainted with suspicion and hostility.

"Well, he is right about it being no one's proper name." Joseph continued speaking in Latin, to Emmanuel's ongoing amazement. "I am Joseph Loudoun Jenkins, now commonly known as Old Joe. When I was young I was known was Low Down Jenkins. Over there is Emmanuel Onofrio, known to his students as Oman Frio, meaning Old man 'Frio. Don't look sour, Emmanuel. You know it's so. Emmanuel is otherwise known as Ralph's brother or Ralph's uncle, depending upon the age of the speaker. Your third guest is James Richard Shaver, commonly known as Jimmy Dick, sometimes called Dick Head."

"Why?" Wilhelm asked.

Joe began to answer. "Well, sir." Hearing the West Virginia accent and word choice coming out of Joseph's mouth while speaking Latin was amazing to Emmanuel. Still, somehow, it felt like Joseph was

yet going to pull it out of the soup. "We came from a very busy time. Anything we could do to get things done faster we did it. Even our language was rushed. We didn't have time to say 'The United States of America,' so we said 'the U.S.A.' When I was a young man we had a 'President,' a leader named Eisenhower. He was very highly esteemed. Everyone referred to him as Ike. Later two presidents in a row were known by initials, J.F.K. and then L.B.J." Joseph answered the question while completely ignoring what was asked.

"Are we just goin' t' stand here or what?" Jimmy Dick spoke up.

Herr Krieger's interpreter translated the question into German. Wilhelm nodded slightly and motioned to the chairs with a slight hand movement. Emmanuel realized that James was a loose cannon who was getting irate about not knowing what was going on. He started translating the Latin into English for him.

"So you shorten names for convenience. That is nothing that we do not do. But he is Dick Head. Is that not an insult?" Wilhelm asked.

"Have you studied Hebrew, Herr Krieger?" Joseph asked.

"Briefly." Wilhelm said. "There were works I wanted to read, but in the end it proved more workable to have them translated."

"I know what you mean. I tried to learn Hebrew and Greek but it was more time than I could spare back then. Knowing French helped when I decided to learn Latin six months ago," Joseph said.

"You have only been working on Latin for six months? Incredible," Wilhelm said. Emmanuel agreed.

"We Americans do things in a hurry. I thought I might need it for dealing with the Catholics, so I was motivated. As I was saying about Hebrew, you know that the word 'Rosh' can translate as 'first' or 'top' or 'head.' Dick can be used in English to mean 'penis.' But it also can mean 'any man' for obvious reasons. Like the words," he shifted to English for two words "lumberjack and steeplejack. So, yes, it can be an insult. But then, to misquote scripture, 'a philosopher is not without honor except in his own home.'"

Wilhelm smiled and started to call for wine by picking up his glass and holding it in the air. But he stopped with the red plastic cup only inches off the table. "Why are we the only ones who have these?" he asked.

"Shit," Jimmy Dick said. "They came from up-time with us and when they're gone they're gone. You're being honored." He swallowed the words, 'ya dumb Kraut', because Emmanuel had impressed on him how important the dinner was. "Honored with a piece of the future. Everybody else here tonight has to make do with the here and now."

Emmanuel started translating what was said into Latin before Herr Krieger's man could give an uncensored version. People at the nearby tables seemed to be taken with sudden fits of coughing.

"Waiter, wine for my guests," Wilhelm Krieger called out. When he did it seemed as if there was a pause in conversation while he spoke. The noise level in the room unquestionably went back up when he set his glass down. "This," he waved his hand to include everything on the table, is truly amazing, so light, yet strong." He picked up a fork and looked at it skeptically. "Can you truly eat with this? It seems like it would break."

Emmanuel was busy translating German to English for Jimmy Dick, who was amongst the minority in Grantville who refused to learn German. So the conversation fell to Joseph, who responded in German. "They can break if you try cutting meat with them, so you use the knife. They were made to be thrown away after one use."

"Truly?" Wilhelm asked with raised eyebrows. "What of the expense?"

"You could buy a box of one hundred for less than you earned in an hour," Joseph replied. "They were not highly esteemed but it saved the time of washing up. Our thought was 'anything to save time.' We were a very busy people."

Herr Krieger's eyebrows went up again. Emmanuel could almost see him thinking that there was a fortune to be made here.

"Unfortunately, we can't make any more. Even if we had the equipment, the materials are not available. These are the last for at least ten years," Joseph said.

"Unfortunate, indeed. Do you teach at the local academy also?" Krieger asked.

"No. I don't have the credentials it takes to do that," Joseph said.

"But with your Latin . . . and you are a philosopher, surely?"

"Neither Latin nor philosophy are much regarded." Turning to Emmanuel, Joseph said, "Why don't you tell Herr Krieger about the school system."

Emmanuel set about giving a detailed account of Grantville's schools. As far as he was concerned, he was justifiably proud of them, even if they were on the low side of average up-time. Joseph translated for Jimmy this time. Ordering food interrupted the flow of Emmanuel's lecture, but he eventually concluded with, "I would put our high school graduates up against Jena's University students when it comes to general knowledge. When it comes to specialized knowledge, I would match Jena graduates with ours in the same field. Of course, we have areas of study that they do not." He was thinking drivers' ed, and then others.

The food arrived. Diners began to leave while others arrived and took seats. It didn't look like the hoped for fireworks were going to happen. No one had the Latin to follow the conversation, so why stay?

"Your colleague says Latin and philosophy are not esteemed?" Wilhelm asked.

"We offer Latin as an elective. Philosophy is covered as part of English literature," Emmanuel answered.

Herr Krieger cautiously cut at his steak with the plastic knife and was visibly surprised that it worked. The silent bodyguard tried cutting his with the fork. It broke in his hand. A staff member immediately turned up with a set of silver utensils for him, and took the knife and spoon away. Emmanuel had the chicken. It was quite good. It had been so long since he last had Kentucky chicken that he couldn't tell the difference. The slaw, mashed potatoes and gravy were superlative.

After his first bite Wilhelm Krieger reverted to Latin. "Herr Head, is war mankind's greatest glory or it's greatest shame?"

Emmanuel translated the question.

"Hell, it's neither," Jimmy Dick Shaver answered. Joseph translated the answer.

"Neither?" Herr Krieger prompted.

"War is a great adventure," Jimmy Dick quoted. "But, an adventure is someone else havin' a hard time of it somewhere else. War is glorious when you win with an acceptable casualty rate. But no casualty rate is acceptable to the casualty. And since someone always loses, war is glorious less than half the time.

"To the men in the middle of it," James continued, "war is at best boring drudgery spiked with moments of terror. For some, it is a walking nightmare that never leaves them this side of the grave."

"Then it is our greatest shame?" Krieger asked.

"There are greater shames," James said after Emmanuel translated the question. "The holocaust comes to mind."

"Do you want me to explain that?" Joe asked.

"Might as well," James said.

"In our history, Herr Krieger," Joseph said, "in the years of the nineteen thirties and forties, a Prussian government rounded up twelve million people they did not approve of. Jews, gypsies, Poles, Slavs, and others. Then they exterminated them."

"Like Vlad the Impaler killing every beggar in the kingdom," Herr Krieger said. "But, that many?"

"It was a very full world," Joseph said. "Look it up at the library. The key words are Nazi, and Holocaust. It will surely confirm the six million Jews. You may have to dig to find the others. They are often forgotten."

Wilhelm Krieger looked at James. "But, this Holocaust is surely a fluke?"

"No!" James replied. "Pol Pot, five million, Saddam, three million, Stalin . . . who knows how many millions."

"So these holocausts are man's greatest shame?" Krieger asked. The undertone of skeptical unbelief was less than perfectly hidden.

"Hell no!" James answered.

A frustrated Wilhelm finally demanded, "If it is not war and it is not slaughter then what is it?"

Emanuel translated the question. Joseph waited for the answer. James paused. His last "hell no" was a reaction without conscious thought. Now he needed a response. "Tell him that mankind's greatest shame is running out of good whiskey. No, wait." A memory of personal pain gushed into his mind like a torrent of water from a long forgotten dam that crumbled. "Tell him our greatest shame is an uncherished child. A man's greatest glory is to love his wife and raise his children well."

Joseph translated it. Wilhelm started at him like a pole-axed steer for at least five seconds. Then he turned to Emmanuel. "Did he translate that correctly?"

"Yes," was all Emmanuel said.

Wilhelm looked back at Joseph. "Do you agree with him?"

"Well, it was my greatest joy. And yes, it is my greatest glory. So I agree with him." Joseph said.

"And you?" Herr Krieger asked, looking at Emmanuel.

Onofrio's memories flashed back through a list of unloved, bright children who faded into dull commonness or blossomed into brilliant horrors. "Yes. An uncherished child is our greatest shame."

"You people are hopeless romantics." Krieger's tone made it clear he thought the idea contemptible.

Both up-timer translators laughed. When Emmanuel explained why, James smirked.

"What is so funny?" an obviously angry Wilhelm demanded.

Joseph dried his eyes. "My wife, may she rest in peace, often told me that I was a typical male with no idea of what romance was."

Wilhelm humphed before asking, "Herr Head, how many children did you and your wife raise?"

"I ain't mankind. I'm one man. Nam was my greatest glory and my greatest shame. When I returned no women worth puttin' up with would have me and any women who would put up with me weren't worth havin'."

* * *

He saw no reason to tell this damned Kraut about his personal life. When Bina Rae found out their baby had "bad bones," probably from something he brought back from Nam; something he hadn't told her about, she moved out on him. She acted like Agent Orange was some sort of venereal disease he could have avoided. When she left he took to hitting the bottle hard and lost his job. Bina Rae wouldn't talk to him, wouldn't go to counseling and wouldn't let him see Little Merle with out a big fight each and every time.

Now Merle was living in the nursing home and as long has the bills were paid he never heard from or of her. Merle would not speak to him for abandoning her. She never even heard his side of the story.

The only happy year of his miserable life crashed in 1973. Bina Rae came home from the doctor and was packed up and gone when he got home from work. He got drunk and stayed drunk. Along the way he got divorce and listed as sixty percent disabled instead of the usual thirty percent for a head case. Up to the Ring of Fire the Veteran's Administration paid for Merle out of his disability check. Now he was making do with family money off of rental properties an agent managed.

None of that was anybody's damned business, especially some damned Kraut.

* * *

"So you admit that your greatest glory and your greatest shame is war. But you would have me believe it is raising children." Herr Krieger turned to his interpreter and spoke in loud, angry, German while rising to

his feet and pocketing the plastic spoon. "You are right! I am being played for a fool. Settle up with the proprietor and return to the lodgings." Then without a fare-thee-well, he and the silent bodyguard stalked out of the totally silent room.

Jimmy Dick was the first to speak. "Ya know, this catfish is really quite good."

The dinning room burst into roaring laughter.

When it had mostly died down Emmanuel Onofrio stood and extended his hand to Jimmy "Dickhead" Shaver. "Mister Shaver," he said in a voice pitched to carry, "it was truly a pleasure translating for Grantville's only fulltime practicing philosopher."

The Misadventures of T & V
Mama Mia, That's A Good Pizza Pie!

By Jon and Linda Sonnenleiter

Early October 1634, Naples

The ash dust flew up when Vince fell flat on his face. They had just left the main entrance to the mission's rented villa and Vince had tripped in a hole he hadn't been able to see.

Tim laughed. "What kind of impression are you going to give the Italians, Vince? They'll probably think you're some kind of major klutz."

Tim Claggett stood 6 feet tall and weighed 190 pounds. A big change from up-time, when he'd been a junk food addict and had weighed 310 pounds. Both men were in their early thirties and in excellent shape. That helped when you were meant to be an embassy guard.

When he was standing above the road, instead of lying on it, Vincent Petrini, aka Vince, was 5 feet 10 inches and weighed in at 160 pounds. Except for the pound of Vesuvius' ash that he was busily brushing from his clothes.

"Damn. You'd think these pockets of ash would have blown out to sea after three years," said Vince. "But no, the wind keeps bring that volcano's ash into the city every time the winds come from the south. I'm tired of tripping in these ash-covered holes in the road." Vince's face was glum. "It's been a bad day and I'm pissed. Let's go." He took off for town at a fast walk.

"Well, what are we going to do now?" asked Tim. He hurried to keep up with Vince who was heading towards the middle of town.

They'd been the city four times since they arrived. By now, they considered themselves old hands at finding their way around, even though they'd only been a mile or less from the villa. The town seemed very busy, and at times dangerous. Still, they were starting to get a little bored with the uptight people and the lack of good food. "Good" food, of course, meaning junk food.

Tim kept dreaming of big, greasy cheeseburgers dripping with ketchup, mustard, onions, lettuce, tomatoes and a half pound of grease from the grill. The kind that were served with western fries, smothered in salt, with a jumbo strawberry shake. Or maybe foot long hot dogs smothered in everything,

with a cherry vanilla coke to wash everything down. His mouth watered just thinking about it.

"Damn it, what I wouldn't give to have a big cheesy pizza with the works." Vince shouted to the sky. He stopped quickly, causing Tim to bump into him. " Man, this is Italy, the home of great pizzas. Where are the pizza shops? There has to be someone who knows something about the subject."

"Vince, remember this is 1634. Hell, Italy isn't really Italy yet. It's not like back home in our time, where you couldn't go a few blocks without seeing a pizza shop, or any kind of fast food place."

"It's not fair," Vince said as he slumped against the stone wall. "There has to be somewhere here that can make a decent pizza."

Vince knew that being here was hard on Tim but here they were. All anyone could do was try to make the best of a bad situation and try to look on the bright side.*If there is one* he thought. At least some things had improved since they got here. Tim had lost over one hundred pounds, fine. But still and all, there was no sense in having to eat the same old food day after day. There was no imagination in the Italian foods. They needed to mix things up a little.

Vince let out a long sigh and started to walk a lot slower. This time Tim was right beside him and not hurrying to keep up. They walked in silence, passing all the street vendors hawking their wares and people pushing each other to get to what they were selling.

"Well, where do you want to go eat now?" Vince asked. When there was no

reply he turned to see that Tim wasn't there. He looked around and didn't see him. "Now where in blue blazes did he get off to?"

Vince took a moment to look around him but saw no Tim. He started to walk back the way he came, all the while looking around to see if Tim was among the crowd. A few minutes later he spotted Tim. He was talking with a man who was selling fruits by a fountain. The fear he had been feeling that his friend might have been taken by some thugs was turning into anger. He rushed up to Tim and grabbed him by his right arm and

spun him around to face him. The fruit vendor let out a little yelp and jumped under his table, almost knocking it over.

Vince felt like punching Tim for scaring him that way. Instead, he pushed him a bit and shouted, "Don't ever do that again. Disappear on me like that. I thought some thugs might have jumped you and shuffled you away. Worse yet, what if a couple of Spanish soldiers wanted one of their special chats with you? If you're going to stop somewhere let me know."

"I told you I was going to go ask someone where they make pizzas. You must not have heard me." Tim rubbed the arm Vince had grabbed. He started off back down the street. "I thought you heard me. Shit, do a guy a favor and he goes off like this. If a couple of criminals took hold of me, I'd have hollered and fought like hell. Ah, shit. I need a drink."

"I need a whole bottle," muttered Vince.

They went to their favorite tavern and picked a table toward the back of the room. "A jug of the best red," Tim said. The waiter scurried off and brought the wine in short order. They were on their second glass when Vince finally spoke.

"Sorry, man. I never should have gone off on you like that. But how was I to know you decided to ask questions and weren't kidnapped? Damn, it's hard to think of the Spanish ruling the roost here."

"I should have made sure you heard before I stopped to talk to that guy. I'm sorry, too." Tim raised his glass and nodded. Vince clinked his glass to Tim's and they both drank the wine straight down. "But I did find out there's a place here that specializes in making pizzas and I thought I'd treat you to one."

"Pizza like the ones we got back home?"

"I doubt it," Tim said. "But I thought we could give it a try. In fact, I got to thinking . . . maybe if it isn't like we could get back home, well, just maybe we could teach them how to make a really awesome pizza." He paused a moment and gave Vince a sly wink. "Never know. We might just make a little money on the side teaching them how to do it."

"You mean like a franchise, like a McDonald's or something?" Vince liked

the way his friend was thinking. For once, he thought, they could be making money the easy way like so many others were. If a bunch of teenagers could do it, why couldn't they? "Do you think we got the stuff here to do it?"

"Vince, we just walked through an open market. Didn't you see the different meats and vegetables and smell the spices?"

"Uh . . . no. I wasn't paying any attention, I was still mad at you." Vince took another sip of his wine.

"Come on, Vince." Tim rolled his eyes. "We've been though here before. Didn't you notice anything then?"

Vince made a face. "Okay, okay. You got me. I just never notice things like that. I was looking at buildings and people. I mean, I saw they were selling food. I just never noticed what kind. I guess that makes me a lousy Italian. Mom would be in seventh heaven here. It's really funny. Up-time I always wanted to visit Italy. But now that I'm here, it's

dangerous and dirty and it really, really stinks."

"Amen to that," Tim said. "Just trust me. I noticed the food. Everything we need is here, if it isn't . . . well, then we can make do with what we do have. Where there's a will, there's a way. What do you say, partner?"

"You know Phil doesn't want us making any waves. The political situation here is dangerous."

"I guess that's why he wants us wearing civilian clothes outside the compound on our own time." Tim poured the last of the wine in the glasses. "We can be careful. What do you say?"

" I say, I've always wanted to own a pizza joint."

* * *

It took them about twenty minutes to find the restaurant the vendor told Tim about. Gillmarino By The Sea it was called, and it wasn't too far from the villa where they were staying. They stopped for a

moment before getting too close and took a look at it. It wasn't that large. And, well, Tim had to admit that it was a little run down. But there was some

space in front that could have some tables put out in it. A vision of a picture he'd seen bubbled to the surface of his mind. Tables on a patio. Wrought iron chairs and tables. Blue umbrellas with the word "Cinzano" emblazoned on them. Yeah. This could work for that. Probably eight tables would fit out front. Maybe a couple of benches. Yeah.

The place wasn't too crowded and getting a table was fast. The first thing they ordered was the best wine they served. When the waiter brought them the bottle and two glasses, they ordered a pizza with the works.

The waiter just looked at them as though they asked for something strange. Tim tried to explain to him what they wanted in his limited Italian and still that look remained. After several minutes, the waiter snapped his fingers and said, " Ah! Neapolitan pie."

"Whatever you call it. Yes, yes." Tim nodded vigorously. "We want the works."

The waiter bowed and headed for the kitchen. Twenty minutes later he came back and placed a large round plate on the table. He stood there smiling.

Vince and Tim looked at what he brought them and they both were speechless. On the plate was a round of cooked dough maybe seven inches in diameter. It had some sliced tomatoes, some green leaves that maybe were a herb of some kind and very little cheese. They looked at each other and then at the still smiling waiter.

"This isn't a pizza." Vince said. "It sort of looks like maybe a poor example or . . . or . . ."

"It looks like something a four year old would try to do," Tim piped in. "Is this your specialty? Can we talk with the manager for a few minutes?"

"Yeah. We don't mean any disrespect to your restaurant, but we would like to show you how to make a pizza from our time," Vince said.

"This may be your best." Tim pointed to the pie. "But we can make it even better."

The waiter left with a concerned look on his face. He returned with a short, bald man who introduced himself as one of the owners of the place.

* * *

Marco felt a little worried about these up-timers and hoped there wouldn't be any problems with them. He knew he and his family couldn't afford to lose any more business or they would lose the restaurant and everything else. He hoped that these two men wouldn't be his downfall. They tried to serve the best food they could but sometimes that wasn't

always easy. The Spanish had placed some pretty high taxes on them—not to mention that they always required the best food for themselves. That left very little for Marco and his people to choose from. He hoped that what the waiter told him was true, that these men could help him. He could use a little bit of luck right now.

"You gentlemen do not like the pie?" he asked, wringing his hands nervously. "This is the best in the house. We only use the best in such a noble dish. We can make you something else to your liking. We wish . . . to . . . "

Tim held his hand up to stop the chatter. "We want to help you. Of course, ourselves, as well. What's your name?"

"I am Marco. My family and I own this little place. You wish to help me in some way? May I join you at your table?"

"Please. Join us and have a drink of this excellent wine." Vince motioned towards the empty seat and asked the waiter to bring another glass. "You probably know just from looking at us that we're what people call up-timers. One of the many things we miss from our time is a really good pizza. You call it Neapolitan pie here, but in our time it was called pizza. What you have here," he pointed to the plate, "is the beginning of a pizza."

"You have tomatoes which is the first thing to start the pizza sauce." Tim took over. "You have everything here to make a really great pizza. I've seen it in the markets. We want to show you how it's done. We'll teach you how to do it and in return we ask to be given a small part of your profits."

"You wish to be paid?" asked Marco. "We have no money to give out."

"No, no." Tim shook his head. "You only pay us once the pizza's start selling hand over fist. okay?"

"What do you do with hand and fist?" Marco asked with a puzzled look on his face. "We only cook food here, no hands or fists." Marco wasn't entirely sure these were sane. What did hands and fists have to do with pizza, what ever pizza might be?

"Listen, Marco. That's just a old saying from our time," Vince said. "It just means making more money than you can imagine."

"You wish to help us do that?" Marco asked, looking at them strangely. He stood up. "What is really going on here? We do not want any trouble. We only want to live peacefully with everyone. We start no trouble."

"Neither do we want trouble." Tim motioned for him to sit back down and he poured him some more wine. "We want a pizza like the ones we remember. And we want to share with the people of Naples the great taste of a truly excellent Neapolitan pie." Tim flapped his hand at the Neapolitan pie on the table. "Yeah. Keep that one. No big deal. But the ones we teach you to make can be called pizza. We'll show you how you can put anything on these pies as long as you have the crust, the sauce and the cheese."

"You will become world famous for your pies and become rich while doing it," Vince pronounced solemnly.

Marco looked at Vince and stated. "You are so sure of this?"

"You bet." Vince grinned. "You'll get rich. I'm willing to bet on it. But my friend and I, we only wish to be comfortable in our old age." He asked the waiter to bring another bottle of wine. Then he took a piece of the pie and tasted it. "This is okay. Not bad at all. But we can make it better. Even great. What do you say?"

"I must first talk with my brothers. We will let you know tomorrow if we wish to get rich as you say."

"Fair enough," said Tim.

* * *

Bright and early the next morning Vince and Tim made their way to Gillmarino's. Marco and his two brothers, Anthony and Michael, met them there. They all sat down and Tim did all the talking this time. Last night, before they went to bed, he and Vince wrote down everything they could remember about making pizza. They'd argued about what their mothers put into their pizza sauces for a while. Some people liked oregano more than others. They'd written an outline of what went on the pizza and how long it was cooked. Tim was ready for any questions they had. After about twenty minutes of talking, the brothers excused themselves and went behind the bar and talk over what to do.

"Five bucks says they don't go for it," Vince said.

"My father always told me to only bet on sure things." Tim answered. "You're going to lose. Again." He cast a look over at the brothers. They were all talking rapidly and waving their hands in the air.

Ten minutes later the brothers rejoined them at the table. It was Marco who spoke first. "You will teach us how it is done. If it is true what you say, about how it will be received, then we will give you five percent of the intake."

"No, twenty percent," Tim said.

Finally they settled on ten percent for four months only. Vince held out one more requirement. Tim and Vince could eat there for free or no deal. After all, the recipe couldn't be kept secret for very long.

"That's fair." Tim shot a look at Vince to keep quiet and let him handle this. "Shall we get started, say day after tomorrow? It will take a few days to get everything set up and tried out and put just right."

* * *

Lucky this was their day off. Vince and Tim spent all day and half the evening making things. They cut up different vegetables and herbs they bought on their way to the restaurant. Tim showed the brothers and the cooks how to cut up the tomatoes and cook them and smash them as they started stewing. He added sage, rosemary, basil and thyme to season the sauce. They didn't have a grater, so Tim showed them how to cut up the cheeses more finely. He even showed them that adding a little olive oil to the dough made a crispier crust.

Vince helped the one brother, Michael, figure out how they'd advertise the new product to the people and how much to charge for each one. It all depended on what was on the pizza. He suggested that they should give out some samples; small pieces, to some of the people who hung around and explained that this would be free advertisement for them.

Michael wasn't real sure about that and it took a good bit of convincing him. "We don't gotta do it every day," Vince said. "Just the first few. Maybe three days? Give the word a chance to spread around." Michael eventually agreed.

By the time Tim and Vince headed back to the villa, they were dog-tired and felt ready to fall asleep as soon as their heads hit the pillows. Hopefully by the time they got off work tomorrow and went to

Gillmarino's, the place would be packed. Vince was a little uneasy about the whole thing. If he'd been able to, he'd have taken a few days leave, instead of letting the Gillmarino brothers do it alone.

"Good grief," Tim said, noticing the worried look on Vince's face. "Everything is going to be fine. Who doesn't like real pizza?" Tim was sure everything would be fine.

Vince hoped he was right. They wished each other a good nights sleep and then went to their own rooms.

Vince settled back into his pillows. They were his own pillows, brought from home in his baggage. He never could sleep on strange pillows.*You'd think it was Christmas Eve* he thought. He was trying to go to sleep so Santa Claus would come. But just like it did for a little kid, the night just dragged on.

The next day was just as bad. Tim and Vince waited anxiously until it was five o'clock and quitting time.

* * *

Finally their relief came. They hurried off towards Gillmarino's. Vince hoped that there was a full restaurant and the pizzas were a success.

Standing across from the restaurant, they both felt a little down. It seemed like only a few more people were going in or coming out. "Shit," Vince muttered. He'd really hoped to see a long line of hungry people. Not so, not today. "Maybe tomorrow." He could still hope.

"From the look on your face, old buddy, you're disappointed." Tim patted him on the back. "This is only the first day, guy. Remember the old saying, 'Rome wasn't built in a day.' So cheer up."

"Duh... we're not in Rome," Vince said. He looked at the few people in line. "I need a drink." He took off across the street, heading for the restaurant.

* * *

The inside of the restaurant was dim. It took a moment for their eyes to adjust. Finally, Tim spotted an empty table. He whistled. One of the waiters looked up and Tim signaled for a bottle of wine.

*Funny*Vince thought.*Tim is acting as Italian as the Italians, what with all that arm waving.* Nevertheless, it worked. The waiter headed for their table with a bottle and three glasses, just as Marco came out from the kitchen and headed toward them.

"How's business, Marco?" asked Tim.

"Slow, but not really slow." Marco poured three glasses of wine. "We did as you told us to do. We started giving out the free samples this morning, yes, yes. They went fast. Hungry people all around, but the majority, they really liked it."

"So the advertising went well, " Vince said. "You got a lot out then?"

"Oh yes, very many. Why, we even sold quite a few in the last hour."

"You don't say." Tim grinned. "We told ya."

Marco ignored him. "Anthony is drawing the menu just like you said, so people can see what comes on the different pizzas, It's good that one of us can draw pictures. You know, with these menus, anyone can order food without having to learn our language. We will get new foreign customers."

"Yes. That would benefit everyone," Tim said. "But Vince was really hoping for a packed house today. Yes, I know, I know, it takes time to get the taste out to the people."

"Mr. Vince." Marco patted him on the shoulder. "This is the first day. I feel within my heart that things will soon improve. You must have faith that this pizza will be received with great hunger soon. How about a pizza with the works?"

Mouths watering, Tim and Vince nodded. "Yes," Vince said. "And another bottle of wine."

* * *

Over the next three days Tim and Vince kept track. Each time they went to Gillmarino's they noticed a little more of a crowd. Quite a few people were ordering; but not a few were standing around hoping for a free handout. Some of the customers seemed to be tearing their pizzas apart and looking really close at the items before they slapped it back together and ate it. This made Vince laugh. Tim told Vince as long as they paid for it, they could wear it like a hat for all he cared.

Anthony and Marco joined them at what had now become their usual table. "My friends." Anthony shook their hands. "Each day becomes better, as does our making of the pizzas."

"As you can see, pizzas are becoming quite popular," chimed in Marco. "Soon we will be selling them faster than they can be made."

"If you say so," said Vince.

Tim looked at Vince and then the people in the room. "How about a cheese pizza and a bottle of wine?"

* * *

The next day, after work, Tim and Vince headed straight for Gillmarino's. As they rounded the corner to the street the restaurant was on, they noticed a huge line of people waiting to get into Gillmarino's. Both their jaws dropped. With pounding hearts they raced

up to the front door and saw Michael directing the flow of people. He saw them and his face lit up with the biggest grin and he hugged them both. He was speaking so fast they didn't understand a word he was saying. But from the looks of the packed place they understood his excitement.

They squeezed their way up to the kitchen area and saw pizzas in all stages. Some dough being rolled out, some getting sauce and toppings, some were coming out of the fire and more going in. Everywhere they looked they saw pizzas. Marco came up to them and also gave them a hug.

"Look at this place. Never has this place seen so many at one time. They are a big success as you said they would be. Once the word got out, people had to come and see and try."

They knew people would love them, but never this much. Even Tim and Vince were struck speechless.

"We even had a fight or two with people wanting to get one first." Marco beamed proudly. "We only

hope this will continue this desire to have a pizza your way. We all are going to be rich. Thank you both. You have saved my family from ruin. You deserve everything you get and you will be getting your percentage tonight. Now would you like a pizza with the works?"

They both nodded yes and turned to look for a table.

"Now you can see why I settled on ten percent," Tim said. "We shouldn't get greedy, you know. And let's just say this is only the beginning of things to come."

"Did you bring your fishing pole with you?" Vince asked.

"My fishing pole?" Tim gave him a puzzled look.

"I'm getting hungry for a McDonald's fish sandwich." Vince smiled and gave him a wink.

Seasons

By Mark H. Huston

May, 1631

The old Buick slowly made its way through the dark countryside, headed away from the high school. The couple inside was elderly, cautious, and tentative on the road. It had been daylight when the meeting at the high school started, now it was well after eleven PM. John's eyes were not what they used to be. He'd had cataract surgery a couple of years ago. It had helped, but seventy-eight-year-old eyes were still seventy-eight-year-old eyes.

He just had to take it easy, and make sure he didn't get in an accident. Before last Saturday an accident might have meant losing the drivers license. That would have been a loss of the freedom they enjoyed; living on their own land, tending the garden, tending the house. It would have meant moving into an assisted living apartment that their daughter had shown them in Wheeling. But that was before last Sunday, when what folks were calling the Ring of Fire came to Grantville, West Virginia.

As he drove the Buick slowly up the hill and out of town, following Route 250, John thought back to the meeting two weeks ago with his daughter in Wheeling. She'd been trying to talk him into moving up to Wheeling. "This is the place I picked out for you and Mom." She was almost shouting; John was hard of hearing. "Isn't it nice?" He had spent too many years in the textile industry. There was no such thing as OSHA when he started, and hearing protection was for sissies and women. Sometimes he wished he had used those awful cotton ball earplugs. But that was past.

"But these places are hard to get into" she said again, a little too loud.

"I can hear, dammit. There's no need to shout."

"But Dad, if you'd turn your hearing aid up, I wouldn't have to shout."

"What?"

"I said, if you turn your hearing aid up there would be no need to shout"

"Wait a minute, honey. Let me turn up my hearing aid." The device squealed with feedback as he adjusted it. It never did fit correctly. "There. What did you say?"

"I said that you can move in here, in Wheeling, close to me, Billy, and the kids, but this place is hard to get into."

"Don't want to, honey," he drawled. "It isn't time. Not yet. Someday, maybe, not yet."

"Dad, these places aren't easy to get into. And this two bedroom is open now. You should take it." Elaine looked nervous. "This an assisted living facility, with a nice dining hall. Mom won't have to cook, unless she wants to. There are only a few apartments that have a kitchen."

"It has an electric range, and your Mom never liked electric ranges." John was beginning to feel more uncomfortable by the minute with this conversation.

"Dad, there are only four two-bedroom apartments with a kitchen in the entire complex. And this one is vacant now. I want you to have the extra room of the two bedroom." She paused and smiled sweetly at him. "Dad, this is open now. It doesn't happen very often. You could see the kids more often. And there's a whole lot less for Mom to clean. And this is so much closer to the doctors. You know that's important, Dad. Mom is at the doctor right now. You can't keep driving all that way, and it will be so much easier for Mom." Her smile had changed into something else. It was still a smile, but it had pain around the edges.

"Elaine, honey." John could still be charming if he wanted to. He didn't want to hurt his daughter's feelings. "Elaine, honey, it's not time for this. Not yet. We like Grantville. It's small, but we like it. And, yes, there's only the one doctor. But he knows us, knows our ways. We have the house. I still do the yard. We have the garden. Where would your mother have her garden if we lived here?"

"But that drive, Dad. It's so dangerous."

"It's just over an hour and a half from our house to yours. And I've been driving Route 250 since we moved out there twenty-five years ago. Long as we get home before dark, it's all right, honey. It's all right." He smiled down at her. He was still a tall man, even at seventy-eight. Elaine had taken after her mother. Short, dark hair and eyes, and a little fat. "I enjoy the drive."

He did enjoy the drive. It represented freedom. But now. Now things were different. Unbelievably different. Unreal. He kept looking out at the moon, and that confirmed the truth. The crazed, hard, real truth. They had gone back in time. Nobody understood how, or why. It had picked them up and turned them around and dropped them down in this new here and now. Except this new Oz was real. And nightmarish. And dangerous. With bands of soldiers that were supposed to be armies terrorizing the countryside. In the middle of a war. Melissa Mailey, the high school history teacher, had told them. No way to get back. He looked at the moon again. He knew they were right. The moon was in the wrong part of the sky . . .

The worst thing he heard at the meeting was that driving wouldn't be allowed for personal reasons. Most people had walked home, but there was no way for his wife Millie to make it. Everyone had told them to go ahead and drive home. She couldn't walk the nearly six miles to their house on the other side of town, near where the Ring of Fire came down and sliced the earth like a scalpel. The Ring ran less than a

hundred yards from their home at the north edge of town. What had been the edge of town. They were now driving west on what had been a north south road, back in another time and place.

"Whadaya think there, Millie?" Charming again. Her full name was Militsa, a family name from her Greek and Serbian ancestry. But he called her Millie, as he had done since they met.

"I dunno, John. Garden is pointed the wrong way. It will be on the east now, not the south side. It seems to be about the same time of year, near as they can figure. Growing season should line up pretty well. Least it ain't winter." Millie sighed. "I hope Elaine is okay." She paused for several minutes. "I mean, what if the rest of the world ain't around anymore and we're the only survivors?"

"I don't know Millie, I just dunno . . ." They looked at each other across the dark car. The rest of the ride was silent, except for the noise of the worn Goodyear's on the blacktop.

They arrived home. The porch light was still on, just as they had left it. The house was a one story, framed, two-bedroom home with a living room and an eat-in kitchen. There was a front bay window, and everything was immaculately painted. It was normally quiet there, but the quiet now was eerie. Usually there would be a truck or a car with its tires whining out on Route 250, noises from the town below, and the gentle background hum of civilization. The neighbors at the end of the road were outside the Ring of Fire; the neighbors between their house and Route 250 were away to see their kids in Chicago. John wondered if he should still keep an eye on the neighbor's house. Suppose so. They might come back. Never know.

He opened the door, stood in the doorway, and listened to the house. Quiet. Just the tick tock of the grandfather clock that had been his mother's. The floor creaked, quietly as he entered. The smell of familiar liniments for sore muscles, and the earlier chicken lunch were pleasant, gratifying, comforting. The same as always.

Millie pulled herself up the three steps to the porch using the railing, then stopped to listen to the quiet. Wheezing softly, she stood near him, barely touching. John knew they were both wondering what would come next.

* * *

The next morning John woke early. But Millie was already up and sipping coffee at the kitchen table. It was still dark.

"You're up early," John said. He was standing in the kitchen door archway that led to the living room.

"Been thinking," she replied. "Thinking about a lot of things." John waited. You don't spend 58 years with a person and not learn when to listen.

"I've been thinking about this stuff," she said after a few moments, gesturing to the basket of medications. They kept the amber and white plastic bottles in a small white plastic basket on the kitchen table. She pushed them gently away from her, towards him. The red and white border on the Formica table was worn from years of use at their two places across from each other.

Millie had the most need for ongoing medication. Her stroke of a few years ago, along with her emphysema, had left her dependent on several medications. John was only on blood thinners and some occasional pain medication for his knees and lower back. "There's no chance of us getting back. We don't even know if there's a back to get to," she said. It was not a question. "Did you hear the wolves last

night?" she added after a bit.

"Yes," he replied. He sat down across from her and took her hands in his. He looked at her for an hour while the sun rose. Millie had sharp, intelligent dark eyes that missed little, and white curly hair. They sat there, saying nothing, just looking at each other. They felt each other's presence, companionship and pain. They felt the house around them start to creak as the morning sun began to warm it. The east exposure popped and cracked as it warmed. Birds began to sing, and the flowers along the house began to open to face the sun. They sat for a while longer, holding hands, quiet, simply being together as they had done for so many years.

"What do you want to do?" he asked.

"I don't want to make a fuss," she said. "I've never wanted to make a fuss." She put her head down on the table, sobbing softly. "I don't want to make a fuss . . ." After a while, it was quiet again and she slowly raised her head and looked up. John returned her gaze, and smiled. Charming smile still. Finally she spoke. "Isn't it odd to see the sun come in that window that way, with the shadows going there. At this time of day the cat used to sit on the back of the couch there in the sunshine, almost all year. There's no sunshine there anymore. Everything is the same, but it's not the same. It's unreal on one hand, and on the other it's very real. Like the sunshine on the couch."

"It was the moon for me last night," he said. "The moon was in the wrong spot."

"I don't want to make a fuss," she said. "I've never wanted to make a fuss." There was hint of anger in her voice this time, mixed with frustration. She paused. "The chickens might have a few eggs this morning. Why don't you get some and I'll cook us a nice breakfast of bacon and eggs."

"Okay," said John, as he rose from the table. He straightened slowly and went out the back door, towards the small henhouse. It was adjacent to the garden. The back yard was expansive, running well away from the house. They had bought the house and the four acres of land up here more than thirty years ago, before he retired. Early in his career he had worked in the quarries in the area, as a heavy equipment mechanic. Then he spent forty years as a maintenance specialist in the mill industry, keeping the spinning machinery running. It was those places his hearing had been damaged by the constant noise of the spinning machinery. He'd torn out many machines over the years. Then he'd crated them up to send to India and Pakistan, as well as Mexico. Soon there were no more textile plants, except for a few. The ones that remained were little more than antiques that made specialty products. It was okay. He was ready to retire. He always hated the business anyway. It was hard, always being away from home. Not to mention, he was constantly caught between labor and management in what was normally a hostile environment.

He went to the henhouse and took a look inside. Whatever the Ring of Fire had done, the chickens didn't seem to mind. Plenty of eggs this morning. As he walked back through the garden, he admired his wife's commitment in the planting and maintaining of it. The garden was substantial. The decorative parts of it were more in the lines of a traditional English garden, with flowers and multiple plants and hedges in the front closest to the house. The back section was for cabbage, corn, peas and beans. There was rhubarb for pies in the spring. The whole thing was surrounded by a fence that was designed to keep the whitetail deer from eating everything in sight. He wondered how the deer were going to feel about the wolves.

* * *

The next morning started like any other. Breakfast early, then to the outside chores. Millie went to the

garden, slowly, carefully. John had built her a small battery powered cart to sit on as she weeded and tended. The cart had balloon tires he'd salvaged off of a golf cart somewhere. There was a well used trolling motor and an old car battery, and some bits and pieces for a gear reduction steering. It also had a tiny differential and axle removed from a riding mower somewhere. It drove easily and was comfortable for Millie. There was a little shelf he built on it for small tools. They'd widened the rows of the garden to accommodate it. He smiled as he watched her head into the still small plantings.

John then went to the shed. He liked to call it a workshop, but it was just a small shed that had been built some years ago to hold a Model A Ford. Built by the previous owners, not him. It was small, but the roof was good. The floor was dirt, but packed and laden with seventy years of motor oil. It was nicely painted on the outside, like the rest of the place. There was a small electrical service that he had put in shortly after he retired. Inside, the shed was packed with the accumulation of a handyman who had grown up during the depression. That is to say, he threw away nothing that could remotely have another purpose, no matter how badly broken, worn out, or just plain junk.

There was another pile in the back of the shed, under a small lean-to that held bulk junk. Angle iron, a set of pulleys from an old flat leather belt drive that looked like undersized steel wagon wheels, with a broad flat surface where the rim should be. He was going to put them in the ground, half buried at the end of the drive one day. An industrial bit of humor at the expense of the many half buried wagon wheels. He thought that would be funny. Nobody would get it except him, but that was okay. He chucked silently at the thought.

"I suppose all of my junk is going to come in handy," he muttered. His son-in-law had tried for years to get him to throw some of it away. "Throw it away," Billy had always said. "Heck," thought John, "he was just afraid of having to clean out the shed after we died." Today, John decided he was going to sort out some hardware in one of the jars. Somehow some metric nuts had gotten into the normal threaded stuff. Hated that. He could still tell from looking the difference between a ten-millimeter nut and a 7/16thnut. Hadn't lost that touch. He was just getting to work when he thought he heard a car horn in the driveway.

"Hallo, the house. John, Millie, you there?" John emerged from the shed into the bright sunshine. The air was very crisp and clean. The Grantville city police car had pulled up behind the Buick. When the weather was bad, he would pull the Buick into the barn, but they had left it out last night. The policeman, who looked familiar, was standing behind his open car door, both hands below the window and out of sight, his eyes moving constantly until he spotted John coming around the corner of the shed. As John moved closer, he saw another person, this one a woman, get out of the passenger side of the patrol car. She too looked wary, eyes constantly moving to the tree line that marked the edge of John's property, to the barn, and finally to the shed.

"You remember me John? I'm Officer Onofrio. This is Maureen Grady."

"Hi, John," said Maureen, smiling broadly. She walked around the car and towards him to shake his hand, arm outstretched. She looked about thirty or so, light brown hair pulled back into a ponytail, with a flannel shirt and jeans. She also had a .380 semi-automatic pistol in a holster on one of her slightly wide hips. "I'm Maureen Grady. I think you know my father in law, Dennis Grady, Sr.?" She continued to smile.

John looked slightly suspicious. Maureen Grady had that same tone that his daughter had when she was trying to talk him into moving to Wheeling. Ingratiating, pleasant, and just a little too much smile. He shook her hand. It was small and smooth in his large and rough hand. "You married Dennis' boy? He is Dennis, Jr., if I recall?" She nodded in the affirmative to him, ponytail bobbing slightly, and he continued, "I was working with your father in law when Dennis, Jr. was born, I believe."

"You have an excellent memory, Mr. Trapanese," said Maureen, still smiling. She moved a step back, apparently to take him all in. She crossed her arms and smiled a little broader.

Now John was very suspicious.

"Where is Mrs. Trapanese?" asked Officer Onofrio. His question came out a little strong, edgy even, John noticed. His eyes were still scanning, not stopping, moving from the tree line, to the garden, the corners of the house, and the sides of the barn. He still stood behind his open door, the motor still running. "Is she in the house?" he asked. This time the question was a little softer, friendlier. As if to make up for the abruptness of the first question.

"Nope," answered John. "Garden." He gestured over his shoulder towards the garden. "How is Dan Frost doing?" John had heard the police chief had been wounded on the first day of the Ring of Fire in a skirmish with some German troops. Tilly's men, they were called. They had just destroyed some big town and killed just about everyone in it. They were still out there, roaming the countryside, destroying, burning, killing and stealing all in their path. They said Dan Frost was doing okay at the meeting the other night, but to not ask would be impolite.

"He's doing well," said the policeman. "Thanks for asking, sir."

Millie came rolling out of the garden on her little electric cart. The cart was very low to the ground; John had built it that way. It moved quietly towards the house. At the side of the house there was a short ramp that went up about eighteen inches and leveled out, ending in a handrail. Next to the handrail was a small box with a cord coming out of it. The ramp and the railing were attached to the house. Millie piloted the little cart alongside the house and up the small ramp, her back to the house and her feet progressively getting higher from the ground. When the ramp leveled out, it was exactly the right height for Millie to slide out of the seat and stand up, supporting herself on the railing. Steadying herself for a moment, she reached around and plugged the battery charger into the cart. Then she began to walk towards them, wheezing slightly. The ramp was something John was proud of. It made it easier for her to sit down and get up from the low cart.

"That's very nifty," said Maureen. She sounded like she meant it. "Did you build that?"

"Yes. The ramp and the cart. Cart came first." He smiled. "Not the horse."

Maureen paused a moment, like she wasn't sure what to say. Then it dawned. "Oh, cart before the horse. I get it." She laughed, a real spot of laughter, that was clearly different than her earlier smile. "I didn't quite expect that," she said, still smiling. Officer Onofrio gave a small smile, too; he had heard the joke before. He had been out here on two separate ambulance runs that had taken Millie to the hospital a few miles away.

"May we go inside and talk?" asked Maureen. She gave a quick glance to Onofrio, who nodded slightly in the affirmative. "Do you want to wait out here, Officer?"

"That would be fine, ma'am," replied Onofrio.

* * *

As the three of them eased into the vinyl kitchen chairs with a cup of coffee, Maureen saw the neat kitchen, the white plastic basket on the middle of the table with medications, and the worn table. It

reminded her of her parents, years ago. The details were different, but the feeling was the same, they were living out the last years as best they could. This was going to be hard. "Well," Maureen said, letting her smile return, the one that made both John and Millie look at her with suspicion, "I suppose you're wondering why I'm here?"

"Not really" said Millie, cutting into the flow of where Maureen was going. "You want us to move out of here, don't you? Too dangerous, or too far from town? For our own good?" Millie was smiling, comfortable, and just a bit argumentative.

Maureen stopped for a moment and blinked a bit. She finally sighed, resigned. "You're right, Mrs. Trapanese. We think it's too dangerous."

"Who's we?" John asked, flatly.

"Well, we're organizing as best we can, and trying to think of everything that might happen. You know Dennis, Jr., my husband is a—was a police officer over in Clarksburg?" They nodded. "Well, he's helping out as best he can, and so am I."

"How are you helping?" asked John.

"I've some experience in social work, and I just thought I could help him and the police force out. This is a good way to help. I've some help watching the kids. You wouldn't believe how this has brought the town together. Everyone is looking for something to do to help. Kind like after the tornado a few years back in Clarksburg. Everyone just stepped up, and did a job, no complaining. This is one of those times."

"There's not much we can do," said Millie.

"You can help us by moving into town," replied Maureen.

"Why is that a help?"

"Basically, this is not a defensible position—we can't defend this part of the road easily. You are not safe here. In town you'd be a lot safer, closer to help. And we don't have to spend the effort to keep you safe all the way out here. We're stretched way too thin as it is." She sat back in her chair. "It's not safe out here on your own."

"Have you had any more incidents since Dan Frost was shot on the first day?" John asked.

"No, just some refugees coming in. Mostly on the other side of town, but a few from this way. They say that the main army has been moving off, away from us."

"Well, Miss Grady," John continued, "I don't think we're in any real danger out here. The barn and yard are well lit, and the phone is working again."

Maureen was getting a little impatient. "What are you going to do for supplies? And how are you going to get to town? What about groceries? Have you thought these things through, Mr. Trapanese? Mrs. Trapanese? Our response time out here will be significant. And out here at the edge of the Ring of Fire, you're the most vulnerable to outsiders. Do you understand how serious this is?"

"Of course, I don't understand young lady," Millie harrumphed. "Who can understand this nonsense? The sun is in the wrong spot, the moon is in the wrong spot. How can anyone understand this?"

"Mrs. Trapanese," Maureen began, "may I call you Millie?" Millie gave her a nod and an additional harrumph, just a bit disdainfully. "Thank you, Millie," she continued. "You're right. Nobody really understands what's happening. It may be that in a few weeks it will sink in. Right now we're just dealing with the reality that we have. And that reality is that this is now a much more dangerous place. It may look the same, but it's not the same. And we don't think it ever will be the same." She paused. "I know you don't want to give up your home, but why don't you come into town? It will be better for you in the long run."

John and Millie exchanged glances across the table. Their eyes met for a moment, and then Millie spoke. "I don't give a shit about the long run."

Maureen blinked again. She started to open her mouth to protest and stopped. She looked at the basket on the middle of the table, and back to Millie and John, who returned her gaze.

"I don't," continued Millie after a time. "Please don't take offence, Maureen. It's just that it's a little too much for us old folks to take in."

"But Millie, you shouldn't think like that," said Maureen. Maureen didn't believe her own argument.

"Then how should I think, Maureen? Should I pretend that the Walgreen's is still in Wheeling?" Millie kept her voice measured, calm, and strong and met Maureen's gaze full on. "I've a few weeks supply of medications, and I know what to do to make them last. Been doing that for years. Too expensive otherwise."

John leaned forward, placed his hand on Millie's, and said, "We're not moving into town. It's not safe there, either, so far as I can tell. The difference between here and down there isn't very much. I don't think it really matters all that much where we live." He too looked at Maureen, with kindness, but also with determination. "And if you're wondering, yes, I do have some weapons here. We met in Greece when I was serving with an Army transport unit right after the war. I should be able to defend us against whatever bad guys are lurking in the shadows. Not that I think it's necessary."

* * *

Maureen and Officer Onofrio drove back to the police station in silence. The V8 drone of the cruiser was the only background noise, along with a couple of squelch tails on the two-way. After a couple of miles, Onofrio spoke up. "I don't know if I'd do anything different, Maureen. I mean, that is where they retired to, where they wanted to spend as much time as possible. Can't really disagree a whole lot."

"I know." Maureen sighed. "I'm just worried about them. What are they going to do? It's dangerous out there on the edge. We just don't know what's going to happen."

June, 1631

Heinrich was famished. His vision was foggy. As he came to the ridge, he paused. The land below him seemed different somehow. Where he now stood the land around him was colors of gray, brown and black. Below him, the land—sharply cut as if by a knife—was a brilliant green. The trees, the grass, all looked alive. He looked down at the farmstead below him. It looked prosperous and untouched by battle. Surrounded by green, with a garden. His spirits lifted. Perhaps he could get a meal, for himself and . . . he looked back to the stand of trees near the ridge. They would be safe there. At least for now. He began to pick his way down the ridge. The ground was soft, and fell away easily. Caution, he told

himself. Caution, don't fall and break a leg.

Heinrich was leading the horse. It had no strength to bear any riders; the hipbones were protruding over the loose flesh. The horse couldn't go much further. The young German looked back and gave the lead a tug. "There may be some food down there, my sturdy friend. Lets go and see." So together they walked down the ridge, until it reached level ground. He looked to the farmhouse, and saw the two farmers standing under an extended roof that formed an overhang to the front door.

He paused, trying to regain his bearings. He then trudged to them, head down. He focused on putting one foot in front of the other. It was all he could do. He looked at the man. A big man in front of the farmhouse. The man was peering at him with some sort of a short telescope; he saw the flash of light off of the lens. The man then began to look above him, at the ridgeline. The woman then took the telescope, and handed him what looked like some sort of a small farm tool. From this distance, and his foggy state of mind, that was all of the analysis he could do. He knew he would be at the mercy of the farmers—to a point. All he wanted was food.

"As soon as I tell them that I will not harm them, they will feed me. The others have. At least those that were alive when we found them." He tightened the belt of his long leather coat, and patted his side. His saber was still in place, out of sight, and his small dagger in the sheath in the small of his back.

He continued with his head down, focusing on walking. The ground was very smooth and covered with the green of spring grass. So green. It looked like another land to him. As if spring came here early. He shook his head again. Focus. Focus, he told himself. This is risky. But they always stop being afraid as soon as I make them understand . . .

As he neared the farmhouse, the farmer said something to him. Heinrich blinked, shook his head and tried to listen. What language was it? The man said it again. It sounded strange. Heinrich stopped. He could feel the horse drop its head behind him. It sounded like the man was giving him a command. He raised his head slightly. Heinrich tried to no longer look people in the eyes. He had seen too many eyes, blank, white, staring at the sky. All dead. No more eyes. "Please," he said, quietly and sincerely. "Please, I need food. Can you give me a meal?" The farmer straightened. He was a big man, larger than he had first thought.

The man said something again. He could not understand. Heinrich lifted his head, and looked to his side. The house was strange, unusual. Fog again, and he shook his head. Focus. Try again, polite. "Please, sir. All I ask is a meal and a place to sleep tonight. I have companions and we have come far to escape the fighting. Can you help me?"

The man said something, and shook his head sympathetically. In the negative. He held out his hand and repeated his commands, and continued to shake his head no. The young German clenched his fists, and relaxed them. He took a step to the man, and pleaded again. "Please, we have no food. We have not eaten in many days."

The man was still shaking his head no. When Heinrich took another step, entreating, he saw the man change his grip on what looked like a farm tool. He heard a click from the tool, and the end was pointed towards him. It was a tube, like a small arquebus. He paused. Was this a weapon of some kind? Farmers did not have weapons such as this. It was finely made, wood and dark metal, and worn in spots from years of use. He focused on the weapon—tube?—and instinctively loosed the belt on his coat. It was an automatic motion; he made it when he felt threatened.

The farmer sensed this, and raised the—what was this thing—weapon.*Yes, it is a weapon. The way he*

holds it, and the way that he speaks. He does not fear me. Heinrich's blood ran cold. This was not supposed to be dangerous. "Just a meal. Please." He felt himself swaying, lightheaded. The old farmer held out his hand, palm out and facing him. He said something like sounded like "halt." He said it strongly. Heinrich stopped, and looked into the face of the man. He was unbelievably old, and wrinkled, but he stood like a much younger man. The farmer dropped the weapon away from his face slightly, and he was speaking again. He was entreating to him for something. Most farmers simply pleaded for their lives, thinking that they were going to be killed. This old man was pleading something else. The young German listened closely. The language sounded vaguely familiar yet unintelligible. The farmer was shaking his head again. Firmly. No. But the meaning of the old man's words came to him in a flash of understanding.

This farmer was not pleading for his life as he had seen so many do before. This farmer was pleading that he wouldn't have to kill. He saw the farmer's eyes fully for the first time. His eyes were not dead. This farmers eyes were shining and clear. Remarkably clear. Alive. He tried to not look at eyes any longer. So many dead ones, staring at the sky and empty. Heinrich swayed briefly, and raised his hands away from his leather buff coat, now only loosely tied in the front. He stepped back. "Please. I just want something to eat." He once again timidly looked into the eyes of the farmer. He saw two things. Bright and remarkably clear eyes for one so old. And genuine relief. Relief that he would not have to kill.

The old woman came out of the doorway, took three steps to the post that held up the overhang, and leaned against it. She smiled. She asked him a question. He struggled to place the language. It was so familiar. He saw the old man look at her quietly, and say something. It sounded like a question to her, incredulous. He was questioning her actions. She answered in a cheery voice that caught Heinrich off guard. The old man stepped back, and made an almost comical harrumph. He lowered his weapon slightly.

His foggy attention went to her. He searched for her eyes. They too were alive. Unafraid. They were dark. Darker than he had ever seen. There was wisdom there. He just blinked at her. Those eyes were sizing him up. His character. His soul. He felt ashamed and lowered his eyes to the ground. There had been no challenge from her that required him to back down. There was only a desire to understand him. He was afraid she would.

She addressed him directly, and made a motion to her mouth as if eating. Startled, he looked at them each. She said a word that was familiar.*Eat.* It was an English word. He could feel his face light up. Tears wanted to come over him. He was going to be fed. "Yes, Yes," he said. "Eat, yes, eat."*Thank you, thank you* .

No tears, he told himself sternly. He swallowed back his raw emotion and buried it. Putting it away in a dark corner. He shook the fog away, and smiled "Yes, eat, yes."

There was another exchange between the man and the woman, and the man looked relieved. ." . . almost killed him . . ." sounded a lot like English. English? Here? Thuringa? Heinrich took a step towards the open door. English? He tried to remember a language he had partially used six years ago when he was in England with his father. He didn't study it. He didn't like England, or the people he encountered there. They were not true Catholics, his father always said. Heretics. He tried to stop at that thought. Heretics. He was so sure back then; everything was simple. There was one true faith. And he was a soldier of that faith. He was going to rid the world of the heretics; convince them of the error of their ways; defeat their armies; and bring them to the church for the glory of God and the Emperor. That's what his father had said, what the priests had said, what everyone had said. For the glory of God and the Emperor. He took another step towards the dwelling.

The man raised the weapon again, this time very quickly. It was still pointed at him. The man gave him a

command; holding his hand out again and saying something that sounded once again like "halt." This time the young German stopped immediately, but he was confused. He looked to the farmer for an explanation. The old lady glanced at the farmer quizzically too, he noticed.

Heinrich looked back to the farmer, who made a motion for him to open his coat. He complied, slowly, with his hands up near the collar, so that there would be no mistake. He was almost embarrassed when they saw his cavalry sword hanging from his side. The farmer made a motion for him to put onto the floor. Carefully, he removed it from his scabbard, using only the tips of his fingers, and placed it on the wooden floor. As he stood up, he felt dizzy and off balance, and he grabbed the wooden post that supported the roof to steady himself. He still had his dagger. He had used it before; he could use it again if necessary. Somehow, he didn't think it was necessary.

He paused before entering the home to look at the door. Strange, delicate construction; it would keep nobody out who wanted in. The glass in the door was very clear. Once inside, the room was opulent, with a padded couch and a massive padded chair, rugs on the floor, and mysterious, highly accurate paintings on the wall of people's faces. More paintings of carriages like the large one outside. The detail was amazing. He shook his head; trying to process the things he saw, define them in the range of his experiences. These people must be very rich. The old lady was saying something to him, and clearly wanted him to move forward towards the open archway.

Heinrich approached the archway, but stopped. There was a shelf on the wall. The shelf was covered with small figurines, no bigger than his fist. When he saw them, he stopped and stared. They looked like a representations of small children. Some had puppies and other pets, some were shy, and some seemed playful. But they all had large eyes. Mournfully peering at him. Eyes. Eyes of innocent children. He tried to break his stare off the objects, but he could not. Their eyes held him. He was far away. He heard the old lady speaking, something about "Precious Moments."

She touched him on the arm, and he came back to the present, weak, hungry and confused. He looked down at her. She looked back up to him and smiled. That smile drew him to the next room where the smells hit him like a hammer in the stomach. The smell of the rich food, made his stomach cramp, and he grabbed his sides to quell the pain. He couldn't identify the smell, but it was far too exotic to be simple peasant food. He was desperately hungry. He felt dizzy.

"Please," he said to her. She led him to a padded chair with a very smooth red and white table, and placed a bowl of steaming soup in front of him. She called it "beeeen zoup." He briefly glanced at it, picked up the bowl and drank the broth down. It had small beans in it that barely needed chewing. The lady made an exclamation that sounded like "jeepers," and went to the counter, returning with several pieces of thin sweet bread that was white and soft. It was almost like eating air, it was so light. He sopped up the bowl with one of the pieces.

The old lady went to a large metal cabinet (when she opened it did a light emit from inside? He wasn't sure.) and pulled out an expensive looking glass pitcher, full of crystal clear water. The old lady put the glass of water in front of him. He stopped and looked at the water in the glass. And it was a glass, not a mug. The water was cleaner than he had seen in a long time. Crystal clean. He sniffed it. Only a faint odor. He felt the cold glass in his hands, and drank quickly, so quickly that he got a pain in his head from the cold liquid. He quaffed it all the way down, in spite of the pain. He was full. His stomach had shrunk so much. He shook his head to clear it of the fog of hunger, and sat still, staring out the window in front of the table. He was beginning to register where he was. He willed his stomach to be still. He had eaten much too fast. His breathing was shallow. He sat there, clenching his jaws together, stifling a retch. His head and stomach both subsided, and he began to breathe normally. His hands started to shake. He was so tired. He started to feel sleepy, and suddenly he remembered. The children. In the trees. He sat bolt

upright and looked at his hosts.

The old man had come into the kitchen and he now moved towards him. The old lady sat next to him. She asked him a question, obvious concern on her face. She looked puzzled. The old man came next to him on the other side, now with no weapon at all. It was hanging on the wall outside the kitchen door where he had placed it. He, too, looked concerned.

"Please, the children, they need food, water. Please, can they be fed? We will not harm you. Please, the children."

The old man said something to the old lady. They both turned towards him. He heard some spots of English, and his word for "children" repeated back to him. The old man faced him and was counting on his fingers. The young German held up three fingers. The old man nodded, this time with an emphatic yes. He walked out the door and bid the German to follow. The old man pointed to the stand of trees with a question on his face. Heinrich nodded. The old man nodded, and the old lady nodded from her window in the kitchen. The old man again nodded to him, and he began to call. "Come down, it is all right. There is wonderful food here. Water. Come down, come down." He waved his hands in the air

A first cautious head looked out from the small stand of trees. Then a second, and finally a third one. Heinrich watched as they started to cross the large open area with no cover. Slowly at first, cautiously. Finally they began to run. The littlest one couldn't keep up. The girl was the oldest, maybe ten or eleven. Then the two boys, one seven or eight, another one maybe a year or two younger. The older children waited as the little one caught up.

They came closer. Heinrich looked at them. They were thin, but still able to move across the open area at a trot. They paused part way through, feeling exposed. He called to them again, and they began running again. As they began to draw up to Heinrich and the old man, they slowed to a walk, looking at Heinrich and then at the old man, from one to the other. Looking for assurance from Heinrich. He kept nodding to them. Finally they stopped a few feet from the old man and Heinrich.

"These are good people, they have a wonderful home and food. You do not have to be afraid." They looked at him, and back to the large and fierce looking ancient man.

The old lady yelled at the old man when she saw the children. She said something about "scrubbing in the barn." The old man didn't look around. Perhaps he didn't hear her. Heinrich tapped him on the shoulder, pointing to the window. She repeated her command. This time the old man nodded.

Heinrich saw that the children were not too sure of the situation. He turned to the old man, and quietly tried to get him to reassure the children. He spoke low, and with simple words and hoped the old man would understand his meaning. The old man told him to "speak up, louder" and put his finger to his ear. Then a high-pitched squealing emanated from the old man's head. The children scattered; the two boys disappeared around the shed, and the girl went the other way towards the barn, stopping near the corner. Heinrich took a step back, astounded that a sound like that could come from a man. The old man began cursing and talking about "something not fitting." Then he mumbled to himself. He put his finger to his ear again.

Another squeal, and the girl disappeared behind the barn in a flash of dirty linen. When he straightened up, Heinrich was looking at him a little wide eyed, and the kids were nowhere to be seen. The old man looked surprised. He said much too loudly something about "a hearing aid." Heinrich continued to look at him. "A hearing aid." The old man kept repeating. "It helps me to hear. You know, hear."

Heinrich burped long and loud at him.

* * *

An hour or so later, John sat back and watched as three damp, scrubbed and rosy-cheeked children sat eating at their kitchen table, pushing in food as fast as they were allowed. He had scrubbed them to within an inch of their lives with soap and a stream of very cold water. They were wrapped in towels while the tattered clothes they had were put though the wash. The German also watched them closely, and stopped them when they began to eat too fast. Their empty stomachs had to acclimate to the food.

The young man had placed the horse in the shade of the barn with water and some feed. Things were calming down. Millie was resting on the couch, looking spent. John was in the kitchen with the refugees.

That's what he decided to call them. Refugees. He thought back to when he had been ten or eleven years old, and his mother would give a meal to a traveling man out the back porch when they came asking. They always asked to perform whatever services they could, and she usually had something to do around the farm. Especially after his father had died. They would then move on, and a few days later another would show up. Those were hard times. But people looked out for each other back then; they were all in the same predicament. The men who came to the back porch to look for food could easily be a neighbor or a relation. "There but for the Grace of God, go I," his mother used to tell him. "There but for the Grace of God, go I."

John examined the four, and tried to figure out the relationship between them. The girl and the littlest one looked as if they were brother and sister. Both had stick straight blonde hair and round faces with bright blue eyes. The middle boy didn't look anything like the two of them. He had a darker complexion and was short and big boned. If he had any meat on him, thought John, he could grow up to be a defensive guard for a pro football team.

The senior German who had shepherded them looked altogether different. He was cleaner now, and he looked to be no more than twenty years old. Tall and lanky, with dark hair and dark green eyes, he carried himself with a youthful authority that showed a sense of command. He too, continued to nibble as he watched the children eat. All of the children would look at him, and then at John as if expecting them to suddenly make them stop eating. When he didn't, they would smile and nod, "*Danke, Danke"* they said, with much deference.

John looked at the German who had brought them, then stood up and tapped him on the shoulder. He spun around rather abruptly and faced John. He was nearly as tall as John. They examined each other for a moment. John watched as the German looked at him, knowing he saw wrinkles and clear eyes. John examined the German's prominent nose and thin mouth. He looked even more like a teenager than before.

"I'm John," he said. "John Trapanese. The lady on the couch over there is Millie, and she is my wife. What is your name?" John spoke slowly and loudly, in hopes that his meaning would be clear. He tapped himself on the chest again. "John."

The German straightened up, and made a small bowing motion with his head. "Heinrich. Heinrich V . . ." He hesitated, and then started over. "Heinrich Busse." He glanced back at the children at the table, who were watching him intently. "Heinrich Busse," he said again, while looking at them.

"Pleased to meet you, Heinrich, pleased to meet you. You don't speak any English do you? Spraken ze English?" John's war movie German was coming back to him.

Heinrich eyes narrowed. "English?" He seemed to John to go far away, as if remembering. "I speak, ummm, a small—little" he finally replied.

"Hey, Millie, he speaks English! Come here, woman. He speaks English. Hot damn, this is a lot better." John's questions bubbled to the surface with a rush of words. "Where are you from, who are the kids, are they your bothers and sisters, how long has it been since you ate? How long have you been wandering around? As you can see, we're not from around here originally, we just moved here. Well, we were*moved* here, we didn't have a lot of say in the matter. Have you ever heard of America? That's where we're from. The great state of West Virginia."

Millie had by now gotten up to the archway that divided the kitchen from the living room, and was met by many dazed eyes, including Heinrich's. The eyes went to her, and then back to John, and back to her again

"I think you might want to slow down a little bit there, John. I get the feeling that he doesn't speak English all that good."

Heinrich slowly nodded, and finally blinked. As did the children, who went back to their slowly disappearing meal.

"Sorry," murmured John.

"Heinrich, my name is Millie. Millie Trapanese. Glad to meet you." She extended her hand, and he once again bowed and took it in his. He avoided her eyes by looking down at the ground.

"Umm und umm happy is to meet to you, ya" he replied uncertainly.

The drier buzzed from the utility room. The children looked startled at the electronic buzzer, and looked to Heinrich for direction.

"Did you hear the dryer, John?" Millie asked.

"What?"

"Did you hear the dryer?"

"What about a fire?"

"The dryer," Millie shouted, and pointed down the hall. "The clothes are done."

"Oh, the dryer. Is it done? I'll get the kids clothing out. Heinrich, tell them I'm giving them their clothes back. C'mon there, kinders, let's get you dressed."

John got up, and waved for the kids to follow. He gave them their tattered but now clean and magically warm clothing fresh from the dryer. He smiled as the girl danced with her ragged dress to her face, spinning around and smelling the familiar cloth. Her face was beaming.

They were all clean, and contented for the moment. John watched as the littlest one fell fast asleep on the living room couch. The others curled up next to the first. Then Heinrich looked up.

"Sounds." He motioned toward the outside. "Sounds." John got up to look. A familiar car was approaching the house.

"Hallo, the house. John, Millie, are you all right in there?" It was Officer Onofrio again. "John? Millie? Are you in there?"

"You sit tight there, young man. Folks is mighty nervous around here." His tone was friendly, but firm. He made a stay gesture to Heinrich, like he would to a dog. Heinrich understood. He turned to the children and gave them a short command. They grew silent. The littlest one woke up, groggy with a touch of fear in his eyes.

John turned to the door and called, "Hello yourself. What can I do for you Officer?" He pushed the screen door out and looked at the cruiser in front of the porch. Onofrio was out of the car and had put the car between him and the house. He had the twelve gauge out. Maureen was also out of the car with her sidearm drawn, held in a combat stance, but pointing towards the ground.

"You okay, John?" asked Onofrio.

"Hell, yes. I got me some refugees, I think. Do any of you speak any German?"

"I've been picking up quite a bit," said Maureen. "Lots of refugees, lots of children especially. Lets give it a shot."

"C'mon out here, Heinrich. Some folks I would like you to meet. Heinrich speaks a little English, we've discovered."

They still hadn't completely put their guns away by the time Heinrich came out into the sunshine, squinting into the sun. John watched as Maureen holstered her .380, dusted off her hands on her jeans, and then put on her smile. Onofrio lowered the shotgun, but he didn't put it entirely away. His eyes were scanning the tree line as they began to speak.

"Heinrich," John said, "this is Officer Onofrio and Maureen Grady. They're part of the police force around here."

"Guten Nachmittag," said Heinrich, addressing Maureen first and then turning to Onofrio with a slight bow.*"Guten Nachmittag* ." He turned to Onofrio with a questioning look. Heinrich looked confused, as if he was wondering how they unhitched the horses so fast, and where they put them. John watched as he curled up his nose at the strange smell. He imagined it smelled vaguely like a blacksmiths shop and warm metal to Heinrich. Heinrich looked even more confused when Maureen began speaking.

"Guten Tag. Mein Name Ist Maureen. Was Ist Sie Haben Gerufen Bitte?"

Heinrich stared at her. The woman was addressing him, not the man in the dark clothes. He replied slowly, "I am called, umm, Heinrich."

*"Sie sind Heinrich, ja?"*confirmed Maureen in her newly minted German. Heinrich nodded in reply. At that point the youngest, rubbing the sleep from his eyes, and the one who looked like his sister timidly stuck their heads out the door to see what was up. They were shortly followed by the stocky one, all peering out around Millie and Heinrich.

*"Und wer sind diese Kinder?"*Maureen said with her smile firmly planted. She beamed at the kids.

They shrank away. John chuckled.

Heinrich spoke quietly to the children, and motioned to them that it was safe.

John watched as Maureen leaned forward with her hands on her knees and smiled again.*"Von wo sind Sie?"* The children looked at Heinrich for the answer. He simply nodded. "Magdeburg," they said. Everyone stiffened. There was a dark gap in the conversation, and the sun even seemed to go away for a moment. John looked at the children and the young man, silently. Maureen recovered first.

"Magdeburg?" she said. "Were you there for the battle with Tilley's men?" Tilley's men had sacked the city, and murdered nearly everyone there. Thousands. There were few survivors.*"Sie haben gelebt dort?"*

Heinrich looked at the children gathered around his legs on the porch, and they looked up at him, waiting for the answer. He turned to Maureen, and answered in halting English, "I lived in the town, yes. These children not have mother und pater . . . We go to my family so that we can live. The children are my *Verantwortung,* um, my family." He wasn't sure of the last word, so he had resorted to German. The children continued to look up at him from around his legs, almost expressionless.

"Are they orphans?" asked Maureen.

Heinrich paused. "They are my, how do you say,*Verantwortung,* charges?"

"Are you related to them in some way?"

"*Nein*, not relative. I am*Beschützer zu den Kindern.* I, umm, help . . . protect them."

The children all nodded, a little wide-eyed.

Maureen continued to smile. John figured that she'd heard these stories from so many people in the last month, all of them were cautious in the telling. But her next question surprised him. She looked square at Heinrich. "*Sind sie ein Soldat, Heinrich?"*

John watched as Heinrich turned and looked at the children, and back to Maureen, then to Millie next to him. She too was looking at him with questions in her eyes. John sensed that Onofrio tensed a little, he had noticed the sword on the porch.

"*Nein*, I am not*Soldat* , umm, soldier." He looked at the children again; they looked back.

"That's too bad, Heinrich. We're hiring many soldiers here. We need to defend ourselves, and we're working to do that. Since you speak some English, you'd be very valuable. Are you sure you have no military experience?"

"*Nein.*" He said forcefully. "*Nein*. Not*Soldat* ." The children were still staring at him, not moving a muscle. Maureen looked at him, and then back at the children.

"If you are not a soldier, then you must be willing to work with us. You should report to the refugee center. They will feed you there, and arrange for a place to stay. I assume that you will want to stay here in Grantville. It's safe, at least for right now. We can protect you."

Heinrich turned and spoke to the children.*"Wir werden sicher hier sein. Wir werden bleiben."* The

children all broke into smiles. He turned to Maureen. "Where is refugee center?"

Maureen smiled again. "Just follow this road down to the bottom of the hill, and turn left. You will find a very good road. Follow that down the hill, you will see some men there. They will tell you what to do and where to go."

The expression on Heinrich's face was hard to classify. He seemed happy, relieved and sad all at the same time. As the various emotions flooded across his face, Millie stepped forward.

"Maureen," she said. "If they need somewhere to live, they can live with us. We have room in the shed and the barn, and there's a room here in the house."

John coughed and his finger instinctively went to his hearing aid. "What did you say, Millie?"

"I said they can stay with us if they like. We can use the help." He looked at her, and she returned his gaze with "The Look." "The Look" said*"Just shut up for now, I know what I'm doing, just go along."*

John said the only thing he could say after "The Look" had been put into play. "Yes, dear."

"Well, thank you," said Maureen. "That's very kind of you. Are you sure you can handle this?" John looked a Millie with a questioning look on his face.

"When this young man came to our door this afternoon, John here almost shot him. Just cause he was askin' for food. He speaks English, sorta. He can talk to any others that wander in. You said that most all of them have been pretty harmless since Dan was shot. We could use a boarder to help around the house and farm. "Besides," she added. We're not leaving. Did you come out here to ask us that again?"

"Can we go back inside and talk?" asked Maureen. "Where we can discuss this." There was a awkward pause. The children looked anxious. "Please?" Maureen asked once again, putting her work smile back on. "We've brought you a few things we thought you might need. But we don't know how often we'll be able to come out here like this." Maureen looked straight at Millie.

"Thank you, young lady. But there was no need for you to come out here with anything. We have plenty of canned vegetables. I've a very full root cellar from the last couple of years in the garden. And the rhubarb is almost ready for pies. Flour, sugar too. Plenty to eat. Reminds me of when I was a girl. And now we got some help now, too."

"Can we please come in?" asked Maureen again.

"John, why don't you get them settled in the barn for now?" Millie said. "We'll work out the details later." She gave him a little softer version of "the look."

The children saw "The Look" this time, and they took a collective step back.

John grinned.*Children are perceptive* . This old lady was used to being listened to. He waved a hand and Heinrich and the children followed him to the barn.

* * *

In the kitchen, Maureen and Millie unpacked the things that Maureen had brought with her. Millie noticed that there was some applesauce that had been put up by someone last fall, the Mason jar had the

hand written date on the top. Then Maureen pulled out a white sack with several plastic bottles of medications inside. "Doc Adams said I should give you these."

"I can't afford those," said Millie. "How can I pay for them? I don't want any charity, young lady. I've never taken charity, and I am not going to start now."

"These didn't cost anything, Millie. They were prescribed for someone else, and they weren't inside the ring when it hit. We found them, and Doc Adams thought you should have them." Millie was peering at the bottles. She reached for a pair of glasses on the windowsill above the sink. She wobbled a bit, unsteady on her feet. Maureen came to her side. "Millie," she began, "are you sure that this is what you want to do?"

"Yes. I am sure of it, Maureen. Very sure."

"Millie, three weeks ago I would have called social services to see what they could do for you. Take you in the hospital, or something, but that was before the Ring of Fire. Before we were cut off from civilization. Or we became civilization. That's kind of scary to think about. Our little backwater West Virginia town becomes the core of scientific learning in the world overnight. I overhead some people in a meeting yesterday talk about the number of books we have and what it represents. Everything is priceless. There's only one of everything in this world, and once it's gone, it's gone. Forever."

Millie looked out the window at John, Heinrich and the three children "It has always been that way young lady," said Millie. "You just never realized it before."

July, 1631

After a few weeks, things settled down. John was happy that Heinrich was learning to communicate reasonably well. Men had come to the house one day from the town and they had bought the gasoline and the refrigerant out of the car. They had paid very well for the precious fluids, but John knew what it meant. The end of his mobility.

John had started the car a week ago and taken Heinrich for a short ride around the property. They went down the hill to the point where their gravel road intersected Route 250 at the bottom. From there, all that could be seen was the old West Virginia landscape. Germany was no longer visible. John stopped the car at the bottom of the hill and paused. He turned right to head away from town. Towards the border of the Ring of Fire. It was a very short ride, and after a couple of turns following the creek they came to the wall of dirt that was seventeenth-century Germany. John stopped the car, and turned it off. It was nosed up to the now crumbling dirt. The dirt of another age and time.

"What is wrong, Johan?" asked Heinrich. "Are you, um, okay?"

John was staring straight ahead. In his minds eye, he could see every turn and tar strip in the road as it wound its way towards Wheeling. He could see the long downhill section, the chemical plants that had been there since before he was born, and the stoplight by his daughter's house. It was so close, yet so far away. He slowly got out of the car and shuffled to the embankment, staring straight ahead, his old eyes boring through the dirt, trying to move it away with his force of his will. In his imagination, it parted, and he drove the road briskly, smoothly. Not so fast as to alarm Millie, but fast enough that he was tested ever so slightly. This late June day, he would have had the windows down, as he cruised through the West Virginia Mountains.

"Is dirt wall," said Heinrich, who was now beside him. Heinrich looked at the old man, and sensed the

pain that was in him. He remained quiet.

After a moments pause, John said, "Ya know what, Heinrich?"

"What, Johan?"

"This stinks. This really stinks to high heaven." He paused. "It stinks." His voice trailed off.

"It smells like good earth to me, Johan.*Gute Erde"*

John turned and looked at Heinrich. His deeply wrinkled face, which was a moment ago a weathered picture of despair, was now looking at Heinrich with shining eyes and a smile. "Yup, Heinrich. Good earth,*Gute Erde.* " He turned back to the dirt wall and sighed. He stared at it for another few minutes, then finally turned and got back in the car. Heinrich followed.

August, 1631

John traded some old scrap, angle iron and a chunk of aluminum for a few good car batteries and set to work. He disappeared into the shed for a few days, and wouldn't tell Millie what he was up to. A week later, he pushed a new electric cart out of the shop. He had used the garden cart as a template, and built one with two seats and a small windshield made out of clear plastic. The tires were the hard part, but he had a pair of ten inch boat trailer wheels and tires stashed away that worked very well for the front, and a pair of wheelbarrow pneumatic tires for the rear. Speed control and gearing was going to be tricky, so he approached it mechanically with a v-belt drive. An old knife switch served as the on-off switch. The cabling was welding cable that had been at the bottom of a pile, and the motor was off a larger trolling motor for which he had traded three boxes of nails. It looked like a cross between a horse cart and a naked golf cart. He ran it around the lawn once or twice. It was a rough ride over the gravel, but once they were on the main road it would be fine. They had their mobility back.

Heinrich smiled as he watched John run it around the front of the house. John dropped it down to low gear and the cart came to a crawl, but it was a speed that would allow them to inch up the steeper transplanted West Virginia hills.

"How do you stop it?" Heinrich yelled across the front lawn.

"I'll show ya," replied John. He increased speed and started heading for Heinrich. As he approached Heinrich, who looked as if he were deciding which way to run to avoid getting flattened, John reached down and pulled a long lever on his left. As he pulled back, the cart slowed quickly, and came to a gentle halt a few feet in front of Heinrich. "Ever been to San Francisco, Heinrich?"

"It's a Spain saint, no?" Heinrich wasn't certain if he was being asked seriously or as a joke. Frustrating language, English.

"Nope, a whole city. And in that city they had a public transportation system sort of like wagons, which were pulled along by cables just under the street. I used the same kind of brakes they did. A block of wood! Ha!" John laughed triumphantly. The wood block was levered against the axle. The harder he pulled on the lever, the more pressure he put on the wood, slowing the cart.

"Ist like wagon," Heinrich said, "but we put it on wheel." He was speaking very loudly, as the hearing aid batteries had run out.

"Same idea, son, same idea," replied John. Turning to the house, he yelled. "Hey, Millie. Come out here, I want to show you what I been working on. Millie. C'mon out here, woman. We're going to town!"

A few days later, John proudly drove them into town. John and Millie were astounded at the change since the Ring of Fire. The town was absolutely buzzing with activity and energy. And people. People everywhere. Storefronts long since shuttered, were open and businesses were beginning to occupy them. There were people in the streets. And children. More than they had ever seen before. The energy was contagious. John felt his sprit soar with the life around him. This town was alive once again.

They stopped at Doc Adams place, and he welcomed them into his office. He was able to give Millie some suggestions on herbs to use when the medicines ran out. He told them it would help, but not at the same levels as before.

John had stopped by one of the machine shops in town, to see if he could swap out some more of his scrap, including the old "wagon wheel" pulleys. He did pretty well, as he had another large chunk of aluminum.

August, 1631

The days passed by, and summer came to the hilltop. The town had planted the remaining flat areas, and there had been some interchange of seeds from Millie's stock. The garden flourished, as did the surrounding crops. John sold a lot of his scrap metal, old bearings and parts of machinery for income. Millie managed her meds as best she could and took aspirin for a blood thinner. Her weight dropped off, and her already dark skin grew darker with the summer sun. It was a curious sun, bright but without a lot of warmth. She was used to the heat of West Virginia, and her native Greece. This sun was just not as warming as she remembered it.

Heinrich and the children had become part of the flow of the summer, and they all were living in the house. Soon the children were to start school, and they were excited. They picked up some English and Millie and John picked up some German.

They had a pleasant dinner of the last of the ground beef. Heinrich was astounded at the chest freezer in the back of the barn. It stayed a freezing temperature all year round it the large white box. Food could be kept there indefinitely it seemed, but it required the mysterious "electricity" to make it work. As near as Heinrich could tell, electricity was some sort of ether that was transferred through wires and suspended on poles. All very mysterious and metaphysical.

The town had helped the Trapaneses bring in the harvest, including their own garden. They spent hours putting up the vegetables in what mason jars and good lids they had available, and carefully storing the rest in the basement of the house. It would be cool and dry down there all winter long, a perfect root cellar. It had been after all, what it was designed for when the house was first built in the 1920's.

For John and Millie, their main concern was the winter. They had both spoken of it during the long quiet summer evenings, sitting on their porch. They knew that they could heat the house with the natural gas that was already provided to them from a nearby well. They wouldn't have to cut massive amounts of wood to heat the place.

Heinrich and John had shot and dressed several whitetail deer, along with two boars that had been foraging near the house one night. The boars made that mistake as John and Heinrich were on the front

porch, watching the evening sky darken. The first time Heinrich had seen the shotgun fire was at one of the boars. He didn't like guns, he said. He had told John that they were cumbersome and slow. But this one was able to fire as soon as it came to bear on the animal. It dropped in its tracks. The second boar turned to charge at the porch, and Heinrich began to pull his blade from the scabbard. He stood between the old man and the charging animal. Behind him, he heard a metallic cycling sound and to his utter astonishment, the weapon fired again. The second boar dropped before it could make the first step of the porch. Heinrich turned to face John, and watched him smile as he cycled the mechanism through again, ejecting the spent shell to the floor of the porch to meet the first one.

"This thing will hold five, but I still haven't taken the old plug out that the fish and game people make you keep in them. I may need more than three shots in the future" said John, still smiling.

"F-F-Five?" gasped Heinrich, his ears ringing.

"Yup." John smiled with a face that was a crinkly bundle of mischievous lines. "Five."

Heinrich looked at the saber in his hand. He then looked back to John, and to the old shotgun in his hands. And then back to the saber. He sighed. "I have always preferred my saber to firearms. They always work, and are always at the ready. No matches or cumbersome locks." He held up the blade in the light of the mercury vapor barnyard lamp. "I am going to have to rethink the time that I have spent learning to be proficient with a blade."

November, 1631

The winter was a cold one. Cold to the bones. Especially, Millie thought, old bones from the south. The home was sheltered from the wind by the barn, tree line and the ridge, but it didn't stop the cold. The dryness was something that they were not used to. In the cold weather, the humidity was low, and that in turn made any moisture on the skin evaporate even faster. It made the cold colder. John compensated for it by putting a pot on the stove to simmer as much as possible. The temperature even dipped to zero and below for a time, and the incoming water pipe froze. After that, he kept it running with a small drip to keep it from freezing.

Heinrich found a job to help support the family, working in town. Briefly he worked for a man making something called microwave ovens, which didn't work out. But John had helped Heinrich find a job at a machine shop in town. He seemed to enjoy the work, and Millie was glad that it gave Heinrich and John something more in common. She watched as Heinrich learned of the many technologies and wonders the town of Grantville had. Curiously, she noticed, he avoided all churches.

The television had returned via a local cable channel brought back to life by students at the high school studio, and the old movies were fun. They passed the time watching the old films, playing records and cassettes, and just sitting, looking out the front window.

It was the night that they watched a film about the Alamo, and the brave stand of Americans against a massive army that seemed to be Spanish. John explained that it was Mexico, a land in North America. The heroes were brave, but they eventually were overwhelmed.

There was a deep quiet snow that night. As John slept that night, the quiet was broken by the noises of a child's nightmares. It woke Millie.

After tending to the child, Millie went into the kitchen for some water. Heinrich sat at the table in the darkness. She looked at him for a moment, and made a decision. She sat across from him. He avoided her eyes.

"You were a soldier, weren't you Heinrich?" It wasn't really a question.

He didn't speak for a long while. Millie waited. She was patient. He finally answered. "Yes, Millie, I was a soldier. Do you wonder why I disappear every time Father Mazzare comes to visit?"

"I think I might know why," she said quietly.

He looked at her and shook his head. "*Nein*. Not possible." He paused again. "My real name is Heinrich von Fremd. My father is of the nobility in Ferdinand's court. I was brought up as a Catholic, a follower of the true faith. My father raised me, along with my older brothers. I was the youngest son of four. My mother died in giving birth to me. I was going to go into the priesthood one day, and my studies were directed that way. Then the war. It was such a simple and noble thing. Defeat the armies of the heretics and save the souls of the people. It was so simple. There is one true faith," he said mockingly. "And I was a soldier of that faith." He snorted before continuing. "We were going to rid the world of the heretics, convince them of the error of their ways, defeat their armies, and bring them to the church for the glory of God and the Emperor. That is what my father had said, what the priests had said, what everyone had said. For the glory of God and the Emperor." He stopped and considered before continuing.

"You are Catholic. I've seen the crucifix and the bibles. I've seen the Father Mazzare come to visit and bring you comfort. But you tolerate the . . . others . . . the Protestants."

"It's our way," she said quietly. "We're sometimes taught tolerance. It doesn't always work, but we try. The church of my time is not the church of this time."

"To tolerate is not how I was taught." He turned to her. "I was with the army for only a short time. Because of my standing, I was made an officer, an aide to a general.

"The only things that mattered were killing, and keeping fed. It was like being a part of a horde of locusts, swept along and devouring everything in your path. That is how I saw myself. A giant locust. An insect. And I was one of them, swept along. So many bodies, so many burning homes, cottages. Why? Why do we do this? Why did I do this? Oh yes, I did these things. I had no idea that there could be that much evil in men. I was able to keep some control of myself, and some of the men, but after Magdeburg, after that, I was lost."

"What happened there?" she asked after a pause.

"They opened the gates for us. I had heard that they had paid a ransom. It was a Protestant town, and punishing them by taking their money to fund our army had a justice to it that was correct to me. Until the fires started. I do not know who, or when they started, but . . . I was assigned to a general under Tilly. The old man had tried to stop them, but they were out of control. They were killing, and raping, and burning and . . . and . . .*Mein Gott* . . . " He choked down a small sob as he lowered his head back again to the table. Millie reached out to brush his hair back. It reminded her of the same motion she used when her daughter was little and crying from some slight.

"I saw the parents of those children killed in front of their eyes. I saw the entrails of their parents smeared across the ground. They were wet with blood, and the burning buildings were reflected in the dirty gore. The middle one had a sister, maybe fifteen years old. She, I couldn't save."

Heinrich sat up, pleading. "I tried to stop it, I tried.*Lieber Gott in Himmel, der er weiß, dass ich versucht habe* ." He gasped for air and began sobbing. "I killed. I killed those men, and tried to kill more. I killed a captain . . . what kind of a God does these things, Millie? What kind of a God allows such pain and agony in his name?" He sank down again.

"You have the children," said Millie. "You have lead them to safety. And you have helped us." The winter silence was long, and his quiet weeping slowed to a stop. Finally, she spoke. "I lived through a world war. It was devastating. Millions died in death camps, in combat, and of disease. You know Hamburg?" He nodded. "In Hamburg our aircraft killed forty thousand people in one night. The Germans did much the same and worse to the other side."

Heinrich was now looking at her. "God love him, I met John in that war, and I still have him. You are one man, Heinrich, one man who did what he could. This war has made you. Just like mine made me. For what it's worth, I think you are on the right track. Those kids need someone. They see you as a father."

She stood up slowly. "Thanks for coming onto my front porch, Heinrich von Fremd. I'm glad my goof ball husband didn't shoot you. Find what faith you have, young man. It's in there, hiding. Search for it. I know it's there. Mine was buried a long time ago, when I was very young, just a girl. It was the war. John rescued me. He is very gentle for all of his bluster and calluses. He found me and rescued me.

"Did you ever wonder why I asked you to stay with us that day when we first met?" she asked.

"You said you needed help with the farm?" He said very tentatively.

"No," said Millie. "It's something I saw in you. It reminded me of myself, many years ago. Until a dashing young American entered my life, I was you."

January, 1632

The heavy snow made some visits to town impossible. When it was cold the battery life was very low in the "town cart" as they named it. John had taken the West Virginia plate off the Buick and put it in the back of the cart in a moment of whimsy. Millie had been too weak to go out in the cart to town in January, so she stayed home.

The food was monotonous, but healthy enough. The diet helped Millie, but she continued to lose weight throughout the season. She grew weaker. By the time spring came, the medications were just about all gone, including some of the improvised herbs and medicines that Doc Adams had prepared for her. They were down to cutting pills into quarters.

April, 1632

As the days lengthened and the sun began to warm the earth, Millie felt better. The garden called to her from inside the house. It was a strong call for her, and one that kept her focused on spring. She wanted to plant. As soon as she was able, the garden would be revived. She would be revived with it.

She did as much of it as she could. John helped. But Heinrich and the children were the most help. Whenever Heinrich was not working, he was with Millie. Their late December night had created a special bond, and he took it upon himself to be her arms and legs, digging in the dirt as he had never done before. Millie could tell that he felt it satisfying, comforting to be in the garden. Millie sat next to him guiding his tasks. The initial plantings went well, and things were beginning to take shape. The spring and summer routine began to take over. Mornings in the garden, afternoon resting, enjoying the sun and the quiet.

June, 1632

John watched Millie closely as the summer began. He made a point of pulling Heinrich to the side to ask him something, away from Millie. They both disappeared into the back garden for the afternoon while Millie rested.

The next day, Millie went back to the garden in the morning, and saw what they had done. It was a beautiful spot, back near the fence, under the shade of an old tree. She immediately began to transplant some flowers, and arrange some plants in a new configuration that she knew would be pleasing, in time. That task, for which she refused all help, drained her. There was a week where she couldn't get out into the garden, she was too worn out.

The following week, however she rose, feeling some strength return. "I want to work in the garden," she declared. "It's a nice day by the looks of it so far." In the days before they would listen to the radio station and get the weather to plan their days. The small Japanese AM radio still sat at the end of the kitchen table, quiet. Next to it was the white basket. A nearly empty white basket. "Don't know how long I'll be able to do that."

"Do you need help with the cart?" John asked.

"No, I think I can make it to the side of the house." She smiled at him.

John nodded in the affirmative. They looked at each other across the table for a bit, and when the time seemed right, they both got up. The morning was glorious, birds were chirping, some of them she'd never heard before. There were sounds of the children running and screaming at each other from down the road. Bees had found the flowers in the front, she was glad of that. Sunny, beautiful. The smells of the damp earth and plants reminded her of her days on the family farm, and her mother, father, slew of brothers. They were all gone now, some to war, some to disease, some to accidents. It was a nice morning.

That day was the last for Millie in her garden. When she parked the cart on its little ramp at midday, she couldn't get up. They went back to full pills, and ran out of nearly all of them in a couple of days. Millie lapsed into a coma and died three days later. Quietly and peacefully in her own bed. John made her as comfortable as possible, and when the end came John held her hand, and it was calm and painless. She looked at peace, sharp shining dark eyes finally closed.

He cared for her as he remembered his mother caring for his father when he passed. It was when he was fourteen or fifteen, and his mother had cleared off the dining room table to wash his fathers' body. He had lost a lot of weight before he died, and John never forgot the emaciated body, pale and naked on the dining room table, his mother carefully washing it, and then wrapping it in a shroud. He did the same for Millie.

He had finished the pine coffin a day earlier. He had been working on it for a week prior. Heinrich,

Maureen, the children and Father Mazzare helped to carry her out to the garden in the pine box. She'd planted the flowers around the grave, and had arranged the plants in a small circular pattern, with the grave in the middle. She'd even made some jokes about planting her own flowers over her grave. They had both laughed at the time. The flowers she'd planted were colorful and blooming. The spring was ending and summer arrived to this part of the world, in this strange time.

Summer still arrived.

Not At All The Type

By Virginia DeMarce

Summer 1634, Grantville, State of Thuringia-Franconia

"That was the year I broke my nose at the demolition derby."

Tina Marie Hollister pointed to the knot. She'd never bothered to have it repaired. Never had the money, to tell the truth. Probably wouldn't have bothered even if she'd been rich.

Kitty Chaffin looked across the desk. The personnel office of the State of Thuringia-Franconia would be hard up without Tina Marie. Her oldest son, Ray Lafferty, had married a German girl, Christina Zuehlke, up at Wismar last year. It had turned out that Christina had two unemployed older brothers with Latin school educations who would be willing to work for SoTF personnel in recruiting down-timers. Brothers from up north on the Baltic coast. Brothers who didn't have cousins, godsons, sons of godfathers, or in-laws of cousins all over central Thuringia. All of whom needed government jobs. Or wanted them, at least. If Kitty could have hired subordinates from Madagascar, she would have considered it a good deal.

Even so, sometimes the sheer raucousness of the other woman got on Kitty's nerves. Not that she was that much older than Tina Marie. Maybe twelve years. No more than fifteen. Tina Marie would be fiftyish to Kitty's sixtyish. Maybe not quite fifty. She could look it up in the files here in the office if it was ever important.

Right now, the younger of the two Zuehlke men was looking at Tina Marie a little dubiously. They hadn't objected when Christina had married Ray Lafferty. At that point, up in Pomerania and Mecklenburg, the devastation had been so bad that they'd been happy enough that their sister had just found a husband who could afford to house and feed her.

Of course, that was in Wismar. Before they met Ray's mother.

But now, with regular jobs, their middle-classness was coming through. Kitty thought that it was hard to get much middle-classier than Johann Friedrich and Dietrich Zuehlke.

It was hard to get less middle-class than Tina Marie. She hadn't explained just what a demolition derby was, but Dietrich Zuehlke clearly realized that it wasn't a sedate music recital. He suspected that it was closer to a bear-baiting.

* * *

"It is not easy, Pastor Kastenmayer." Dietrich Zuehlke sat uneasily in the minister's study in the rectory of St. Martin in the Fields Lutheran church.

The church itself sat, almost as uneasily, just outside the borders of the Ring of Fire. While wanting to provide religious services to the many refugees of his own faith, Count Ludwig Guenther of Schwarzburg-Rudolstadt had concluded that they were capable of walking far enough to attend sermons delivered on land that was clearly still his own.

"All of us are living in her house," Zuehlke continued. "*Frau*Hollister's house. Given the situation with space and rents in Grantville, this is unavoidable."

"All?" Kastenmayer had seen Zuehlke with a group of other people at services, but there hadn't seemed to be so many of them.

"The house has three sleeping rooms. If, as*Frau* Hollister points out, you count the one that she made out of a side porch when her sons got to be noisy, rambunctious, teenagers."

"How many people?"

"*Frau*Hollister and her youngest daughter Carly Baumgardner in one room. Her daughter April Lafferty and my half-sister, Anna Sartorius, in the other. And on the 'porch' there are three sets of beds. My brother and I have one set. Frau Hollister's younger sons Vance Lafferty and Garrett Baumgardner have the second. The third—that depends on who is in town. Sometimes her son Ronnie Baumgardner. Sometimes my half-brother, Jacob Sartorius, when he is not in classes at the university in Jena. Sometimes my stepfather, Lucas Sartorius, since he is in Erfurt on business and comes down to visit us. The only family members who do not live there are Frau Hollister's oldest son Ray Lafferty who married my sister. Her name is Christina. They are up north still, in Wismar."

Pastor Kastenmayer thought. "These 'bunks' are two-level beds, set upon posts?"

Zuehlke nodded. "Frau Hollister sold off her up-time beds with box springs and mattresses, replacing them with down-time made bunks with rope slats and horsehair mattresses. She says that she gained, thereby, spare funds to pay for April's apprenticeship. That is another issue, apprenticing a girl to an artisan's craft. Plus, she has a couple of canvas cots that can be set up if they are needed."

"Where?"

"There is space for them in the two rooms used by the women. The rest of the house isn't all that big, either. A living room, an eat-in kitchen, and a bathroom. Which is a luxury, certainly. As is the natural gas heating system. Anna says that if we return to Wismar after this summer's campaign is over, presuming that the Swedes win the war, of course, she will greatly miss the natural gas 'range' in the kitchen."

Kastenmayer smiled. "And the refrigerator?"

"Refrigeration isn't a big worry up on the Baltic and North Sea coasts." Zuehlke's expression was quite serious.

Dietrich Zuehlke was always quite serious. At the age of thirty, he was a responsible sort of person. Responsible in a way for his older brother Johann Friedrich, who tended to lapse into frivolity and

facetiousness if someone didn't keep an eye on him. Responsible for his younger half-sister and half-brother.

Jacob, who was just eighteen, was at the university in Jena most of the time, so that was a minor problem. But, Dietrich explained, he worried about the influence of*Frau* Hollister on his sister Anna, who was just twenty-three. Even more, he worried about the influence of nineteen-year-old April, now Christina's sister-in-law, on Anna.

Above all, he felt responsible because, under his influence and because of his urging, his stepfather, Lucas Sartorius, had come to Grantville for several visits.

"It is my fault," Dietrich said. "I practically dragged him down to Grantville so that he could see where his stepsons were working now. To show him that, given a reasonably stable interval in this eternal war, we are not wasting the money he spent on our education."

To Grantville, where he had fallen under the spell of this Jezebel.

*Frau*Hollister, in whose house Dietrich was necessarily living.

Erfurt, Summer 1634

"When can we expect the shipment to arrive?" Dennis Stull, Grantville's civilian head of procurement at the USE's main supply depot for Thuringia and the rest of the central Germanies, had been impatient for two weeks. He hated evasions. He expected a lot of them this morning.

"Never." The tall man seated opposite him—Lucas Sartorius was his name—reached across the desk and handed Stull a letter. "This came in yesterday evening from our firm's factor in Luebeck."

"Never?"

"At the direct orders of Emperor Gustavus Adolphus, all of the grain shipments we are managing to bring out of the Baltic are being diverted to supplying the armies in the north."

"Just how does he propose to feed the armies in the south? At Ingolstadt? In Swabia?"

Sartorius leaned back. "May I suggest that the king, ah, the emperor, is in the north himself and sees the need there directly."

"Is this some version of 'out of sight, out of mind'?"

"A universal proverb, more or less. In the same category as, 'there's no use in crying over spilt milk.'"

"I don't intend to have Baner foraging in Franconia. We have enough problems going in Franconia with the Ram Rebellion. And while I have no doubts at all that Horn has been foraging through Swabia just as ruthlessly as Bernhard of Saxe-Weimar has been foraging through Swabia, I'd really like to try to keep it within reasonable limits."

"So that, if he prevails, there will be something left in the region for you to govern?"

"Or for Gustavus Adolphus's allies to govern. Parts of the region, such as Wuerttemberg, are Lutheran."

Sartorius turned from political speculation to business. "You do realize that no firm has a great deal to offer right now. This year's crop of Polish grain is still in the field. It will be months before it can be harvested and transported to the Baltic ports. During my career, I have traveled as far as Koenigsburg regularly. Sometimes farther, up to Finland. Arranging exports and imports, contracts and sales. Every year, my main stop was Gdansk. Danzig, the Germans call it. I am not giving you an excuse. It is a fact. The only thing any factor can hope to find for the rest of this summer is grain that someone has, as you say, 'stashed' because he was hoping for a higher price. 'Hoarding' is what we call it."

"Well, then." Dennis steepled his fingers together, his elbows on the desk. "Found any good hoards lately?"

Grantville, Summer 1634

". . . absolutely outrageous," Dietrich Zuehlke finished.

Lucas Sartorius looked at him rather mildly. "Tina Marie and I merely went out for a pleasant evening at the Thuringian Gardens. Had a few beers with friends."

"And finished it off in her bed."

"It's not a bad bed," Sartorius said judiciously. "A little narrow and involving some hazards with the upper bunk. Overall, though, quite comfortable, and the absence of bedbugs is particularly delightful. I plan to take several containers of this DDT with me when I return north."

"You should be thoroughly ashamed of yourself. My mother. . . ."

"I was faithful to your mother," Sartorius said.*Well, reasonably. She never knew anything to the contrary. Finland was a long way from Wismar, after all.* "But she has been dead for two years."

"The horrible example she is setting for Anna and April and Carly. . . ."

"None of whom were home. April and Anna were still at the Thuringian Gardens, with their own friends, when Tina Marie and I decided to leave. There is no reason for either of them to come into Tina Marie's bedroom in the middle of the night. Carly was having a 'sleepover,' which should—*should*—have guaranteed us a quite adequate level of privacy. If you had not chosen to follow us home."

* * *

"I am not here voluntarily."

Ludwig Kastenmayer looked at Lucas Sartorius. He'd seen a lot of men like this during his pastoral career. Not bad men, in the sense of being evil. But not precisely well-behaved, either. Men whose commitment to the Ten Commandments left something to be desired and who, although they appeared

for church on Sunday, tended to leave for the tavern before the sermon started. "I guessed as much."

"I'm not, either." That was the older stepson.

"You do realize, Hans-Fritz," Sartorius said, "that you may be excused."

"No you may not." Dietrich glared at his brother.

Jonas Justus Muselius would probably have smiled if he hadn't been more concerned about certain looming communications problems.

Sartorius, who had apparently decided to be difficult just for the sake of being difficult, or possibly mischievous just for the sake of being mischievous, was speaking Low German—the*Plattdeutsch* of the northern flatlands and coastal regions.

Neither Jonas nor Pastor Kastenmayer spoke the*Platt* . They spoke the*Hochdeutsch* of the Saxon uplands and the southern mountains.

This wasn't a matter of the dozens of variant dialects of the central Germanies. These were, really, two different languages.

Jonas felt certain that Sartorius could speak High German just as well as his stepsons could. After all, he was doing business in Erfurt. The man was just being contrary. Still . . . He got up and wandered over to Kastenmayer's book case.

"What are you looking for, Jonas?"

"The Bugenhagen translation of the Bible." Jonas pulled a volume out of the cabinet, tucking it under the elbow of his bad arm. "If Herr Sartorius prefers to speak*Platt* , perhaps we can deal with unfamiliar words by comparing passages in Luther's translation to the same verses as rendered by the good*Doktor Pommer* for our northern colleagues."

Kastenmayer nodded, his eyes glinting with amusement. He looked at Sartorius again. "Since the topic of this meeting is your association with*Frau* Hollister, who certainly does not speak*Platt* , how do you, ah, communicate with her?"

Sartorius twitched his nose. "Verbally?"

"Yes." Kastenmayer's tone was firm. "In which language?"

"English. Or High German. Or a mixture of both. Usually a mixture of both."

"Great," Jonas said. "I'll call Gary Lambert."

* * *

"If I'm going to be hauled up before the Inquisition, Kitty, I want you to come along."

Kitty fiddled with the paper clip container on her desk. "They're Lutherans. I'm pretty sure that Lutherans don't have an Inquisition."

"They have something called a marriage court. An*Ehegericht* ."

"How are you getting involved in a marriage court?"

"If. Just if, mind you, Lucas Sartorius thought he might possibly want to marry again . . ."

"You have to be a witness to his good behavior or something?"

"They're sort of wondering if I'd make a suitable bride for a respectable businessman."

* * *

"You understand," Sartorius said to Tina Marie. "I didn't want anyone saying that I hadn't done right by my wife's sons from her first marriage. So I sent them to Latin School and in a lot of ways I don't regret it. They are*Beamter* now, with government jobs. Working in the office with you and*Frau* Chaffin. It's a lot less risky than being in business for yourself. They probably won't get rich, but they probably won't go bankrupt, either. Or be jailed by an angry Swedish commissary here because the king of Sweden's aides up north diverted a grain shipment from Erfurt to Oldenburg. In other ways, though . . ." His voice trailed off.

She made a small, encouraging noise, designed to keep him talking. Overall, she found it easier listening to German rather than thinking up sentences to say in it.

"It's all those pastors and would-be pastors they have teaching in secondary schools," he said. "That's the problem. The boys turned into prudes. Especially Dietrich." He patted her shoulder. "No need to worry that Christina will be like that when you come up north to Ray's and meet her. She didn't go to Latin school. She's a jolly girl and likes a dirty joke as well as the next person."

"That's good," Tina Marie said into her beer. "*Sehr gut*."

Actually, it was very good. It certainly changed the slant she'd been getting on her daughter-in-law from the Zuehlke boys.

"She's likely to want to stay in Wismar. Not come here to Grantville to live. Christina is very attached to Wismar. She won't leave it unless she is forced to. I made her go away in order to complete her education. After she finished the municipal school for girls, I sent her to my sister in Koenigsberg when she was fourteen. My brother-in-law was a grain factor, too, with headquarters there. She stayed for four years and then another two years in the household of a friend, a factor in Danzig, before she came back to Wismar to nurse her mother in her last illness. Didn't like being away."

"She probably wouldn't have liked staying home, either. After all, she was a teenager. Think of how April and Carly gripe at me."

"Entirely possible. In any case, she's a good bookkeeper and well-trained to be the wife of a merchant. I'm glad that Ray is a brick mason when he is not serving in the military. There's no stone up on the coast, but a big market for brick. I've made it my business to investigate the new brick making techniques being used here in Thuringia. Once this year's campaign is over, perhaps your army will discharge him. There's a fortune to be made in brick, all the rebuilding that will have to be done."

Tina Marie nodded and finished her beer.

"Would you like another? Or would you rather . . .?"

She grinned at him. "Get lucky? I'd rather. Let's go?"

* * *

"The year I met John Lafferty and married him was one of the best years of my life." Tina Marie looked at Pastor Kastenmayer and stretched her arms over her head, pulling the tight tank top so high that it showed a couple of inches of belly. "I was what he liked, back then. I'm from Texas, originally. I'd finished high school in Brownsville—well, I'd just barely scraped through—and come to San Antonio looking for a job. Got on a commercial landscaping crew—office complexes, malls, things like that. John was the foreman. I was nineteen. Skinny as a rail. Thin face, narrow shoulders, narrow rib cage, flat as a pancake in front, not much hips and what I did have low, widest at the thighs. Every girl John ever dated looked like that. He just went for the type."

"So I got pregnant with Ray, and pretty soon I didn't look like that no more. Instead, think of a pear on stilts. Then I had him—Ray was born, I mean. That was down in San Antonio. The doctor said I ought to breast feed him, which made me soft and squishy on top as well as soft and squishy in the belly from being pregnant. Which sure didn't impress John. So he brought me here to Grantville, dumped me off to keep house for his dad. Dave Lafferty, that was. Vance's middle name is after him. Dave was crippled up with emphysema. He and Linda Lou, John's mom, had been divorced since 1953 and she stayed out in California. John just dropped me here and went to Toledo. Got a job in Toledo and didn't show his face again for five years."

Kitty took a deep breath, thinking of Tina Marie when she came to Grantville. Thin, scrawny, tanned, rough-spoken, and boyish. About as far from soft and squishy as a woman could get. Even when she'd been pregnant with her sixth kid, Tina Marie had looked like a goal post with the football fastened onto its middle with duct tape.

Pastor Kastenmayer gave Tina Marie one of those "keep going" nods.

"I honestly didn't mind keeping house for Dave. He wasn't that bad. But it wasn't a barrel of laughs, either, and John didn't send money all that regularly, so I figured that I'd better get a job. Got on the loading crew at the discount appliance warehouse in Fairmont. That's where I ran into Zane Baumgardner—at a country-western bar over in Fairmont. He was from Grantville, but our paths hadn't ever crossed here."

She smiled. "Okay, Zane was quite a guy back then. I went out with him a couple of times. Over to the 250 Club, mostly. He was like that song that Faron Young used to sing on the jukebox. 'I want to live fast, love hard, die young, and leave a beautiful memory.' Too bad he didn't die young instead of ending up as a drunk up in the holler with the Murrays and Bateses. He'd have left a lot more beautiful memory if he had. Even Cheryl Ann divorced him last year. It takes a lot for a man to be worse than Cheryl Ann Bates is willing to put up with."

Dietrich Zuehlke was frowning.

So was Gary Lambert.

"By 'went out with him a couple of times,'" Kastenmayer interrupted, "do you mean what people call 'a couple of dates'?"

"Well, not official dates. More just hanging out." Tina Marie looked at Gary Lambert for help. He and Jonas started mediating and interpreting cultural differences.

"Hey," Tina Marie said. "What I mean was that I didn't just fall into bed with Zane right away. Though he'd have been happier if I'd been willing to. I actually left Ray with Dave for a few days and took the Greyhound out to Toledo to see what was going on with John. He was running another landscape crew and he'd bought an up/down duplex. Housing several of the illegals he'd brought up from Texas in the upstairs apartment, which brought in enough to cover the mortgage payments. And downstairs, living with another woman. Doris Motylewski was her name. She lasted longer than most of his girls—had enough sense never to get pregnant, so she never got soft and squishy. She eventually dumped him, but that was seven years later. A year after I divorced him and she figured out that he still wasn't going to marry her. She found a guy who was willing to marry her and walked out on John. Every time he came back to Grantville after that, he had a different girl with him. John got older, but the girls he brought stayed the same age."

"Oh." Gary Lambert was looking a little embarrassed.

"Anyway, I figured that what was sauce for the goose was sauce for the gander, so I came back and told Zane that I was willing to see it his way. Which is why I had Ronnie a couple of years later. I put 'Lafferty' on his birth certificate. I was still married to John and keeping house for Dave, after all. Ronnie is a Baumgardner, though—we went to court later and had it changed. A year after that, Zane lost his job in the mines here. He went out to Wyoming to work in the strip mines. I'd have gone with him if he'd asked me. But, hell, he didn't ask me to go. That would have been 1980, I guess. We had a big fight about it. Not the best year of my life by a long shot.

"Dave's health was getting a lot worse, so I wrote John and told him that he needed to come back home. He didn't move back, but he did show up occasionally, which I guess was better than nothing. I got Vance and April out of those years and it seemed like every cent that I could make had to go for baby sitters and baby food and disposable diapers. If old Dave hadn't had the house and his disability payments, we'd have been sunk. So eventually I went out to Toledo to see if I could get some child support, this time lugging all four of the kids along. Just to find that Doris was still living downstairs in that duplex with him. That's when I divorced John and put in for child support. He never forgave me for that support order. Not never."

Both Jonas and Pastor Kastenmayer frowned.

"Anyway, in '85, Zane came back from Wyoming and we picked up with each other again. This time, he married me. And we had Garrett and Carly. Right after Carly was born, he started drinking heavy. Then a couple years later, in '92, he left me for Cheryl Ann Bates and I divorced him, too. By that time, believe me, he was no loss. But his parents took it ill and they tried to take Ronnie and Garrett and Carly away from me. It was mostly his mother making the fuss. Horace just went along with her. I was an 'unfit mother,' Mildred said. That's why I stayed in Grantville, really. The court in Fairmont let me keep the kids, but if I'd tried to move away from Grantville, Horace and Mildred would have been right back to their lawyers. So I took office courses at the Tech Center and moved from loading crates in the warehouse to shuffling papers in the office. More ladylike, even if it didn't pay as much. The kind of thing that impresses a judge or a social worker. I got to the point where I could pretend that I was a lady pretty well. At least long enough at a stretch, even though I'm really not at all the lady type. Mildred will tell you that, if you ask her.

"Then John sued for custody of Ray. Tried to get custody of Ray, even though he'd never paid a speck of attention to the boy."

"Ah," Dietrich Zuehlke said. "Did he request custody of Vance and April as well?"

Tina Marie stuck her chin out. "Nah. He wasn't that sure they were his."

Her answer seemed to hang in the air.

"Well, neither was I. At least not as far as April's concerned. Vance is his. I wouldn't have given him David for a middle name, for John's father, if I hadn't been sure of that. I just named April after the month she was born. I figured it was kind of neutral. No point in naming her after Linda Lou or after my mom, anyway. They both cut out of our lives pretty early. Plus Mom was named Philena, which isn't the sort of thing anyone ought to do to a kid."

Kastenmayer nodded. "I see."

"Face it. John was really just mad that because I moved out of his dad's place, Dave had to go into the nursing home for a year before he died. To pay for that, along with his Medicare, he had to sell the house, so John didn't get a thing when Dave died. John was totally ticked off about it. Dave didn't hold a grudge, though. He told me to go ahead and divorce John. Said it was good riddance to bad rubbish."

Dietrich Zuehlke inserted a comment. He didn't precisely say that around the time of April's birth she had been acting as a whore. But he certainly implied it.

Tina Marie shook her head. "I may have slept around a bit back then, with John in Toledo and Zane in Wyoming. I'm not going to lie to you about that, but it wasn't ever for money. Never with a guy I didn't actually like. The most I ever got out of an evening was a meal in a nice restaurant. Like that Italian place in Fairmont. You know. High class. The kind of place you can wear a dress and heels and feel okay, because other women are wearing them too."

She stood on her toes, picked up Pastor Kastenmayer's wife's shawl that was lying across the high back of a bench, draped it across her shoulders, and swished.

"Not that I owned all that many dresses. I didn't need them, the way I lived. I was lonesome. Taking care of Dave Lafferty and the kids plus commuting to work at the warehouse in Fairmont wasn't any picnic. A girl wants to have*some* fun."

She glared at Dietrich Zuehlke. "And I never took a cent of welfare, either. Not food stamps or WIC or anything. I paid my own way."

"Er." Ludwig Kastenmayer cleared his throat. "What did your pastor have to say about this?"

"Pastor?" Tina Marie frowned.

"Preacher," Kitty and Gary Lambert clarified simultaneously.

"I don't go to church. Never did." Tina Marie shook her head. "Ray and Vance and April are Church of Christ. A friend of Dave's used to pick them up on Sunday morning and take him and them to church with her. After he died—that was in '86—she kept taking the kids. The Baumgardners—Horace and Mildred—were Baptists. Well, Mildred still is. Horace died two years ago. But the church threw Zane out on account of the drinking, way before the Ring of Fire, so Ronnie and Garrett and Carly haven't ever seen any reason to join up. Me, I'm just not the Holy Roller type."

* * *

Gary Lambert's explanation of "Holy Roller" turned out to be beneficial to Tina Marie's cause—at least from Pastor Kastenmayer's perspective. He could only think highly of a woman who, however lamentably uninstructed in the creeds, nevertheless avoided the temptations offered by heterodox sects and cults of various types. This led into a digression on the place of snake handling in Appalachian religious culture.

Kastenmayer found it fascinating. He was already familiar, of course, with the more routine and mundane aspects of up-time religion, such as that the Baptists eschewed infant baptism but somehow expected their children to become believers as adults. Just out of a clear blue sky, with no catechism classes.

"That's not*exactly* how it works," Gary said. "Or not exactly how it's supposed to work. If this Mildred had been a responsible grandmother, she should have been picking Ronnie and Garrett and Carly up and taking them to Sunday school. So they'd be propagandized into joining when they were old enough. Like that friend of Dave Lafferty's did for the other three. Sounds to me like she was just being a grinch."

Grantville, Autumn 1634

"Thank you for assisting us this evening," Sartorius said to Jonas and Gary as they walked into the high school library. "I thought it was important for Tina Marie to understand just how far away from Grantville my work normally lies."

"I am not grateful," Dietrich commented. "I consider it to fall more into the category of 'aiding and abetting a crime.'"

"Let's just find the globe," Gary looked around with a bland, mild, expression on his face.

"Here." Jonas moved to the right from the entryway. He turned the globe. "This is Grantville, now. Right about here. That would be Wismar, about here. The globe only has the names of the cities that were largest up-time, so Wismar isn't on it. But here's Gdansk."

"Remind me again why we're here." Tina Marie was impatient.

"I don't want you to be unhappy if you go with me. My first wife was very attached to Wismar. It was her home town. So I left my household there, even though most of my work was in ports farther east and I was not able to return home as often as I would have preferred. You need to see how far you will be from your home."

"One inch. One piddling little inch from Grantville to Wismar if you measure it on this map." She snorted and turned the globe. "Look at this." She put her finger down. "That's Brownsville, Texas. This is just about where Grantville came from in West Virginia. That was four times as far. At least. That doesn't even count crossing the whole ocean and skipping over France for us to get here." Her fingernail traced a path. "What's Wismar like?"

Dietrich Zuehlke emitted a simultaneously hostile and wistful-sounding, "Flat."

Gary Lambert laughed.

"All these hills make me sick. Really sick. Your Doctor Adams said that the word is 'claustrophobic.' Not enough sky; not enough horizon; not enough room, not enough space, not enough flatness."

"Flat?" Tina Maria looked at the globe more closely. "Flat like Brownsville? With a river?"

Sartorius assured her that all the Baltic ports had in common that they were flat, with a river.

She stared at the globe for a minute. "I wonder sometimes if anyone left up-time ever gives me a thought any more.

"Your parents stayed in Texas?" That was Gary Lambert.

"I'd been in foster care a dozen years before I left Brownsville. Which doesn't mean that I don't miss the Rio Grande. Mom came around now and then until I was twelve or thirteen. Then she just sort of dwindled away. I didn't know whether she was still alive or not, even before the Ring of Fire. If she died, nobody told me. Maybe she just left town, looking for something better. Never did know my dad. Mom said that he smashed himself up in a car accident when I was just a baby. Well, drag racing, to tell the truth. He spent a long time in the hospital and then died. I've been gone from there a long time. Never kept in touch. Nobody to keep in touch with." She started singing softly:

Remember me when the candle lights are gleaming,

Remember me at the close of a long, long day.

It would be so sweet when all alone I'm dreaming

Just to know you still remember me.

"Well," she said. " None of the rest of you probably ever heard that old chestnut, anyway."

"I have," Gary Lambert answered, leaning his elbows back against the encyclopedia shelves. "It's a Bob Dylan song, isn't it?"

"He might have sung it, but it's way older than that. Probably ten years older than me, even. I learned it from a Willie Nelson record, I think. T. Texas Tyler sang it, too. I suppose the only person left up-time who might ever give me a thought is John Lafferty. Not that it's likely that he will." Kicking off her flip-flops, she started to waltz by herself in the small open space between the library entrance and the tables:

The sweetest songs belong to lovers in the gloaming,
The sweetest days are days that used to be.
The saddest words I ever heard were words of parting
When you said "Sweetheart, remember me."

You told me once that you were mine alone forever

And I was yours till the end of eternity.
But all those vows are broken now, and we will never
Be the same except in memory.

A brighter face may take my place when we're apart, dear,
A sweeter smile, a love more bold and free.
But in the end, fair weather friends may break your heart, dear.
If they do, sweetheart, remember me.

Remember me when the candle lights are gleaming,
Remember me at the close of a long, long day.
Just to be so sweet when all alone you're dreaming
Just to know you still remember me.

Tina Marie's dance slowed to an end. She rubbed her hands against the back pockets of her black denim jeans. "Scotty Wiseman wrote it, back when the National Barn Dance was broadcast out of WLS in Chicago." She straightened her shoulders. "Wash that all out in the laundry, will you, guys? Just forget about it. I'm really not one bit the sentimental type."

She turned back to the globe, Sartorius looking over her shoulder.

"The point is that Wismar's not that far away."

* * *

"It's a beautiful song," Jonas said to Gary Lambert and Ronella Koch that evening. "A little melancholic, but lovely." He looked rather wistfully at Ronella; then looked away. "I believe that I will translate it into German."

* * *

"They can't mean it." April was horrified. "They can't really mean for her to go off with him and leave us behind."

"Considering that they just told us so," Hans-Fritz said, "they probably mean it. Look, we're not that bad."

"But we've always been able to count on Mom."

"Don't be stupid," Dietrich said. "She's a totally unsuitable wife for my stepfather. It's absolutely shocking for her to plan to leave you here, sharing it with Hans-Fritz and me until Ronnie and his fiancee get married. We aren't even really related."

"If you don't like it, there's nothing to keep you from moving out."

"April, that's rude." Ronnie shook his head.

"Well, then, if he doesn't like it, then I can move out. Live with my boyfriend. Maybe he thinks that's less shocking."

"You don't have a boyfriend," Vance pointed out.

April shot a hostile glance at Dietrich. "If he pushes me, I'll find one. If I need to."

"Mom's not going right away." Carly looked at Anna. "That's right, isn't it?"

Anna nodded. "Not until some time in the spring."

"So we don't have to panic right away, do we?"

Ronnie hugged her. "We don't need to panic at all. Someone will think of something. If Mr. Know-It-All there would just stop sticking his oar into the water."

"If Grandma hadn't sold her house after Grandpa died," Garret said, "we could move in with her."

April's expression was sour. "You and Carly could. The odds that she would have me are zero percent."

"Well, she did sell her house," Hans-Fritz said. "So that's not one of the things that you need to worry about."

"Easy for you to say."

"Well. If nothing else works, I guess I could find somebody and get married myself. I'm the oldest, after all."

Carly stared at him. "But Hans-Fritz, you're not in love. You're not even dating."

"No. But I have a government job and live in a house with indoor plumbing. Trust me, Carly. In a pinch, I can put out word that I'm looking for a wife and have one in a month."

Garrett stared at him. "Would you really do that for us?"

"Hey, kids. I may not be as conscientious as Dietrich here, but I'm not all bad. I'm about the age I should be thinking of getting married. Lucas was good to us. If he needs a favor from me, I'm willing to pay him back."

* * *

"Yes. It is quite true. All that remains is to set a date for the wedding." Salome Piscatora nodded her head firmly.

"I can't believe that she's even thinking of marrying*him* ." Mildred Baumgardner pointed at Lucas Sartorius with her fork. "Or that he's thinking of marrying*her* , for that matter. She's a horrible woman. An unfit mother. But if she takes off with this, this—this*German* , Garrett and Carly will have no mother at all."

"She*isn't* an unfit mother." Kitty Chaffin gestured with her cup. "She never was. She fed them. She kept them clean and sent them to school looking neat. She never once left them without a sitter. And you know that yourself. If it was otherwise, you'd have brought it up in court when you were trying to take them away from her."

"You. What do you think?" Mildred turned to look at Salome.

The heavily pregnant wife of the Lutheran minister took a sip of the boiled milk in her cup. "It is not my place to have an opinion. I do know that under the laws of the church, her first husband was left up-time and will be considered dead. Her divorce from the second husband is valid, since he both abandoned her—that is desertion—and committed adultery. Those are Biblical grounds. We do not have as many divorces now as you up-timers have, and only those two grounds exist. But*Frau* Hollister's divorce from your son, gracious lady, is valid under our laws."

Kitty wasn't ready to let go of Mildred's other allegation. "She's always kept a close eye on all her kids, and they've all turned out just fine. Ray and Ronnie are in the military. Doing well. Ray's still up north and Ronnie's been detailed to the Mechanical Support Division. Ray's married. Ronnie's dating Megan Collins, who is a real nice girl. Vance is military too—a radio operator up in Erfurt. April's out at the mine, apprenticing to be an electrician. They all got their high school diplomas. Garrett will graduate from high school next year and go into the military, too. Carly's grade are good. What more could anyone ask?"

"Custody of the kids," Mildred said. "Considering that they're the only grandchildren I have."

"You're in the assisted living center," Kitty pointed out. "Because of the walker and all. It took three of us to get you down to the café this morning. Salome and him and me. It was one thing back when Horace was alive, but how could you possibly take custody of those kids now?"

Sartorius listened to them talk, twisting his goatee.

* * *

"It won't be hot on the Baltic coast," Lucas Sartorius said. "Not in the way you describe this Brownsville. I'm afraid that you will find it cold. Cold and damp."

"You do have fireplaces, don't you?"

"Yes. But mostly they burn peat rather than wood or coal."

"Anna will go back with us. She says that in spite of all Grantville's attractions, she would rather be with you than with her half-brothers, 'given how stultifying they are.'" Tina Marie laughed. "That seems to be her favorite word right now."

"But not*your* daughters."

"April says that she can take care of herself."

"Can she?"

"Why not? She'll have my house to live in. Megan can move in too, once she and Ronnie get married. Vance and Garrett will be home most of the time. In a pinch, we could ask Ronnie and Megan to move up the wedding a few months. Have it before we leave. There's no reason they can't."

"So?"

"No matter what, she's staying to finish her apprenticeship. I sort of doubt that there are many jobs for electricians in Wismar anyway."

"Which leaves the question of whether Carly goes or stays."

Tina Marie bit her lip. "She stays. I want her to finish high school here."

"Can April take care of her? Does she have the time? Or the will?"

"I don't really want to risk that. April doesn't have the time. Or the patience."

"Her father?"

"Impossible."

"So?"

"If Dietrich tries to come all fatherly on her, she'll just fight it. Rebel. She wasn't even three when Zane left. She's never had a father telling her what to do and she's not used to it. I cry every time I try to think about leaving her behind."

"Perhaps there is a solution."

Tina Marie raised here eyebrows.

"Move the grandmother into the house with Carly and April. With them, plus the boys, plus Ronnie and Megan, she does not need an assisted living center to take care of her. They can easily carry her up and down the steps to the street. Shop for her."

"That means that Mildred wins, I guess."

"You are giving them up to go with me. Can you tell me honestly that you would not feel better to have their grandmother with them?"

"I can't. But I sure*wish* that I could."

"Perhaps she will be so demanding of attention and keep Dietrich so busy that he will not have the time to exasperate April and Carly."

Tina Marie finally smiled. "If Mildred has to be wished off on somebody . . . Well, Dietrich deserves her if anybody does."

* * *

"I'm giving her custody. For a year. Carly's willing. So is Garrett. If they can't get along, all of them together in the house, we'll know by the end of the year. If they don't, I'll have to think again. I had a long talk with the child welfare people."

Sartorius smiled. "I have a feeling—an omen perhaps—that the plan will succeed."

Tina Marie turned to him. "I have a feeling—an omen perhaps—about marrying you. I'm not one bit the

superstitious type, but they do say that the third time's the charm."

Grantville, February 1635

"Pastor Kastenmayer could have done more to prevent this marriage," Dietrich Zuehlke complained to Kitty Chaffin.

"Well, maybe. But after I got to know your stepfather a bit, I figured the two of them were a pretty even match. Maybe the preacher thought so, too."

"It all worked out pretty well, I thought," Hans-Fritz said with his usual amiability. "At least, I didn't have to get married right away. Although now that I have the idea in my head, I may do something about it fairly soon."

Kitty grinned. "Who's the lucky girl?"

"I don't know yet. But what April said about a boyfriend sort of got under my skin. That if she was pushed, she could find one. I can probably find some pretty girl who's interested in me." He smirked at Dietrich.

"Go to work, guys." Kitty threatened them with her paperclip holder.

* * *

"I sort of doubt that anyone at the city hall could tell you how to get there," Ronella Koch said. "Why don't you try the post office. All the people who deliver mail have to know their routes and there's one that goes out that way, into the holler."

So Pastor Kastenmayer made his way to the post office and requested a favor. Bernita Walsh obligingly agreed to get the mailman on the route to write out directions, even though she just had to ask why anyone in his right mind would want to talk to Zane Baumgardner, given that he'd devoted the last dozen years to drinking his life away.

Kastenmayer looked embarrassed. "Not only is he a lost soul, but a lost soul with a German surname."

"What difference does that make?"

"It is obvious. Some time between 1630 and 2000, some place between Germany and your West Virginia, the Lutheran church, as Gary Lambert would put it, 'dropped the ball' in regard to this family. Until now, I have let my parishioners go out and gather in freshly cut sheaves, as in the case of the young men who will be confirmed in April."

"Oh," Bernita said. "Yeah, I'll be there. One of them's my brother."

"Ah. Which one?"

"Lew Jenkins."

"Sabina Ottmar is a fine woman."

Bernita pushed her hair back from her face. She was so tired all the time these days. "I sure hope so. That's what I'm counting on."

"I have limited myself to instructing the candidates for confirmation when they were brought to me. I have merely placed the grain in storage, if that is the correct way to phrase it. I have not acted as an evangelist. But perhaps I should be a missionary. Although I may not succeed in restoring this man Baumgardner to faith and sobriety, at least I will try."

Bernita looked at him. "Good luck," she said. "From everything I know about Zane, he's not at all the religious type."

CONTINUING SERIALS

The Dr. Gribbleflotz Chronicles, Part 2
Dr. Phil's Amazing Essence Of Fire Tablets

By Kerryn Offord and Rick Boatright

1633, Jena, Dr. Gribbleflotz's office

Dr. Phillip Theophrastus Gribbleflotz took another look at the bill. He was spending*that* much on candles? Surely not. "Frau Mittelhausen. This bill for candles. Who has been using wax candles so wastefully?"

Frau Mittelhausen sighed heavily before looking Dr. Gribbleflotz straight in the eye. "You have been, Herr Doctor. You use the good wax candles to heat your beakers. Why you can't use that alcohol burner the up-timers provided, I don't know."

Phillip paused to digest Frau Mittelhausen's statement. Well, yes, he did use candles to heat the beakers sometimes. Especially when he didn't want a big fire. The problem was that the tallow candles didn't give anything like the same heat. And they produced too much soot. Even wax candles, which burned cleaner and hotter, made a lot of soot. He often needed to use several candles at once.

He knew what he needed. Something like the "Bunsen burners" at the up-timer high school. However, that would have to wait until he had access to gas. He knew there had been talk of producing "propane," but for now that was as far off as his much-needed aluminum. As for the alcohol burner the Kubiak Country people had given him, it was very clever. But he could never see the flame, and the alcohol was always evaporating, and it always ran out at the most inconvenient moment. At least with candles he could easily add more, and the heat they put out was greater than that of the single alcohol burner.

He returned to checking the bills. "There must be a better way."

1633, Jena, the new HDG Enterprizes facility

Dr. Gribbleflotz walked around the site of what would soon be the head office and main manufactory of HDG Enterprizes. The new facility was a large compound with buildings for the various production lines,

accommodations for laborants and other employees who lived on site, the head office, and the new apartment building for himself and his household. Finally, there was the set of rooms that were his personal office and laboratory.

The current area of interest was the large waterwheel, or more precisely, the area where the waterwheel would be installed. Phillip could see the men clambering around the heavy structure that would eventually support the wheel. He joined the small crowd watching an older man slapping clay around the joints in the steel. Confused, he continued to watch.

"You might want to step back, Dr. Gribbleflotz."

Phillip turned and looked up to see Ted Kubiak. "What is he doing?" He pointed to Erwin O'Keefe.

Ted followed Phillip's pointing arm. "We want to weld the steel frame together. Erwin is going to thermite weld. Right now he's slapping on clay to contain the molten steel until it cools."

"Molten steel? How can you melt steel without a furnace?"

"It's a chemical reaction, Dr.. I can ask Erwin to explain if you like, but for now, just watch. This is really cool."

Phillip watched as Erwin set an odd package over one of the clay covered joints, lit a fuse and jogged back a considerable distance. After a few moments, the brightest light Phillip had ever seen burst from the package. White-hot droplets leaked from the bottom of the clay seals.

Ted pointed. "Those droplets are molten iron from the thermite. The clay holds it in, and the iron cools in place to make a weld. It's really neat to watch."

Phillip stared, awe struck. "Yes, please, Herr Kubiak. Do ask Erwin to explain."

* * *

Dr. Gribbleflotz idly fondled a crude iron ingot while he read the letter from Erwin O'Keefe. The ingot was the product of a final demonstration of the thermite reaction that Herr O'Keefe had conducted with one of the remaining thermite kits he had brought with him. The demonstration had so impressed Phillip that he had asked for a "cheat sheet." Herr O'Keefe's letter described the thermite reaction in such detail that he was sure he could easily duplicate it. Herr O'Keefe had even included a couple of alternative methods of initiating the reaction.

Phillip looked over at his cabinet of chemicals in their jars and bottles. He selected a couple of jars and walked to his fume cupboard. He placed a watch glass on a dished firebrick and carefully measured out a small amount of the purple crystals from the up-time "chemistry set." Then he added just a drop of the oily liquid, clicking the stopwatch function of his pocket watch at the same time.

While he waited Phillip admired the "Buick" logo on the door of the fume cupboard. He watched through the safety glass of the fume cupboard door as the purple powder ignited. With the first signs of ignition Phillip stopped his watch. After observing the whole pile of crystals burn, he retreated to his desk where he made notes in his journal. The observed time for the reaction to occur was within the range Herr O'Keefe had written. It was a most interesting experiment, but not as interesting as melting iron in a ceramic pot would be.

As he read Erwin O'Keefe's directions, Phillip could see a potential problem. The thermite reaction used aluminum. Aluminum was a rare and strategic resource. The Kubiak people had indicated he was lucky to get the few pounds they had been able to provide.

Unlike his aluminum pyramid, the thermite reaction could use any aluminum. Minor impurities did not matter. Phillip looked along his bookshelf, toward the model pyramid with its faceted gems. He sighed. He had had such hopes when the Kubiak Country people had provided him with the ingots of aluminum. However, his tests with the scale model had failed to invigorate the*Quinta Essentia* of the small rodents he had tested it on. It was the aluminum he had concluded. It wasn't pure. The Kubiak Country people had admitted that there were other elements in the mix.

Phillip already knew that pure aluminum would not be available until the up-timers were able to mine the ore. Well, they had admitted that there might be a way to purify the aluminum. However, it required a chemical he wanted nothing to do with. After reading the up-timer handling instructions and warnings, he was happy to let others play with hydrofluoric acid.

He walked over to his store cupboard. Once there, he picked up the few remaining ingots of aluminum. At a guess he had half a pound left. Biting his lip, he turned his gaze to his dysfunctional model pyramid. Make that two pounds.

Seated back at his desk he caressed the iron ingot while he re-read Erwin's letter. An image appeared in his mind. He could see it vividly. He, Dr. Phillip Theophrastus Gribbleflotz, the World's Greatest Alchemist, giving one of his justly famous seminars, and as the pièce de resistance, a demonstration of thermite with . . . Phillip looked down at the iron ingot in his hand . . . a specially molded shape. Something special. Something of distinction.

Thinking of distinction, he looked down at Erwin O'Keefe's letter. No. "Thermite Reaction" didn't have the right ring to it. It needed something more. A real name. Phillip allowed his mind to wander as he searched for inspiration. The molten iron could obviously be molded into any shape. It would take a little experimentation to get it right, but imagine, in a haze of the brightest light, forming an ingot of pure iron from the dross of rust. Phillip shivered. It was almost a holy event. Then it struck him. The "Gribbleflotz Candles of the Essence of Light." Nobody else in Jena would be able to duplicate the demonstration, and if people should want to buy the iron ingot . . . Maybe if it was formed into some significant shape? The ideas ran through his mind while he visualized the demand for his demonstrations.

With a sigh he came back to reality. He didn't have enough aluminum to demonstrate the Gribbleflotz Candles of the Essence of Light at all of his regular seminars. It was a pity, but he would just have to limit the demonstration to maybe one a month. Maybe by the time he used up his small store of aluminum, the up-timers would be mining the ore for more. But first things first. Before he could do any demonstrations he had to be sure he could make the Gribbleflotz Candles of the Essence of Light work reliably. To have one fail would be humiliating. He walked over to the door of his personal laboratory, opened it and called out for his laborant. "Hans. We have work to do."

Several months later, HDG Enterprizes, Jena, the new facility

The first demonstrations had gone well. The audiences had been most impressed by his Gribbleflotz Candles of the Essence of Light. The molds his personal laborant, Hans Saltzman, had prepared had produced finely detailed animals. The rabbit, the lamb, even a ram. Phillip smiled at the memories of his success and turned back to watch Hans preparing for his next lesson in alchemy.

With the electricity from the water driven generator, Dr. Gribbleflotz had been able to experiment with electrolysis. His first experiments had duplicated the work he had seen demonstrated at the water works in Grantville. Since then he had been adding things to the basic "bleach" to see what he could make.

Phillip withdrew the jar containing his latest creation. So far he hadn't had time to examine the white powder the laborants had scraped from the wash filters. This was . . . he looked at his notes again . . . this was the twenty third result from mixing something with "bleach." Bleach was such an ugly word. It did nothing to describe the substance. "The Ethereal Essence of Common Salt." Much more satisfying.

* * *

"Light the candle, Hans." Phillip was standing just behind his laborant while he instructed him on laboratory procedures.

"Now, using the wood split like a spoon, scoop a small amount of the compound onto the splint." Hans held the loaded splint just above the jar. "That is a little too much. Tap it gently on the jar to reduce the amount. Yes. That is enough. Now hold the tip of the splint over the flame."

Their eyes followed the loaded tip of the wood splint as it was placed over the flame. Phillip waited to see what would happen.

"What!" Hans dropped the suddenly flaring splint. He slammed the sliding door of the fume cupboard down, sealing the still burning chemical inside. He was shaking a little.

"What happened, Hans?" Dr. Gribbleflotz' voice was remarkably calm.

Hans' voice shook. "I was holding the compound over the flame when suddenly it burst into a violent flame. I am sorry I dropped the splint, Herr Doctor Gribbleflotz. Should I repeat the experiment?"

"No, Hans. You did well. Even I, with my years of experience, was surprised at the vigor with which the compound burnt. I compliment you on your quick thinking in shutting the safety door. I want you to write up what you did, what happened, and your conclusions. We will compare our observations and conclusions over dinner."

"Thank you, Herr Doctor." Hans grabbed his notes before making his escape.

Phillip smiled at the retreating back. Hans was proving himself a suitable student of alchemy. He certainly had the right reflexes. Shutting the safety door of the fume cupboard and letting the splint burn rather than try to pick it up again had been the right thing to do.

He made his way over to his desk and sat down. He considered the experiment they had just conducted. It had been a most vigorous reaction. Excepting the Candles of the Essence of Light reaction, and the self-ignition of the Flowers of Hartshorn, it was one of the most vigorous he had ever seen. He wrote up his observations and conclusions.

* * *

The noise in the courtyard attracted Phillip's attention. Looking through the window he was in time to see Frau Mittelhausen greeting the up-timer, Ted Kubiak. A couple of men helped Ted unload the wagon. There were a number of large bottles of something. Ted took one handle of a large basket that contained

a bottle, and, with Hans Saltzman, carried the bottle into the building.

Moments later he could hear them in the corridor outside his laboratory. Quickly he hurried over to open the door for them.

"Where do you want it?" Ted asked. "This sucker is pretty heavy."

"Over there on that table, please, Herr Kubiak." Dr. Gribbleflotz waved towards a table set against a wall. "What is in the bottle?"

Ted smiled and patted the five-gallon bottle. "This is some of the new waters of formalin you were asking about when you visited the gas works."

Phillip looked at the size of the container. "That is much more than I usually deal with in my experiments, Herr Kubiak."

"Sorry about that." Ted shrugged. "But the gas works were going to charge about the same price to fill the big bottle as they would if we filled a little bottle. So I went for the big one. You never know, you might find a use for it all."

Dr. Gribbleflotz smiled in return. Yes, if the price was much the same it was silly to buy just a small bottle.

Ted had been looking around the laboratory. Right at the moment he was sniffing the air around the fume cupboard. "What are you working on at the moment, Dr. Gribbleflotz? If you don't mind me asking."

Phillip looked from the fume cupboard to his notes. "Nothing much. Just before you arrived, I was supervising Hans as he tested a new compound. It was something I created using the new electrolysis equipment, 'The Salt of the Ethereal Essence of Common Salt and Ash.' However, it was most disappointing. All it did was increase the rate at which a splint of wood burnt."

"Oh, well. Not everything you discover has an immediate use. Maybe sometime in the future you'll find something it's good for."

Phillip smiled at the up-timer's attempt to raise his spirits. He rested his eyes on the bottle of waters of formalin. "I now have something new to experiment with. Thank you for bringing me the waters of formalin, Herr Kubiak. To make a special trip to Jena just to make the delivery was most kind."

Ted's ears showed a red tinge. "Actually, Dr. Gribbleflotz, I'm on my way to Magdeburg and points north on a buying and selling trip. I had to stop by anyway, to stock up here before I left." Ted shot a gaze at his wristwatch. "Is that the time? I really must get on my way. Your people should have filled the wagon by now."

Phillip smiled broadly while the tall up-timer made his hasty escape. Then, with a contented sigh, he turned his attention back to his laboratory. That fume cupboard needed to be cleaned out first. "Hans, please clean the fume cupboard while I gather my notes from the gas works. We will both have to do some reading."

Hans, who had been hanging back while the good doctor talked to the up-timer, hastened to clean up the fume cupboard. He was interested in finding out what Dr. Gribbleflotz intended doing with his new "waters of formalin."

* * *

Dr. Gribbleflotz took notes as Hans carefully added the spirits of hartshorn or "ammonia" to the formalin. In accordance with the recommendation of his up-timer contacts he had been concentrating the solution. At higher concentrations, less of the spirits were needed.

Hans gently stirred the mixture as he added the spirits of hartshorn.

"Stop!" Phillip had seen the first signs that something was precipitating out of the solution. Stepping forward, he read the level from the titration tube and recorded the information.

"Notice, Hans, how something is 'precipitating out' of the solution. Under the up-timer chemistry, we should be able to calculate something about the nature of the product. That will be an assignment for you."

"Thank you, Herr Doctor."

Dr. Gribbleflotz smiled at Hans' less than enthusiastic response. Both of them were finding the up-timer chemistry difficult. "Continue to add the spirits of hartshorn until you are sure there will be no more precipitate produced. Then run it through a filter paper and we will see what we have."

Phillip stood back and observed while Hans added some more spirits of hartshorn. When his laborant thought the reaction was complete, he selected a piece of filter paper from a drawer, folded it, and placed it into a funnel. He then poured the contents of the beaker through the funnel. Then he placed the filter paper on a clean watch glass. Turning to check that Dr. Gribbleflotz approved of his actions, he then opened the folds of the filter paper to expose the precipitate. Then he used his fingers to squeeze it.

"It is waxy, Herr Doctor. And . . ." Hans touched his fingers to his tongue. "It is sweet."

"Hans!" Dr. Gribbleflotz was shocked. "What is the first rule of safe alchemy?"

Sucking his finger still, Hans looked at Dr. Gribbleflotz. "Everything is considered dangerous until proven to be safe?"

"Yes. And do you know that compound is safe?"

Hans took his finger from his mouth and looked at it. The implication of what Dr. Gribbleflotz was saying finally hit him. "No, Herr Doctor."

"Then why did you use your bare finger to test the texture of the compound, and then put it into your mouth?"

"But it should be safe, Herr Doctor. The waters of formalin and the spirits of hartshorn are not poisonous." Hans hesitated a moment. "Are they?"

Dr. Gribbleflotz looked down at his watch. It had been only a couple of minutes since Hans introduced the compound to his mouth. Much too soon to be sure of anything. "We will wait. How do you feel?"

Hans was starting to sweat a little. Using the front of his lab apron he mopped the sweat from his brow. "I do not feel unwell, Herr Doctor."

They waited for several minutes.

"You are still with us, Hans?"

"Yes, Herr Doctor. I still do not feel unwell."

"Then I believe we can conclude, that in the dosage you took, the compound is not poisonous. But let that be a lesson to you. Do not take unnecessary risks." Phillip paused and looked from Hans to the compound sitting on the watch glass. "Sweet, you said?"

Hans nodded.

"Could it be 'sugar'?"

Hans thought for a moment then shook his head. "No, Herr Doctor. It is not that sweet."

"A pity. A great pity, Hans. To be able to make sugar by mixing chemicals would have ranked as a glorious discovery. Especially given the cost of sugar. Now, I guess I must taste it myself."

* * *

Phillip stood behind Hans. They were back testing their new compound. Hans had loaded the tip of a wood splint and was about to place it over the burning candle.

Both of them paid close attention. The reaction, when it occurred, was most interesting. The compound, whatever it was, caught fire before the thin splint of wood.

Hans took some of the remaining precipitate and rolled it in his fingers. Then, holding it between two splints, he held it over the candle until it caught fire. He then passed his left hand above the burning compound. "It gives off a good heat, Herr Doctor."

"Drop in onto a clean watch glass and see how cleanly it burns."

Hans dropped the burning compound onto a clean watch glass and held a second clean watch glass over the burning compound. He had to put it down quickly because of the heat. He slid a clean piece of paper under the watch glass so any soot would show up better.

"It is less soot than from even a wax candle, Herr Doctor." Hans turned excited eyes to Dr. Gribbleflotz. "Could it be a wickless candle?"

Phillip thought for a moment, then shook his head slowly. "No, Hans. I don't think it will give off the light of a true candle. However, you say it gives off heat. Maybe we have discovered a replacement for the expensive candles we currently use in our experiments. Come. Let us make a bigger batch. We have many more tests to conduct."

Winter 1633, Magdeburg

"Hi, Mike. We've got something for you." Greg Ferrara and Christie Penzey slipped into Mike's office. Greg delved into a paper bag and extracted a package from it. He slid it across Mike's desk.

Mike poked suspiciously at the waxed paper bundle. "So, what is it?"

"Cyclotrimethylenetrinitramine."

Mike looked to Christie. "Could you translate that, please?"

"Its RDX, or Cylonite. One of the main ingredients in military C-4 high explosive."

"I thought you said you couldn't make anything other than nitro or dynamite without benzene from the coal tar process?"

Greg grinned a bit sheepishly. "We did. We were wrong. Not about getting benzene from the coal tar process. But we were wrong about the benzene."

"So when did you start making this RDX?"

"We aren't making it, Mike. There's a small company that was making small lots for the Thüringian Rifles." Greg nodded to the package on the desk. "That's where we got that package."

"Well, how much more can they make? And how come the Thüringian Rifles got it first?"

Greg shrugged. "They're only set up to make pounds per week. The RDX is a sideline from their main product." Greg shuddered as he remembered the main product of*Brennerei und Chemiefabrik Schwarza* , or the Distillery and Chemical Factory of Schwarza. "Percussion caps."

Mike pulled back from his desk and stood up. "I thought you said we couldn't make percussion caps. Wasn't that the reason we went for flintlock over caplock?" Greg nodded. "So how is it that some back woods down-timer operation can make percussion caps when you say you can't?"

Greg shuddered. "You have to understand. They are using*mercury,* Mike. They're making fulminate of mercury percussion caps, for God's sake. Believe me. That stuff is lethal. It's not that we can't make percussion caps, Mike. We could easily make fulminate of mercury percussion caps. Just tell me how many lives I can budget for. What's my death quota?"

Mike glared at him. "What's with this 'death quota' and 'lives budget' nonsense?"

Christie spoke up. "What Greg is trying to say, Mike, is that people are literally dying to make percussion caps. Sure, we could make percussion caps. But we would have accidents, and probably deaths. Neither Greg nor I want to be responsible for people dying while they make percussion caps. Fulminates are very sensitive. If they're less than pure they become unstable. Hell. Copper fulminate will explode as soon as look at you. That's the problem. To make fulminates you need pure ingredients. Trouble is, we can't just call up our friendly chemicals supplier and ask for a few hundred gallons of pure nitric acid. We have to triple distil everything, even the water we use."

Greg took over. "Then there is the matter of volumes. The best of the backwoods outfits is making maybe an ounce of fulminate of mercury a day. That's enough for about five hundred caps. The army needs millions. There's just no way we can safely make enough caps using fulminate of mercury."

Mike collapsed into his chair. "Okay. I think I understand. We can make caps, but not safely. Certainly not as many caps as the army would need." At Greg and Christie's nods, he settled and returned his gaze to the RDX. "So, how did these folks make this RDX before anybody else?"

"Fuel tablets." At Mike's raised eyebrows Greg smiled. "Yep. Initially they developed the technique using fuel tablets from Tracy Kubiak's old stock from before the Ring of Fire. Apparently, she still had a few cases left. Anyway, they picked up a cheat sheet for RDX from somewhere and started making it. The real break, though . . . that came from Jena." Greg grinned and drew another packet from his bag and presented it to Mike.

"Gribbleflotz Essence of Fire Tablets?"

"Yeah. Maybe you don't know the connection between the Kubiaks and Herr Doctor Gribbleflotz? Anyway, Ted, Tracy's husband, discovered that their Dr. Gribbleflotz was making some kind of fuel tablet. So he got some and turned it over to the people making the RDX."

"So we can start volume production of RDX?"

"It depends on what you call volume, Mike. Kubiak Country Industries has built a facility just outside the Ring to make the fuel tablets. Actual production will depend on the demand. Ted said that there should be good demand from the soldiers who will want something that they can use to cook or start fires with. But for high explosives, the problem is still the pure acid needed to convert it from fuel tablet to explosive. Besides, neither they nor*Brennerei und Chemiefabrik Schwarza* want to touch volume high explosives. The*Chemiefabrik* guys are happy to license their methods to anybody who is interested." Greg paused to collect his thoughts, "The question then is, what's the government's priority here? Do we buy a license, set up a plant, and set money aside for widow's benefits? Or we can pay a premium and convince our contractors to up their production. The miners could certainly use it. So could the military. This decision is, as Frank says 'above my pay grade.' So, what do you want us to do?"

Dr. Phil Zinkens A Bundle

By Kerryn Offord

Jena, 1633

The new chemical "battery" was most interesting. Just by adding two electrodes of different metal into a glass container of weak oil of vitriol one could generate enough of the new electricity to light the small light bulb.

Dr. Phillip Theophrastus Gribbleflotz returned his attention to the up-time science book. The large printing and colorful pictures gave clear directions on the process and explained everything in the simplest of English. Just what was needed for the World's Greatest Alchemist, especially as he had only learnt English because those silly up-time females from the town of Grantville could only provide reference material in English.

Phillip looked back at his "wet cell battery." The zinc electrode was wasting away before his very eyes. He had been warned about this. He pulled the electrodes from the oil of vitriol and wiped them with a rag. Then he turned to the collection of chemicals the Grantville females had given him when they presented him with the up-time science books. One jar caught his eye. It was labeled "Zinc Zn." There was less than half a jar of the precious metal left.

With a heavy heart he turned back to survey his laboratory. There were a number of electricity experiments that really needed zinc. However, zinc was not available in Europe except as an expensive import from the distant East Indies.

Dragging his feet, Phillip made his way to his study. In there were all of his reference books. Maybe there was something in there about zinc.

* * *

There was nothing on sources of zinc in his library. He sighed heavily. He had been afraid that would be the case. He moved over to the window and looked out over the crowded streets of Jena towards the university. No. That would never do. He would not go begging those people for help. Phillip conceded defeat. He collapsed into his chair. Reached for his pens and ink. Pulled a sheet of paper from a drawer and sat and chewed the end of the iron tipped pen while he debated how to start the letter to Frau Kubiak. If any of the up-timers knew how to get zinc, he was sure Frau Kubiak would be able to obtain the necessary information. His only worry was what the dratted woman would ask in return.

Grantville Canvas and Outdoor, Mahan Run

Tracy Kubiak carefully placed the letter from Dr. Gribbleflotz on the kitchen table. She stepped back from it and walked around the kitchen. All the while, she kept an eye on the letter, expecting it to get up and bite her, or try to escape. She had had sufficient dealings with Dr. Gribbleflotz to know just how hard he must have found it to write that letter. The fact that there were no errors or blots suggested that it wasn't a first draft. A lot of care and attention had been invested in it.

Tracy searched high and low for her husband, calling out as she searched. She finally ran him to ground in his workshop. "Ted. There you are. Why didn't you answer when I called?"

Ted very carefully didn't say that he had answered. "What's the problem, Trace?"

"I just got a letter from Dr. Phil. He wants to know about zinc. What do we know about zinc?"

Ted smiled at his wife and shrugged his shoulders. "Somewhere between nothing and not a lot. What does he want to know?"

"He says he's afraid of running out of zinc for his electricity experiments. I think he wants us to find him some more."

"That's not going to happen. Every bit of spare zinc, even up-time coins, is being melted down for use in industry. They don't make it in Europe yet. They import it from the Far East, as far as I know. Do you want me to check out the library?"

"Please. If there's nothing else you need to do, I'd like you to see what you can find."

Ted smiled wryly. "So, what is it you want from Dr. Phil this time?"

"Actually . . ." She smiled back. "Nothing. I can't think of a thing, but it won't hurt to have Dr. Phil owe us. You never know. Maybe one day we'll get something really good out of him."

"Yeah, right." There was only a hint of skepticism in his voice. "I'll finish cleaning up in here then head

over to the library. While I'm out that way, I might as well drop in on the ammonia plant and see how Dr. Phil's crew are doing."

HDG Enterprizes, Jena

Dr. Gribbleflotz and his personal laborant, Hans Saltzman, carefully read over the large bundle of notes Tracy Kubiak had sent. They described zinc and the extraction process, but the notes created more questions than they answered.

"I shall have to journey to Grantville and examine the research material myself, Hans. Please see that everything is made ready."

"Of course, Herr Doctor. Will you be visiting the spirits of hartshorn facility?"

Phillip paused to think for a moment. "Yes. If I include an inspection of the facility, I will be able to claim the cost of the trip against the company."

"Very reasonable, Herr Doctor. Will you be requiring my presence on this journey?"

"No." Phillip shook his head. "Not unless you wish to come. You could visit some of the up-time facilities if you wish. I am sure Michael Siebenhorn and Kurt Stoltz will be only too happy to make arrangements."

* * *

Once in Grantville, his duty visit to the spirits of hartshorn plant complete, Phillip had set out to complete his real mission. Michael Siebenhorn, the ex-laborant in charge of the facility, had introduced Phillip to a most excellent specialist library researcher and a copyist to do the hard work of the actual library search and the taking of notes. While the two specialists visited the various libraries around Grantville, Phillip, with time heavy on his hands, had taken the opportunity to investigate the clothing and shoe stores of Grantville. Hans was left to amuse himself touring some of the up-time facilities

* * *

Jena

The copious notes assembled by the researcher and copyist sat in piles on Dr. Gribbleflotz' desk. Both Phillip and Hans worked away in silence, reading and taking notes.

"'Both sphalerite and calamine are ores of zinc.' Well, that is old news." Phillip looked across to Hans, a look of disgust on his face. "You would think, for the exorbitant fees those leeches charged, that they would tell me something I didn't already know. Why, I've made brass using both of those self same ores many a time."

"But, Herr Doctor. Read this." Hans waved the sheet he had just finished reading. "It says here that it is from the vapors of those ores that one can obtain the zinc."

"What? Let me see that." Phillip grabbed the sheet and quickly read it. He dropped his head into his hands. "So close." He looked up at Hans. "So many times I have been so close to discovering zinc. If only I had thought to trap the vapors. I would have earned my rightful place beside my great grandfather, the great Paracelsus."

"Herr Doctor, one of the notes says that the great Paracelsus named the metal zinken." Hans hurriedly flicked through the researcher's notes. "Yes, here it is."

Phillip read the note. "Then in honor of my great grandfather, from now on, I shall call the metal zinken."

Phillip started to walk around his study. "We will need to prove that we can isolate the zinken. Either of the ores will do for that. However . . ." Phillip paused to read from the sheet he held. " It appears that 'pure' oil of vitriol can be made by catching the vapors from the zinken ore sphalerite. As the process to isolate zinken is the same for both ores, we shall experiment with sphalerite."

Phillip stopped to read further. "I believe ten thousand*Pfennige* should be enough. According to this paper, that is sufficient to produce four thousand*Pfennige* of metallic zinken and two gallons of strong oil of vitriol."

Phillip made for the door. "Hans, start making a list of what else we will need while I instruct Frau Mittelhausen to place an order for some sphalerite. We will start designing the new retorts we will need when I return."

* * *

Phillip found his housekeeper-cum-business-manager in the kitchen. After stopping to slip a couple of cookies out of the cookie barrel, he approached her. "Frau Mittelhausen."

"Yes, Herr Doctor?"

"Frau Mittelhausen, please place an order of ten thousand*Pfennige* of sphalerite ore. I believe it should come from the Harz region. Please be sure to insist on only the best quality ore, and ask that it be delivered as soon as possible. For such a trifling amount the transport cost should not be excessive."

"I will pass on the order to Herr Ostermann when I collect the bread and pies from the bakery, Herr Doctor." Frau Mittelhausen added a note to her shopping list.

Ostermann Transport, Jena

"Good afternoon, Frau Mittelhausen. What can we do for you today?" Joachim Ostermann asked.

"Herr Doctor Gribbleflotz wishes to purchase some material from Harz." Frau Mittelhausen checked her shopping list. "Ten thousand*Pfennige* of sphalerite."

"Sphalerite, ten thousand*Pfennige* ?" Herr Ostermann checked to confirm he had heard correctly.

"Yes. Only the best premium grade ore mind, Herr Ostermann."

"Of course, Frau. For the good Herr Doctor, only the best of the best. For such a small amount the supplier might charge a premium price. Will that be agreeable?"

"Yes, Herr Ostermann. If you would prepare a contract, I will sign it when I return from the bakery."

December 1633, Ostermann Transport, Jena

Joachim Ostermann passed a horrified gaze along lines of pack mules carrying what the mule skinner leading them claimed was Dr. Gribbleflotz' order of sphalerite. "How did it happen?" he demanded of the world.

Hans Ostermann, his son, checked the bill of lading the skinner had presented. Confused, he looked at his father. "What is the problem, Papa? The order was for ten thousand*Pfundt* of premium ore, to be delivered as soon as possible. That is exactly what we have here."

"Let me see that." Joachim grabbed the bill of lading from his son's hand. A quick glance confirmed what his son had said. Someone, somewhere, had converted the order from*Pfennige* to*Pfundt* .

"How did you pay for the ore, Hans?"

"I sent a signed money order, Papa. Just like we always do. You saw me collect Frau Mittelhausen's signature before I took the authorization to the banker."

Joachim slumped against the first of the more than fifty pack mules that carried the premium quality ore and sighed. "Hans, my son. We have a problem. We could be bankrupted over this error."

"Bankrupted? But the Frau signed for it. We have a signed contract." Hans took time to have another look at the bill of lading. He waved it like a talisman towards his father. "Yes, Dieter correctly calculated the estimated cost of freight. So even the freight has been mostly paid. How can we be bankrupted?"

Joachim mopped his sweating forehead. "Hans . . ." He paused as he struggled to find the words. "Hans, the order should have been for ten thousand*Pfennige* , a little less than twenty*Pfundt* . Not ten thousand *Pfundt* . We have over-ordered by a factor of more than five hundred, and the freight is inflated more than a thousand fold. I do not know that Herr Doctor Gribbleflotz will accept the mistake."

"But Frau Mittelhausen signed confirming the order, Papa."

"Yes." Joachim shook his head. "Someone made a mistake. Somehow the order was prepared using *Pfundt* rather than*Pfennige* ." Suddenly Joachim jerked upright. His eyes opened wide. "That fool Beyer. It must have been him. Dr. Gribbleflotz' order was the last one he processed before he became so ill he had to be taken to Saint Jakob's infirmary. Come, let's check his desk."

* * *

Hans passed a sheaf of papers towards his father. "Papa, I think this explains what happened."

Joachim read the notes taken by the late Dieter Beyer. He could only nod his head in agreement. "It is obvious what happened. There is a drop of something, I hope it is just water and not whatever killed Dieter, on the word*Pfennige* . It is smudged so badly that it could be read as either*Pfennige* or*Pfundt* ."

Hans nodded. "He hadn't been with us long enough to be aware of the small units Herr Doctor Gribbleflotz uses and read it as ten thousand*Pfundt* ."

Father and son exchanged grim looks. "Well, we know how the mistake was made, but that doesn't get us any further forward. There is no way we can repay the cost of the ore and its priority transport."

"But, Papa! It was an honest mistake, and we have a signed contract."

"I know, son. But a signed contract will not save our reputation. I will have to go to him, cap in hand, and ask for understanding."

HDG Enterprizes, Jena

"Ten thousand*Pfundt* ? How is this possible? What was the cost?" Frau Mittelhausen all but roared.

Originally, when he discovered that Dr. Gribbleflotz was out of town, Joachim Ostermann had felt happily confident to be dealing with the housekeeper. However, that was before he felt the full force of an outraged Frau Mittelhausen. Anybody would have thought the money spent had been her own.

"Frau, it was an honest mistake. My clerk was ill when he prepared the contract. However." Joachim was careful to emphasis this part. "The contract you signed clearly stated ten thousand*Pfundt* . If you had read the contract before signing it, the problem would have been detected and easily corrected before the order was sent out."

Miffed at being blamed for someone else's mistake, Frau Mittelhausen looked down her nose at Joachim. "And where is this clerk who so conveniently made such a mistake?"

"Dead. Dead of fever at the infirmary that same night."

Stymied, Frau Mittelhausen sighed heavily. "Herr Doctor Gribbleflotz will not like this."

Joachim nodded his head in agreement. "No, he will not be happy. However, I am hoping that we may come to some kind of arrangement. If Dr. Gribbleflotz were to honor the contract, I am willing to refund some of the cost of transporting the ore. I am sorry, Frau, but that is the best I can do. The only other alternative is I try to sell the excess ore elsewhere. There have been rumors that the staff at the University might be interested."

Joachim sneaked a quick look at her when he said that last. There were no such rumors, yet. However, if necessary, he would start one himself. One never knew. The university faculty might even want to buy the ore. The animosity between Dr. Gribbleflotz and the faculty of the University was well known and a source of constant amusement to the good people of Jena.

"Humph!" Frau Mittelhausen eyed Joachim skeptically. "I will leave it for Herr Doctor Gribbleflotz to decide."

"That is all I ask, Frau. A fair hearing with Herr Doctor Gribbleflotz."

* * *

"Herr Doctor Gribbleflotz. Herr Ostermann has the sphalerite ore you ordered." Frau Mittelhausen had been waiting for Phillip to return to his office.

"At last. What took so long? I expected delivery weeks ago."

"There has been a slight mix up, Herr Doctor."

"What? A mix up? It is the ore I ordered?"

"I believe the ore is sphalerite, Herr Doctor, and all premium quality. The problem is the quantity. There

is significantly more than you asked for."

"Where is it? Where is my ore? I wish to start my experiments immediately."

"Herr Doctor, Please listen to me. The ore is still at Herr Ostermann's. I have declined to take delivery of it."

"Declined to take delivery? Why ever not?"

Frau Mittelhausen sighed heavily. Getting through to Herr Doctor Gribbleflotz was often a trial. "Because it is significantly more than you asked for, Herr Doctor. I felt that only you could acknowledge delivery."

"Only I could acknowledge delivery?" Phillip paused, something of the sense of what Frau Mittelhausen was trying to say finally penetrated. "How much ore did Herr Ostermann try to deliver?"

"Enough to require some fifty pack mules, Herr Doctor. Ten thousand*Pfundt* ."

"But that's . . ." Phillip looked at Frau Mittelhausen in shock. If Herr Ostermann had tried to deliver that much ore . . . "You haven't already paid for the ore yet? Have you?"

"Yes, Herr Doctor. I signed the contract and the request for the banker's draft at Herr Ostermann's at the time of ordering. Apparently, they were correct for the amount of ore delivered."

"Didn't you . . ." Phillip started, only to stop. Of course Frau Mittelhausen hadn't checked the documents. If she had, she would have detected the mistake. He couldn't really blame her for not checking. He himself usually signed without really confirming that the amounts were correct. It wasn't as if Joachim would have deliberately inflated the order. His livelihood depended on his honesty.

"Someone at Herr Ostermann's made a mistake processing the order?"

His housekeeper nodded. "Herr Ostermann says it was a new clerk, ill with fever. The order form was smudged and the clerk calculated the order based on quantities he normally dealt with."

Phillip collapsed into a chair opposite Frau Mittelhausen and buried his head in his hands. "With a signed contract Herr Ostermann is legally entitled to keep our payment, unless . . ." Phillip looked up hopefully. "Unless Herr Ostermann can find an alternative buyer. Is there a chance that Herr Ostermann can find a buyer for the excess ore?"

"Herr Ostermann suggested that there were rumors that the Jena faculty might be interested, Herr Doctor."

Shocked, Phillip shot to his feet. "*No*. I will not let*them* get ahead of me in the discovery of zinken."

"Herr Doctor, I suspect your reaction is exactly what Herr Ostermann is hoping for."

Phillip nodded agreement and lowered himself back into his chair. "Yes. He is probably hoping that I will not take the risk." He slammed his fist onto the arm of his chair. "He is right. I am unwilling to risk that the university might be interested. If Herr Ostermann is willing to keep the mistake secret, I will accept the ore. Please confirm delivery with Herr Ostermann, Frau Mittelhausen."

Frau Mittelhausen issued a loud sniff of disgust. "You shouldn't let Herr Ostermann get away with his

incompetence so easily, Herr Doctor."

"You may renegotiate a new price if that will make you feel better, Frau. But please take delivery of the ore. My research is already much delayed. Why, there is the chance that someone else, maybe even from the university, might isolate the zinken before I do."

"If you insist, Herr Doctor. But what are you going to do about the drain on company finances? Frau Kubiak is sure to question the magnitude of the expenditure."

"How much did the ore cost, Frau?" Phillip had an idea that it was going to be a truly terrifying amount.

Frau Mittelhausen answered by passing over the statement from Ostermann transport. The long string of zeros had Phillip almost choking.

Defeated for the moment, Phillip pulled himself to his feet and stumbled up the stairs to his rooms. In the draft created by his departure, the statement gently floated to the floor. Frau Mittelhausen watched him struggle up the stairs. Then, with a sigh, she picked up the statement and filed it.

December 1633, HDG Enterprizes, Jena.

"I have called you all to meet here to address an emergency situation." Frau Mittelhausen looked around the collected faces of Herr Doctor Gribbleflotz's senior laborants. All of them had started with the original baking soda production line. These were the smart ones. Some of them were responsible for the production lines producing the various products of HDG Enterprizes and Kubiak Country Industries.

"Recently, at considerable cost, Herr Doctor Gribbleflotz took delivery of ten thousand*Pfundt* of premium quality sphalerite. That purchase has created an enormous hole in the accounts. Such a big hole that, unless something is done, we will not be receiving any bonus this year, and probably not next year either."

"Why would Dr. Gribbleflotz purchase so much ore, Frau Mittelhausen? That is much more than he would ever need for his experiments," Michael Siebenhorn asked.

Frau Mittelhausen looked everywhere but at Michael. "A trifling mistake was made in the preparation and confirmation of the order. But the how is no longer important. The Herr Doctor has barely left his laboratory for the last two weeks. Isn't that right, Hans?"

Hans Saltzman, Dr. Gribbleflotz's trusted personal laborant of nearly two years nodded. "Yes. Herr Doctor Gribbleflotz feels that he is responsible for the problem. Even as we speak he is driving himself hard making the zinken and oil of vitriol."

"Zinken?" Maria Anna Siebenhorn, Michael's younger sister, looked up with some excitement. "Chemical symbol Zn?" They were all aware of the way Dr. Gribbleflotz used his own naming methodology.

"Yes. 'Zn.' Why? Is it important?"

"Yes, Hans. It is important." Maria Anna looked around the dinner table. "You all do know that I'm working for a company making percussion caps?" The people at the table nodded. "What you might not know is that the company has up-timer partners."

Kurt Stoltz lifted his eyebrows in a scowl. "Some of us know, and are fully aware that the up-timers are happy to let down-timers risk their lives with fulminate of mercury. You don't see them risking their own lives."

"Kurt, settle down. They pay well and they provide the best safety equipment they can. I earn over a hundred dollars a day for less than five hours work. Where else can I earn that kind of money, plus free bed and board in an up-time house?" Maria Anna turned back to the group. "Anyway, the up-timers are really interested in zinc. Hans, can the Herr Doctor really make pure metallic zinc?"

"Zinken, Maria Anna. He calls it zinken. Apparently his great grandfather Paracelsus first used that name for the metal. Yes, he has managed to make zinken and oil of vitriol. However, he will take years to convert all of the ore to zinken and oil of vitriol."

Frau Mittelhausen stood to attract attention. "That is why I asked you all to meet here. The Herr Doctor is good at what he does. However, he works only in small amounts. I have been following the progress of all of you and the facilities you are running. I have noticed that production volumes have increased while running costs have declined." Frau Mittelhausen looked almost fondly over the young faces. "I can only assume you have been able to modify the processes so as to increase batch sizes."

"We have introduced a few continuous processes, Frau Mittelhausen," Kurt admitted. Michael and a couple of others nodded. The up-timers had been very helpful when it came to improving the production techniques.

"My question of all of you is: can you take whatever process Herr Doctor Gribbleflotz has created and increase the volumes?"

"Will Herr Doctor Gribbleflotz let us help him?" Maria Anna asked.

In silence everybody waited for Frau Mittelhausen to respond. Herr Doctor Gribbleflotz was a proud man. Would he accept help from his students?

With a resigned sigh, Frau Mittelhausen looked up the stairs towards Herr Doctor Gribbleflotz's laboratory. "I will ask."

February 1634, Kubiak Country

"Hey, Tracy. Wasn't the geek working on zinc?"

"Tasha, please don't call him 'the geek.' Yes, Dr. Phil was interested in zinc. Why do you ask?"

"But he is a geek. Okay, I'll try not to call him a geek. Anyway, there's an article in the newspaper by one of those Jena doctor guys. He's written something about how to make zinc. Do you think he's beaten Dr. Phil to the punch?"

"Could you show me the article, Tasha?" Tracy looked over Tasha's shoulder.

"There, that one." Tasha pointed out the article before she passed the folded newspaper to Tracy.

It took only a few minutes to read the article. Tracy grimaced. Dr. Phil was not going to be happy. It was possible that the author had only been interpreting what he had found in up-time books, but the way the article read did suggest the he had actually tried the process.

"Oh, heck. I think a trip to Jena might be on the cards. Dr. Phil isn't going to be happy having a Jena academic alchemist beating him to produce zinc."

February 1634, HDG Enterprizes, Jena

"Ted. Why do you suppose everyone is looking at us so guiltily?"

"I have no idea, dear. Do you suppose we could just ask Frau Mittelhausen how Dr. Phil is taking the publication of that article on the secrets of zinc?"

"But, Ted. Haven't you noticed the people? There are too many laborants. I'm sure there weren't this many last time I visited. What about when you last visited?"

"Pardon? Oh, the new faces. Well, Dr. Phil was working on his fuel tablets. I'm sure he's just training up some more people to work on them."

"The fuel tablets . . ." Tracy nodded as if the information confirmed something, "Yes. That would explain why I saw Michael Siebenhorn and Kurt Stoltz."

"What?" Ted searched around the central compound of the HDG Enterprizes facility. "Both Michael and Kurt?"

"Yes. Over by the west wing. Why? What's so special about those two being here? I thought they were two of the company's best production alchemists."

"They are. But converting Dr. Phil's test tube level production to volume production shouldn't need both of them. Besides, if they're here, who's minding the store back in Grantville? No. Something is going on. Come on. I want to talk to Dr. Phil and find out." Ted strode off toward Dr. Phil's office.

* * *

"Herr Kubiak, Frau Kubiak. How can I help you?" Frau Mittelhausen's not inconsiderable bulk blocked their way into the office.

"You can tell us what is going on, Frau Mittelhausen. Why are both Michael and Kurt here in Jena? What is so important that both of them had to be called in from Grantville? And why weren't we notified?" Tracy's voice was cross.

Frau Mittelhausen looked from Ted to Tracy. They were obviously after answers and wouldn't leave without them. With a heavy sigh of resignation, she guided them into the office.

"Frau Kubiak, if you will remember, Herr Doctor Gribbleflotz and I can sign for goods without limit . . ."

"Yes, yes. I know that. With you both in Jena, it was silly to require everything to go through Grantville. Please get to the point."

"Frau Kubiak, that is the point. If either the Doctor or I sign a contract there is no further check. There is no book keeper to question any purchase . . ."

Ted frowned. "Hold it. Are you suggesting either you or Dr. Gribbleflotz have ordered something you

shouldn't have?"

"No, Herr Kubiak. The order was for sphalerite ore for Dr. Gribbleflotz's zinken experiments. No. The problem was not what was ordered, but rather, how much was ordered."

Confused, Tracy searched Frau Mittelhausen's face. "But why would there be a problem? We have never complained about what Dr. Gribbleflotz has ordered yet."

Frau Mittelhausen went to a cabinet and removed a folder. Opening it she selected a sheet of paper and passed it to Tracy. Tracy took a while to read the invoice, finally reaching the bottom where the costs were tallied. Horrified, she looked at Frau Mittelhausen. "You paid that much for zinc ore?" She waved the invoice in the air. "Why?"

"There was a mistake, Frau. The doctor only asked for a fraction of the amount. Such a quantity, barely a small shopping basket full, should have been easily conveyed by the fastest method for only a few dollars. However, the mistake resulted in ten thousand*Pfundt* being delivered by pack mule." Frau Mittelhausen stopped speaking, unable to convey in words the significance difference in cost of transporting a small basket of ore as part of someone else's cargo compared with the cost of more than fifty pack mules and their handlers.

"The actual cost of the ore, Frau, was a mere pittance compared with the cost of transporting it all the way from the Harz Mountains."

Tracy slapped the invoice onto a table. "How badly does this effect the books, Frau Mittelhausen? Are we in debt?"

"No, Frau Kubiak. We had sufficient reserves from the sales of Gribbleflotz Sal Vin Betula, although expenses have increased considerably."

Tracy winced. Sales of Dr. Gribbleflotz' Sal Vin Betula, better known as Dr. Gribbleflotz' Little Blue Pill of Happiness, had been very profitable. So profitable that others had started making aspirin in competition. Prices were stable at about a dollar a pill, but they had been forced to invest in advertising to maintain market growth.

Ted read the invoice, then turned to Frau Mittelhausen. "What is being done with the ore?"

Tracy stared at her husband. That was a very good question. Somewhere, there was something like five tons of sphalerite. If Dr. Gribbleflotz could extract the zinc, then maybe all was not lost. "Yes, Frau. What is Dr. Gribbleflotz doing with all that ore?"

"Please, follow me and I will show you."

Tracy and Ted followed Frau Mittelhausen to the wing where Tracy had seen Michael and Kurt.

They were greeted by silence when they entered the building. Young men and women lining the room turned and looked at them. Accusing looks were directed towards Frau Mittelhausen.

Michael Siebenhorn made his way towards them. "Frau Kubiak, Herr Kubiak. How can I help you?"

"We would like to know what is being done with the sphalerite that was delivered here late last year."

With a guilty look at both Ted and Tracy, Michael called for the laborants to return to work. "You know then? It wasn't Dr. Gribbleflotz' fault. It was an honest mistake."

"Michael, what have you been doing with the ore?" Ted asked impatiently.

"We have been refining it."

Tracy perked up. "All of it? You've refined all of that ore?"

"Nearly. We are on the last couple of bushel baskets now. Come, follow me and I will show you what we have."

Bubbling with hope, Tracy dragged Ted along as she followed Michael. Michael unlocked the door to the storeroom and stood back to let them look at the treasure within.

"What's in those big bottles?" Ted asked.

"Strong oil of vitriol. Actually, very strong oil of vitriol. We think it is over ninety percent pure. Herr Doctor Gribbleflotz is still testing it."

"How much do you have?"

"About fifteen hogsheads, Herr Kubiak."

"And the metallic zinc?"

"About four thousand*Pfundt* of zinken, Herr Kubiak."

Ted laughed. "Zinken? Is that what Dr. Gribbleflotz is calling it?"

"Yes, Herr Kubiak. It is in memory of his great grandfather, Paracelsus. Zinken is the name Paracelsus gave the metal."

Ted nodded. He drew out a pencil and paper and began recording the contents of the store room. "Anything else?"

Michael smiled. "Yes, Herr Kubiak. There is also some four hundred guilders worth of other metals and compounds."

Ted and Tracy tried to calculate the worth of the goods. "The value of everything you extracted from the ore is probably enough to cover the cost of it, with something left over. But, what about the cost of recovery? What were those costs?"

Michael shrugged. "Too much, I am sure, Frau Kubiak. We worked with great haste, and with considerable secrecy. Both of which added to our costs. However, we have been developing our technology. We now know how to recover the metals and compounds from sphalerite."

"And what good is this technology, Michael?" Tracy asked.

Smiling smugly, Michael guided them out of the storeroom. "Frau Kubiak. With our technology we can smelt zinken. Other people . . ." Michael paused to look at Ted and Tracy. "Did you read about the

doctor on the Jena faculty who isolated the zinken?" They nodded. "Other people might know the secret of zinken, but they do not know how to recover not only the zinken, but the sulphur and the other metals and compounds. We at HDG Enterprizes have developed the necessary technology. The more we can recover from the processing of the sphalerite, the more economic the process becomes. We have already sent out feelers for partners. We believe we can construct a smelter outside the city of Halle. There is ample coal near the city that can be used to smelt the ore, and transport of the sphalerite from the Harz Mountains should be affordable, because we can use barges to float the ore down the river to Halle."

"Nice. But why the secrecy? Why didn't you notify Tracy and me?"

"It is the Herr Doctor. We had to prove the technology first, otherwise Herr Doctor Gribbleflotz could have been a laughing stock. At least, that's how it all started." Michael smiled in reminisance. "There is also the fact that we currently hold the largest supply of pure metallic zinken in Europe. We have an agent exploring the prospects of 'selling short.' We think we will be able to maintain the current high price as long as people don't know we are producing zinken locally."

Tracy snorted. "How do you hope to keep your activities quiet? Surely people will see your production facilities?"

Michael smiled. "That is the thing with the new technology, Frau Kubiak. That academic, he talked of calamine. We are using sphalerite. If we used calamine, then people might suspect we were making zinken. But sphalerite? From sphalerite people will see us making and selling oil of vitriol. It is an important and valuable chemical. If we are careful, we can keep the zinken processing secret." Michael's smile grew triumphant. "And, of course, that will keep the local price high. High enough for the maximum profit."

"What about those partners you were talking about?"

"Only a few of them know of the zinken. Most of the potential partners are either miners looking to sell their ore, or people interested in the oil of vitriol and other by-products. Only fifteen people, including you two, know of the zinken."

Ted and Tracy exchanged glances, then turned their attention back to Michael. "You really think you can make a going concern of a zinken smelter?" Michael nodded in answer. "Then . . ." Ted turned to check that Tracy agreed. She nodded. "How can we help?"

"Money." Michael rolled his eyes. "And if possible, Herr Kubiak, can you get some more of those 'catalytic converters?'"

"How much money?" Tracy asked.

"What do you want the catalytic converters for?" Ted asked.

"The converters improve the yield of the oil of vitriol, Herr Kubiak. Frau Kubiak, we don't know how much money, but it will be a lot. We may have to ask that you mortgage the HDG Enterprizes facility and the ammonia facility. Mining and mineral processing is very expensive. However, the potential returns are enormous."

* * *

"You know, Trace, I wouldn't have thought Dr. Phil had it in him to build up that kind of personal

loyalty."

Tracy looked back over her shoulder at the HDG Enterprizes facility. "It was a bit of a surprise. Maybe there's more to our Dr. Phil than meets the eye."

Essen Steel, Part 1
Crucibellus

By Kim Mackey

Chapter One

By early morning they had passed beyond the siege lines and lay hidden in a copse of woods four miles from the Magdeburg gates.

"We will travel only at night for the first few days," Henri said, "and hide during the day. Best not to tempt fate."

That afternoon, after sleeping most of the morning, they watched the huge pillar of smoke boil up into the sky from the direction of Magdeburg. Henri, her father's friend, and an almost uncle, turned grim. "It is much worse than even I suspected it would be. They should not have set fire to the town. Magdeburg alive could sustain them. Magdeburg destroyed will force them to forage into the countryside. We will have to move as soon as we can tonight."

As Colette Dubois watched the black smoke rise into the sky she imagined she could hear the screams of the women and children on the breeze. She shuddered. Raped and murdered. Thousands of them. And now Tilly's wolves would be scouring the outlying districts for more plunder and victims.

They rode for days, constantly on guard and careful to avoid concentrations of other travelers who might attract the attention of soldiers. Finally they stopped at an abandoned house on the outskirts of a village so that Henri could get more supplies. Colette and Colas, her brother, hid in the woods near the house and waited, tying their horses far enough back so they would not whinny in greeting to any horses passing along the road.

In the late afternoon they heard hoof beats on the road. Colette quickly grabbed Colas before he could jump up and expose himself. "What are you doing?" she hissed. "Wait and see if it is Henri first."

Crouching back down, Colette and Colas watched as half a dozen soldiers kicked in the door of the house and began to ransack it.

So stupid, thought Colette. There was nothing of value left in the house. But the soldiers seemed to delight in smashing what little furniture there was. Two of the men began a more systematic search of the outside yard and were beginning to work their way steadily in Colette's direction. If they came too close . . . Colette shivered. She knew what her fate would be. Death, if she was lucky. And Colas wasn't strong enough to survive even a week in a soldier's camp, given his recent sickness.

It was the light that saved them.

The soldiers were twenty yards away when the sun spawned on the earth. A titanic wave of sound rolled

across the house. Terrified, the soldiers quickly mounted their horses and galloped off.

Colette watched them go. She breathed a sigh of relief. Then felt Colas' tug at her sleeve.

He pointed. "Where did the hill go?"

Colette shivered again. A sign from God. But what did it mean?

It was an hour later when they once again heard hoof beats on the road. This time it was Henri. He had no supplies and he seemed to be favoring his left shoulder.

Colette saw the blood on his jacket. "You've been shot!"

Henri dabbed at the wound. "It's nothing. No bones broken, not much blood. A band of cutthroats. We'll have to ride on for supplies." Henri gestured toward the house. "What happened here?"

Colette shook her head. "I don't know. There were soldiers, half a dozen of them. They would have found us but for the light. It was like the sun was rising from the earth. The sound nearly deafened us."

They spent the night several hundred yards deeper in the woods.

* * *

"Josh! Your move, boy."

Josh sighed. Normally it took his grandfather at least 15 minutes to make a move in the middle game. He'd thought there would be plenty of time to use the phone in the kitchen for a quick call to his sister-in-law.

"What was that?" Michelle asked.

"Gramps. We're playing chess. It's Sunday after all," Josh said.

Josh's grandfather always hosted the weekly parish chess club. Josh had been involuntarily inducted when they heard about his U.S. Chess Federation master rank. This Sunday, of course, the group was limited to the real chess fanatics who were willing to incur Vince Masaniello's wrath by skipping out early on his fortieth wedding anniversary party.

Josh could feel his sister-in-law smile. "You going to let him win this time?"

"Not likely." Josh chuckled. "He knows I'm still a master. If I let him win I'd never hear the end of it. But at least I can make it seem like a struggle."

"Tell that French witch you're busy, boy. I just made the move of the century! No way you're getting out of this one!"

"Oh great," Josh said. "Now you're the French witch."

Michelle laughed. "Tell Joe he's a surly old curmudgeon."

"Michelle says you're a surly old curmudgeon, Gramps."

Joe snorted. "She's got that right."

"Hey, Lou," Josh said, "is Gramp's move that great? Maybe I should stay in the kitchen."

He heard the pause in the speed chess game and knew that Lou Giamarino was looking over the board.

"Yeah. You're in trouble all right," Lou said dryly. "Looks like he bought your sacrifice. Probably mate in five for you."

Josh laughed and listened for a minute as the three old friends began arguing over Joe's last move.

That should keep them busy, he thought. "Did you get all of the books sent, Michelle?"

The company Josh worked for had received the contract from the West Virginia Department of Transportation to investigate the old Baltimore & Ohio railroad route for the "rails to trails" program. Josh had pushed hard to get the job, knowing that he could save a lot of his per diem by staying with his grandfather in Grantville.

But, as a quid pro quo, Josh's boss had demanded that he prepare a paper for a symposium, any symposium, involved with industrial archaeology. Josh had discovered that the twenty-sixth International symposium of the International Committee for the History of Technology was looking for an American to present a report. Since he worked mainly in Pittsburgh, Josh decided that the early history of steel would be just about perfect.

Initially, Josh had made good progress on the paper for the symposium, gaining access to a variety of records from Pittsburgh steel companies. He had also done extensive spelunking on the internet, vacuuming all kinds of files onto his laptop's hard drive. Early on, he discovered "The Sheffield Connection" in the Pittsburgh crucible steel industry, but the only decent sources available for deep background were dusty nineteenth-century books not found in the United States. Taking advantage of his sister-in-law's upcoming trip to London and Paris, he asked her to air express some of the books he had selected.

"Yes, they've all been sent," Michelle said. "Didn't you get them yet?"

"No, just one package with the two history books. The rest are probably lost in some DHL warehouse in New York. If they aren't here by Wednesday I'll run their tracking numbers down. The B & O survey should be wrapped up soon and then I can really get working on the paper for the symposium." Josh heard some noise from the other end of the line. Daniel's voice.

"Oops." Michelle laughed. "Someone wants to say hi."

"Josh!"

"Daniel! How's my favorite nephew doing?"

Josh smiled when he heard Michelle say, "Speak French, Daniel."

"*Josh, grandpere m'a amené voir Notre Dame*."

"*C'était amusant?*"

"Josh,*c'est une cathédrale* ," scolded Daniel. "*Plutôt ennuyeux. Mais les gargouilles, ça, ça me plait.*"

Josh grinned. "*Alors, peut-être la Tour Eiffel te plairait plus. Laisse-moi parler à ta maman maintenant*."

"Okay, Josh. See you."

"Later, Daniel."

Michelle came back on the line.

"Got to go, Michelle," Josh said. "I'll call again when I get back to Pittsburgh.*Je t'aime.* "

"*Je t'aime au . . .*"

The phone went dead at the same time a brilliant white light lit the sky and a distant sound of thunder seemed to echo across the hills. For a second Josh stood there, stunned. What the hell?

"What the hell was that?" his grandfather yelled from the living room.

"I don't know, Gramps. But both the power and the phone are dead."

Lou and Bart came into the kitchen, both with vaguely worried expressions on their faces. "The phones went out at the same time as the power?"

Josh nodded.

Bart shook his head. "Odd. The phone system is supposed to have its own power supply. Think I'll go take a look around town to see who's in the same boat. Want to come along, Lou?"

"I'm with ya." Lou turned towards the living room. "We're taking off, Joe. We'll call when the phones start up again."

"Party poopers," Joe grumbled.

Lou grinned. "Take care of the old man, Josh. He's getting a might touchy in his dotage."

"You ain't no spring chicken yourself, Louis Giamarino!"

Lou laughed and waved to Josh as he and Bart went out the back door. "Later, Josh."

Joe yelled from the living room. "Damn. Josh, come finish the game and we'll wait it out, whatever it is. But open the curtains so we have some more light."

"Come on, Gramps. Let's go find out what's going on. Maybe it's something serious."

Joe snorted. "Forget it, boy. Can't be anything that bad. Besides, I still think I've got you cornered here, no matter what Lou says."

Josh sighed and glanced out the kitchen window. Odd, the sun seemed to be in a different direction than he remembered it being. Josh shrugged and walked back into the living room.

* * *

For Colette, Henri and Colas, the strangeness started again when they came across the road. Colette had been lost in thought and did not realize they were on a road until she noticed the change in the sound of the horse's hooves.

"Stop!"

Colas and Henri reined in their horses and watched as Colette slid off her horse and squatted to stare at the black-topped road.

"What is it, Colette? What's wrong?"

"Think, Colas. Where did this road come from? Look at it!"

Colas nodded. "It is very nice. Nice and wide. And very smooth."

Colette got to her feet and looked to the south. The road disappeared around a curve half a mile away. Colette took out her dagger and dug a bit of the black stuff out of the road. She rolled some of it on her fingers. Sticky. She sniffed her sample, then tasted it with her tongue. Tar. It was tar of some kind.

Colette stared at the road. "Henri? Don't you see it?" She paced the width and looked at the edge. She rolled some of the gravel and tar in her hand again.

"It's about twenty feet wide, and perhaps a little more than a half foot thick." Her eyes closed for a moment, her mind occupied with calculations. When Colette got her answer she shook her head.

No, that's impossible. She looked at the road again, stamped on it with her foot.

Definitely real, she thought wryly.*Not impossible* .

By now Henri and Colas were staring at her.

Henri cocked his head in puzzlement. "See what? It is just a road. A very good road, true, but still . . ."

"Henri, this road uses more tar for every mile than the annual production from Finland! How rich are these people?"

Henri opened his mouth, then shut it. He understood now what Simon Dubois had meant when he said he was sometimes afraid of his daughter. She thought . . . differently.

Colette looked again to the south and noticed that the road did not follow the exact curve of the hill but cut through a portion of it. It was like a chess problem. Colette was fully focused, gnawing at it like a hungry dog gnaws at a soup bone.

Colette studied the road more carefully. How was it made? Too smooth for slaves or other human labor. Too perfect.

"Machines of some kind," she muttered to herself, "definitely machines. Wherever this road goes we will find machines."

Henri stared at Colette again and then shook his head. "Should we stay on the road?"

Colette nodded. "Yes. But on the side, I think. This road is used for more than just carts and wagons."

They followed the road for another mile, passing several houses before Colette's words came true. They could see a river and another road that intersected the one they were on. They were several dozen yards from the intersection when a square metal box on wheels came from the right and moved rapidly through the intersection. The horses spooked slightly at the noise of its passing.

Colas' eyes were as round as saucers. "Was that a machine?"

Colette nodded. True, she had expected something, but the reality of it was certainly different than she had imagined. Especially the speed.

"Did you notice the man inside, Henri? I think he was guiding it, like a farmer guides his wagon with reins."

Henri nodded. "What do we do now? Follow it? It's at least heading in the direction of Saalfeld."

"Yes," Colette said. "But carefully. You saw how fast that machine moved."

After another mile they found themselves looking at a large rectangular building. They watched from the edge of the woods for almost an hour. Many of the people moving in and out seemed to be young, under the age of twenty. But all appeared to be well-fed and in excellent health. Some left or arrived on two-wheeled vehicles that they steered with their hands. Others got into the metal machines which moved off with loud noises. The machines came in a variety of styles and colors but Colette noted certain commonalities. Every one had four black wheels with a metal looking center. And when they started and moved every one seemed to emit smoke to a greater or lesser degree.

Occasionally words were shouted loud enough for them to hear clearly. Colette realized that all of the people she saw seemed to be speaking English.

"English?" Henri said, when Colette told him. "What is a colony of Englishmen doing in the middle of Thuringia?"

Henri winced when he moved his shoulder. The bullet was still in there. Colette knew they would have to get to a surgeon soon. It needed to be removed. With all of these machines the Englishmen seemed to be master mechanics. Perhaps they had good surgeons as well.

Colette smiled. "Let's go find out. But pretend to know no English. We may find out more if they think we don't understand their language."

"That will not be difficult," grumbled Henri. "I don't know any English. And how is it that you do?"

"Papa hired an English Jesuit, Father Line, to teach me mathematics. I asked him to teach me English as well so I could talk to the merchants who sometimes come to Liege. After learning Latin, Dutch, and German, it wasn't too difficult."

Colas hesitated a moment. "Are you sure, Colette? Maybe these Englishmen are Tilly's soldiers."

"Colas, have you seen any weapons? Any weapons at all?"

Colas shook his head.

"Soldiers would have weapons. These people act as if they are safe," Colette said. "If Tilly's or Hoffman's soldiers were anywhere about, these people would be armed and barricaded or acting with fear. And if they do not know of Tilly's soldiers, then we can obtain their gratitude by warning them."

Colette got to her feet and motioned to Colas and Henri. "Let's go. Henri, keep your sword sheathed. When we get close, start waving."

As they approached the building several of the young people stopped to watch them. When Colette waved at them, they waved back. She heard bits and pieces of their conversation as she got closer.

" . . . Jeez he's big . . . Be great power forward with those shoulders . . . She's pretty . . . looks like one heck of a sword . . ." What was "power forward," Colette wondered.

They seemed friendly enough. Colette considered a moment.*"Excusez-moi, savez-vous s'il y a un chirurgien par ici?"*

An older boy turned and motioned for a younger blonde-haired boy with glasses to step forward. "Sounds like French to me. Mark, you better handle it."

"My name is Mark." The boy's French was hesitant. He pushed his glasses up his nose. "But I do not speak French well. Would you like to speak with my teacher, Madame Hawkins?"

"Yes, please," replied Colette.

Mark led them inside the building and motioned for them to wait. In less than five minutes Nicole Hawkins arrived. Colette quickly explained their story to Nicole and asked for a surgeon, pointing to the dried blood on Henri's shoulder.

"We have a makeshift hospital right here. Other refugees have been injured, some seriously. Please come with me. Dr. Nichols will take a look at that for you."

The surgeon was an older man, a Moor, who acted in a very competent manner. Once Henri had his jacket and shirt off, Nichols probed and pushed at the wound, watching Henri's face as he did so. He had Nicole translate for him and Colette tried to follow his English.

"The bullet is in there and it has to come out. You already have signs of infection and we will have to clean out the wound channel." Nichols cocked his head at Henri. "How old are you?"

"Forty-nine." Nicole Hawkins translated.

Nichols nodded. "We'll want to keep you under observation for a couple of days to make sure no infection is starting after we operate."

"His immune system isn't as good as a younger person's," Colette heard Nichols mutter. "Better safe than sorry."*What was an "immune system"?*

Nichols looked at Nicole. "Where are they staying?"

Nicole shrugged. "No idea. Let me ask them what they want to do."

When Nicole addressed the question to Colette, Colette thought for a moment. "Is there a Catholic Church here? Perhaps the priest has room for us."

Nicole nodded. "Excellent idea. Yes, the churches are opening their doors to refugees. And if you're Catholic, you'll be more comfortable there. I'll drive you myself."

The next few days went by like a dream. Colette went on numerous walks around Grantville. She and Colas visited Henri after his surgery. He was grumpy about staying at the hospital. Dr. Nichols told her, through Nicole Hawkins, that it was necessary to be sure the wound did not become infected, especially seeing as their supply of antibiotics was limited.*What were "antibiotics"? Anti-living? It does not make sense.* But Nichols had assured her that Henri would be released by Thursday evening.

* * *

It was only after the town meeting on Wednesday that the emotional impact of the event everyone was beginning to call the "Ring of Fire" began to hit home for Joshua Modi. Josh was driving Joe back to the house. Both were lost in their own thoughts.

I'll never see my family again, Josh thought. The tears started to come but he forced them back.*Got to be calm, for Gramps' sake.*

The discussion he'd had with Doc Adams had made it clear that there was little that could be done for Joe's diabetes. His only living relative in this universe, his only family inside the Ring of Fire, was going to die. And there was nothing—absolutely nothing—he could do about it.

As they pulled into the driveway of Joe's house on Turnbull Street, Josh cleared his throat. "Gramps? How much insulin do you have?"

"About a four month supply," Joe said calmly. "But I'm giving half of it to David Miklos, the butcher."

"What? Gramps, you can't do that, damn it!"

"I can and I will, Josh. David and I use the same type of insulin but he was just getting ready to order some more when this damn Ring of Fire hit. He has less than a three week supply. And he has a family, Josh."

Joe patted Josh's hand. "I've lived a long, happy life Josh, and I'm seventy-five years old. David is under thirty. He deserves a few extra months with his family. Now come inside. I've got some things to show you."

Josh wanted to argue with his grandfather but he knew it would be useless. And Josh understood how precious the extra time might be for David's family.

* * *

Joe led Josh through the house and down into the basement. The basement was crammed with all kinds

of things: a set of barbells, a workout bench, canning jars, three or four toolboxes. Josh spotted two boxes labeled "Josh."

"Are those my old college books?"

Joe grinned. "Yup. Maybe you can find something useful in them for this predicament we find ourselves in."

Josh snorted.*Predicament.* Typical for Gramps to understate the situation. Grantville was in the middle of one of the worst wars in human history, surrounded by potential enemies, and for his grandfather it was a "predicament."

Joe stopped to heave an old trunk out of his way. Then he inserted a key into a lock on a brown metal container about eight feet long and three feet wide. When Joe threw back the lid Josh could do nothing but goggle.

"What the heck is that?"

Joe chuckled and took the large semi-automatic rifle out of the container. To Josh it seemed to ooze lethality.

"I forgot you aren't a gun nut. This is an Italian version of the Garand I used to carry in World War Two. It's called a BM-59. When I saw one in*Shotgun News* I just had to get one for nostalgia's sake. Bought about a thousand rounds of ammo, too. But you'll probably want to give that to the army."

Joe pulled back a blanket on the left side of the container and handed Josh a comic book in a protective plastic slip cover.

Josh looked at his grandfather and smiled. "And how long have you been keeping this a secret? I never knew you collected comic books."

"About forty years," Joe said. "And don't tell anyone or you'll find out what this old man can still do with that BM-59. I get enough ribbing as it is." Joe rubbed his jaw thoughtfully. "I have no idea if these will be worth anything here, but you never can tell.

"The most important part of your inheritance, Josh, will be this house and the rentals down on Clarksburg Street. Property has always been a good investment. With that, and with the money in the Grantville Bank, you should be fine."

Then it hit Josh. His inheritance. "Gramps, what are you saying?"

Joe smiled. "What I'm saying, Josh, is that all of what I own, all that I have, I am giving to you. You have to make a new life for yourself, boy. And this is a damn hostile world for poor people. Just promise me you won't squander it on damn foolishness."

Josh nodded. Tears came to his eyes. This time he did nothing to stop them. "I don't want to inherit anything, Gramps," he said softly. "I want you."

Joe's voice was rough as he patted Josh's shoulder. "I know you do, boy. I know you do. But at least this way I can go to the Lord with the knowledge that you can make a fresh start for yourself. Now promise me you won't screw things up by blowing your inheritance on fast cars and loose women."

Despite himself, Josh chuckled. "I promise, Gramps. I promise."

"I've had my will made up for a long time and you were getting most of it anyway. But I'll need to see an attorney in the next week to revise it. No need to have your mom and dad in the will since they don't even exist in this universe, or whatever the hell it is." Joe hugged his grandson gently. "Let's go upstairs. Got a lot to talk to you about. You don't know much about the people in Grantville, since it's been ten years since you lived here. Like any town, there are some good people and some bad people. The more you know, the better off you'll be."

Josh and his grandfather went upstairs and talked for hours before Joe got tired and fell asleep in his easy chair. Josh carefully covered him with a blanket and went to his own bedroom. But he couldn't sleep. Over and over in his mind the facts churned through his head. His family was gone forever. Joe was going to die. Grantville was in the middle of a ferocious war. And he had no job. What the hell was he going to do with his life?

Somehow he eventually fell asleep. But the last thought he remembered was still . . . what the hell was he going to do with his life?

* * *

Josh was up before Joe. He moved quietly around the kitchen. When the phone rang he jumped to grab it before it could ring twice. "Hello?"

"Hi, Josh. Father Mazzare here. Is Joe awake yet?"

"No, he's still . . . wait a sec . . ."

Joe yawned and walked into the kitchen, still in the clothes he'd slept in.

"Gramps, it's for you. Father Mazzare."

Joe nodded and took the phone. "What can I do for you, Father?"

Josh listened to the conversation. He could tell it was about housing. The meeting the previous night had made it clear that there were hundreds, perhaps thousands, of refugees out in the woods around Grantville. Housing them was going to be a real problem.

"Nope. Sorry, Father. Those houses on Clarksburg are packed with Vince Masaniello's relatives and guests from his fortieth wedding anniversary party," Joe said. "At least until they can make other arrangements. But I've got a spare bedroom in the studio over the garage and you're only a couple of blocks away."

Joe listened again and then nodded. "Talk to Josh, he speaks French really well."

Josh took the phone from Joe. "What's up, Father?"

Father Mazzare sighed. "As you know from last night's meeting, we've got one heck of a refugee problem. In fact, the rooms on the second story of the parish hall are already packed with people. Most of them seem to be German, but one group of three seems to speak French better than they speak German. Can you come over and talk to them, get their story? From what I can gather the older man is a

close relative or friend of the family, while the woman and boy are brother and sister. The man, Henri Bex, had a bullet in his left shoulder that Dr. Nichols took out day before yesterday. The wound was festering a bit, so they have him under observation over at that makeshift hospital they put together at the high school."

"Sure, Father. When do you want me to come over?"

"How about right after lunch?"

"Sounds good, I'll be there." Josh hung up the phone. "What do you think, Gramps?"

Joe motioned for Josh to have a seat at the kitchen table while he got out milk and Cheerios for both of them. He tossed two bananas to Josh. Josh peeled and sliced them both into the bowls he'd already set up in anticipation of their usual morning breakfast ritual.

"Did I ever tell you the story about how your great-great-grandfather, John Modi, first came to Grantville?" Joe asked.

Josh shook his head. "Don't think so. You told me lots of stories about his tinker and peddler business, though."

Joe nodded. "Well, my grandfather came from a town in Lebanon called Beit Meri. Somehow, he'd heard about the opportunities here in Grantville at the turn of the century and came to make his fortune. He didn't know anybody in town, of course. But, through the kindness of people at the railroad station, he found a family to put him up for a week or two while he figured out what he was going to do and learned enough English to get by."

Joe took a bite of Cheerios and bananas, then wiped his mouth. "I think its payback time, don't you?"

Josh smiled. "No problem as far as I'm concerned. I'm in total agreement with what Mike Stearns said last night. We are way too small to fight off the entire population of seventeenth-century Europe. So you want to put up this French family?"

Joe nodded. "You speak excellent French. I think that would make them feel more comfortable. They may stay or they may not, but if they're good people and hard workers, well, those are the kind of folks we'll need to help us. We can house them for awhile."

"Okay. So put the woman and boy in the studio? And what about the man? I can sleep on the couch, it's pretty comfy." The couch in Joe's living room was actually a sleeper that folded out into a family size bed.

"Yeah, let's put the sister and brother in the studio. The uncle, or whatever he is, can have your bedroom until he's healed up."

Around ten o'clock that morning a second call came.

"Hey, Sparks. Nat Davis here."

Josh smiled. "Been a long time since anyone called me that."

When Josh had been kicked out of his home in Pittsburgh after a ferocious argument with his father ("chess won't make you a living, son!") Joe had offered him a place to stay and had gotten him a job at

Nat Davis' machine shop. He'd gotten his nickname when he was using a cutting torch and failed to notice where the slag from his cut was going. It had set Lou Giamarino's pants on fire. From that day forward Josh's nickname at the machine shop was "Sparks."

"Joe talked to me last night. Got a job for you, if you're interested."

Josh sat up in his chair. "What kind of job?"

Nat explained some of the details of the previous night's Executive Committee meeting, especially the need for steam engines to provide power for the electrical system.

"Last night Joe told me that you were working on a paper for a symposium about pre-Bessemer steel. The machine shops are going to need some direction so we don't squander our material. We also need to get a better handle on what kinds of resources might be locally available. Think you can come up with something to help us?"

Josh thought a moment. "Sure, Nat. How much time do I have?"

"I don't know," Nat said. "How about a week? Is that enough time?"

"No problem. I'll check with Lou and other people. Maybe Bart Kubiak. I've got a couple of books that came in just before the Ring of Fire. So figure a meeting next Thursday? And who's my audience?"

"Sounds good, Sparks. Your audience will be mainly the machinists and the owners of the machine shops, but Greg Ferrara and Bill Porter will probably be there, too. Listen, I'm on a coffee break and the meeting is starting up again. Call me if you need any help."

Over the next hours Josh worked through what he had, and needed. He called Lou and others to arrange a Saturday morning meeting. At noon Josh walked the two blocks to St. Vincent De Paul's and met Father Mazzare outside the parish hall.

When they walked into the parish hall a woman with honey-colored hair was sitting with a boy of about ten. The boy had jet black hair similar to Josh's, but his facial features resembled the woman's and they were clearly related.

The woman looked up from the book she was reading and their eyes met.

*She's very attractive.*Josh was surprised by the thought.

The woman rose as they came near and extended her hand. "Hello. My name is Colette Dubois."

Josh shook hands with her. "A pleasure to meet you, mademoiselle. My name is Josh Modi. Or is it Madame?"

"No, monsieur. It is mademoiselle." Colette turned to the boy. "And this is my brother, Colas. He is twelve."

Josh extended his hand. "Pleased to meet you, Colas."

"Thank you, monsieur." Colas smiled shyly. "Colette has said that we will be staying at your house?"

"Actually, my grandfather's house. But yes, you will be staying in a one bedroom studio with your sister and your uncle . . . Henri, is it?" Josh looked at Colette. "He will be staying in my bedroom while I sleep on the couch. Father Mazzare said that he would be out of the hospital this afternoon some time?"

Colette shook her head. "Yes, but understand that Henri is not really a blood relative. He was my father's best friend and married my father's sister, but she died many years ago. We have always considered him to be an uncle."

At that moment a woman Josh recognized as one of the Parish council members appeared at the door of the hall and motioned at Father Mazzare. "Phone call, Father. I think it's important."

"You okay here, Josh?" Father Mazzare looked a bit harried.

"No problem, Father. We'll be fine." Josh turned to Colette as Father Mazzare strode away. "Do you have all of your belongings?"

Both Colette and Colas were dressed in typical twentieth-century clothing except for their boots; blue jeans and long-sleeved shirts.

"Yes. Father Mazzare was kind enough to provide us with clothing while ours were washed and the vermin removed." Colette smiled. "Very nice. I think I am in love with . . . what do you call them . . . washers and dryers?"

Josh laughed. "Yes, washers and dryers. Have you seen a dishwasher yet?"

Colette nodded. "Oh, yes. Those are wonderful, too. But the shower was even better. It is the first time I have felt clean in many months."

Colette and Colas had picked up the paper bags with their possessions.

"Ready?" Josh asked. "Let's go, then. My grandfather is expecting us."

As they left the parish hall Josh turned to the young boy. "So what do you think of Grantville, Colas?"

Colas laughed. "Colette calls it 'fairy-tale land.' And it is truly wondrous! Are you really from the future?"

Josh nodded. "Yes, about three hundred fifty years beyond the 1630's. The future is quite different from what you are used to. I spent a semester at the University of Paris studying European business history, so I know a bit about the seventeenth century."

"You've been to Paris?" Colas seemed impressed.

"Oh, yes. But it is much bigger than the Paris in this century. Much bigger. Perhaps three to five million people."

Colas had his mouth open. "Three to five million? That's impossible!"

Josh smiled. "You might think so, but that's nothing compared to Tokyo. I think there were fifteen million in Tokyo."

Colas shook his head. "You are joking, yes?"

"Nope. It's the truth. I'll show you an atlas when we get to my grandfather's house. You'll see."

"But how is that possible? Wouldn't the people get sick? What do they do with their . . . ummm . . . urine and manure?"

Josh noticed a small smile creep onto Colette's lips, while she listened to their conversation. He winked at her. To his surprise, she winked back. As they approached the door to Joe's house, Colette put her arm through his. "Thank you," she murmured softly, moving closer to him. "Colas has been very bored with talking only to me these past few days."

God, she smells good, thought Josh. *Down, boy. Down* !

"Welcome, strangers!" Joe threw the front door open. "Welcome to our humble home!"

When Henri Bex showed up that evening, Josh smiled to himself. Okay, this guy is huge. And he's got a sword. Do not piss off the chaperone.

* * *

The next morning Josh woke up on the couch and for one disorienting moment didn't know where he was.

"Check, you scoundrel," he heard a woman say.

"Ha! Ha! That won't save you."

Josh got out of the sleeper couch and put on his sweat pants before padding barefoot into the kitchen. Colette and Joe were playing chess.

Joe looked up at him. "Good morning, boy. Sleep well?"

Colette was brushing her hair, her attention focused intently on the chessboard. She glanced up at him and smiled.

"Good morning, Josh."

"I thought you didn't know English," he said accusingly.

Colette sighed. "I'm sorry, I was . . ." She switched to French. "Dissembling? I wanted to learn more about Grantville and thought it would be better to pretend not to know English." Colette switched back to English and patted Joe's hand. "But your grandfather is too nice a man to keep secrets from. He lets me win at chess."

Joe flashed a smile at her. "Ha! Not likely, young lady. Not likely! You're a great player! I won the first game but she's beaten me three games in a row, Josh. Great moves. Great! Maybe better than yours!"

"Sounds like a challenge is in store," Josh murmured.

Colette's smile was now more of a grin. "Ah, but Joe has warned me about you, Josh. He's told me all of your secrets!"

"Well, then. I'll just have to pull a few rabbits out of the old chess hat."

Joe stood up. "Good, good. You two play. I'm getting hungry. Anyone else?"

Both Colette and Josh nodded vigorously. Colette began to reset the chess board. Colas and Henri appeared in the entrance to the kitchen. "We're hungry."

"Colas and Henri are hungry, too, Gramps. Make plenty."

"Flapjacks okay with you? Or should we make waffles? I have some strawberries in the freezer."

Colette looked pleased. "*Waffeln*?"

Josh laughed. "Oh yeah, Gramps. Definitely waffles."

An hour later, with a dozen waffles demolished, Josh knew three things. Colette was indeed an excellent chess player. She absolutely loved waffles. And if he wasn't careful he was going to fall in love with a woman he had just barely met.

* * *

On Saturday Colette and Henri participated in the lunch time discussion about iron, steel, mining, metal working and the conduct of business in the seventeenth century. Many of their insights were invaluable and Josh took copious notes. As the discussion wound down, Amy Kubiak, Bart's daughter, stopped by.

Bart was justifiably proud of his daughter. Energetic, vivacious and intelligent, Amy Kubiak had been one of the brighter stars in the academic firmament of Grantville High School the year before. With her high SAT scores and strong grades in math and science, she'd gotten a four year full-tuition scholarship to West Virginia University in Morgantown.

"Hi, Dad! Hi, guys!" Amy gave Bart a quick hug. "Are you about done? Mom's got some errands for you." The Kubiaks lived just four blocks from Joe's house.

"Josh, anything else?" Bart asked.

Josh waved his hand. "Nah, I think that's enough for now. But I'd like to look at that book on the history of metal casting you mentioned. I'll stop by on Monday."

Josh saw Colette motion her head at Amy. "Amy, I'd like you to meet Colette Dubois and Henri Bex. They're from Liege. You can try out your French on them." Amy had taken four years of French at Grantville High School with Nicole Hawkins.

"Cool!" Amy said. She switched to French. "I'm Amy Kubiak. Pleased to meet you." She shook hands with Colette and Henri. "So you're from Liege? How does it compare to Grantville?"

Colette smiled. "About four times the population, at least. But the people live much closer together and the streets are narrower."

Josh suddenly snapped his fingers. "Amy, do you have any spare dresses? Colette doesn't have any nice

clothes for church tomorrow. You two seem about the same height and build."

Amy stood back from Colette and eyed her critically, motioning for her to turn around. "Sure. I think I've got just the thing. Maybe two. Want to come over and try them on, Colette?"

"That would be wonderful." Colette paused a moment. "Are you sure you can spare them?"

"Oh, yes." Amy grinned. "I'm not into dresses these days and I've got a nice pants suit for church. Come on, let's go try them out."

* * *

Over the next four hours Amy and Colette talked about many subjects. Men. Family. Grantville. Books. Clothes. Men. Sex. It took them two hours to get to the sex. By then, with that innate social sense that women tend to take for granted and that men find mysterious, they knew they could trust each other with their secrets. In Amy's words, "They were buds."*Simpatico* .

Except for Marie de Gournay, a Frenchwoman who had written "The Equality of Men and Women" in 1624 and with whom Colette had corresponded with for years, she had never had a female friend she could confide secrets to. But Marie was considerably older and letters were an inadequate communications medium anyway.

"I had two love affairs this past year at college." Amy had her legs curled underneath her as she sat on her bed. "Dad would have a fit if he knew. I swear he glared at every single boyfriend I ever brought home from high school." Amy sighed. "The first one was to just get over my virginity, but the second . . . Hank was a great lover. I miss him. A lot."

Colette nodded. "I missed Etienne for years. His touch was so . . . so . . ."

"Electric?" Amy laughed.

Colette nodded again. Both women sighed.

"So?" Amy patted Colette's leg. "What about you and Josh? Do you find him attractive?"

Colette blushed. "Yes. But he is still mourning the loss of his family, I think." Colette absently twisted a strand of her hair. "I can empathize. I mourned Jacques and Etienne for a long time."

"But his family isn't really dead," argued Amy. "Just . . . left behind. Do you think he's attracted to you?"

Colette blushed again. "I . . . I think so. I sometimes catch him watching me when he doesn't think I notice."

"Well then . . ."

Colette shook her head. "It is too soon. And he should make the first move."

Amy raised her hands in exasperation. "If women waited for the men to make the first move all the time the race would be extinct." She pulled at her chin. "Hmmm, we need an expert in Basic Man Trapping 101 . . ." Her face brightened. "I know!" She picked up the phone.

Two hours later, just as Josh was starting to get worried, Amy and Colette walked through the front door.

"Well, Josh, what do you think?" Amy said.

At first Josh didn't recognize Colette. She was no longer just attractive. She was beautiful. It was not just the dress, or the different hair style, or the subtle use of make-up. It was also the smile and the way her eyes seemed to glow in the late afternoon light.

"Josh? Hello?*Earth to Josh* !"

"What? What did you say?" Josh felt a bit dazed.

Amy smiled. "I said, "Doesn't she look gorgeous?" I want to hear you say that in French."

"You do look very beautiful," Josh muttered in French.

Colette dimpled and curtsied. "Thank you, monsieur."

"Well, I've got to get home. See you two at church tomorrow." Before Amy left she leaned over and whispered in Colette's ear. "What did I tell you? Pole-axed like a steer. See you tomorrow."

Amy skipped down the stairs and began to stroll home. As she went she occasionally snapped an imaginary whip, all the while whistling the theme to*Rawhide* . Rope him in girl, rope him in!

* * *

"Our communion meditation will be number four thirty-eight.*We Will Rise Again* . Number four thirty-eight."

As the church began to fill with music, Colette allowed herself to think about what she had seen during the Mass. It had been profoundly different from any other Mass she had ever attended. From the lack of Latin, to the priest facing the congregation, to the sharing of the sign of peace, it had been strange, but in many ways, exhilarating. Especially when she saw that women were allowed on the altar as readers and Eucharistic ministers.

The people around her seemed to have a deep faith in God and a sense of community that even rivaled what she had seen in the béguinage de Hermee. All week she had prayed to God before going to sleep. Prayed for the soul of her father. Prayed for Henri while he was in the hospital. Even prayed for Joe when she discovered that he was suffering from a fatal disease. But most of all she had prayed for guidance. What should she do with her life?

She could see that many of the congretation were singing. But at least a dozen were weeping. Then, it was as if the hand of God touched her soul.

This was no "fairy-tale land" as she had first thought. This was a tiny piece of a world ripped out by the roots and plunged into the depths of a man-made hell of war, disease, and unspeakable cruelty.

The people of Grantville were no weaklings. But neither were they giants. They could not stand alone, not just a few thousand of them. Not against the millions who would willingly devour them alive just for the fact that they were different. They would need help.

Again it felt as if God touched her. She shivered. She would not be here if not for the Ring of Fire. She knew, with certainty now, that she would have been raped and murdered, along with her brother. So, just as the coming of Grantville had helped her survive, so now would she help Grantville survive.

She would help them.

With every ounce of her strength and her mind, she would help them.

Thank you, God. Thank you.

The refrain began again. And Colette Dubois began to weep.

"We will run and not grow weary, for our God will be our strength, and we will fly like the eagle, we will rise again."

* * *

Later that afternoon the parish chess club of St. Vincent de Paul inducted its first female chess player ever. There was no ceremony. But no one was going to deny Joe Modi.

"Look," Joe said, "She's a great chess player, she's living in my house, and I like her. She's got spunk." He looked at the seven men in his living room. "Any objections?"

Nothing but smiles and shrugs. "Great! Let's play chess!"

"Who gets to play Colette?" Lou Giamarino glared at Joe. "You can't hog her all to yourself, Joe."

Jerry Calafano raised his hand. "Me!"

"Like hell! I get her first," Bart Kubiak said.

Vince Masaniello spoke up. "Wait a minute! Age before beauty!"

"You calling me a pretty boy, Vince?" Bart asked in mock anger.

Colette laughed gaily. "Please, gentlemen, please. I'll play all of you. But how to choose . . ."

"Where we came from, Colette, we often did things in alphabetical order," Josh pointed out.

Colette smiled at him and nodded. "In that case, let's go in alphabetical order, by first name. But since I've already played Josh and Joe, they're out."

Bart Kubiak waved her over. "B as in Bart, young lady. I'm first."

But parish chess club meetings were not just about chess. They were also social gatherings and it was expected that multiple topics would be discussed throughout the afternoon. What everyone did not expect, however, was the direction it would take when it was Jerry Calafano's turn to play Colette. No one noticed when it started, but after awhile it became apparent that Jerry and Colette were no longer really speaking English, nor were they playing chess.

They were speaking mathematics.

It became most obvious when they got paper from Joe's computer room and sprawled on the floor, drawing diagrams, writing equations, and jabbing excitedly at each other's work.

When Jerry finally left, promising to bring some of his math texts and other books the next day, Colette was more aglow than Josh had ever seen her.

"Josh, do you realize what this means?" She was positively effervescent.

Josh smiled and shook his head. "No. What?"

"I will be the first person in Europe to understand the calculus! From what Jerry said, it was not really formalized for another fifty or sixty years. And the merging of algebra and geometry using coordinate geometry. Descartes has not even published yet! And non-Euclidean geometries! Oh, this is going to be so much fun!"

Josh laughed. "Just so long as you don't try to explain it to me too much. I had a tough time just getting through a couple of semesters of business calculus for dummies."

Josh had a thought. "Wait, I've got something for you." He went into the kitchen and got his briefcase. He'd stuck it under the kitchen table. He opened it and took out his Ti-30 solar calculator.

"Here. A gift from me to you. It's solar powered so you can use it anywhere there is enough ambient light. Should last for at least another ten years if you don't drop it too much."

Josh leaned over Colette's shoulder and placed the calculator in her hands. He started explaining the basic keys and functions. After a few minutes she looked up at him. Her green eyes sparkled. She caressed his arm.

"Thank you, Josh," she said softly. "This is a wonderful gift. I will treasure it forever."

Inside Josh smiled. Who would have thought that the way to a woman's heart would be through a calculator?

* * *

"My shoulder is healing well, Colette." Henri and Colette were sitting in Joe's small backyard. The fence around the yard was six feet high, just tall enough to prevent passersby from observing them as they sat at the wooden table with its large blue umbrella. "We can leave tomorrow if you wish."

Colette was playing with her hair, a far-off look on her face. "I am not going, Henri," she said calmly. "And neither is Colas. You may do what you wish. We will stay in Grantville."

"But your father would have wanted . . ."

Colette stopped him with a gesture. "My father is dead, Henri. There is nothing else for me. If I could get to Amsterdam . . ." Colette shook her head. "No, not even Amsterdam attracts me now. The Ring of Fire was a sign from God, Henri. If it had not happened when it did, Colas and I would be dead. I am certain of it."

She gestured around her. "This will be my home for now. The people in Grantville will need our help, Henri. They are master mechanics but they are very few in number."

Henri looked at her skeptically. "You expect this Joshua Modi to marry you? Like you expected Etienne to marry you?"

Colette stopped playing with her hair and glared at him. Then her glance softened. "I loved Etienne, Henri. As much as you loved either of your wives. He would have married me if he had not died at Dessau. I am sure of it. But I have mourned him long enough. And Josh Modi is not an unattractive man. His family has been left in another universe, except for Joe. He will be totally alone when Joe dies."

"Eh?" Henri grunted. "What do you mean?"

"Joe told me the first morning we were here. He has a disease that requires medicine they cannot manufacture anymore. He will live no longer than three months." Colette reached out and touched Henri's hand. "Henri, I need your help."

Henri sighed. "What do you want of me, Colette?"

Colette gave him three packages of letters. "I have written several letters. This first package is to be delivered to my aunt, Annette, at the béguinage de Hermee in Liege. She is executing my father's will and she must know where I am so she can forward the monies from the selling of his businesses. I have decided to sign over the house on the Rue Chodelistree to the béguinage de Hermee. That is the second document I have in there. Once you reach a secure Thurn and Taxis post house, I want you to send the second package of letters to Marie de Gournay in Paris. The third package of letters is to be delivered to my uncle, Louis de Geer, in Amsterdam. He has a keen eye and an even keener nose for business. What I have told him about Grantville in these letters should catch his interest. Grantville will have a need for wealthy patrons I think."

Colette looked at him. "Will you do this for me, Henri? The letters to Annette and Louis de Geer must be hand-delivered. I dare not take the chance that they might be misplaced or lost."

Henri nodded. Simon Dubois, Colette's father, had died in Henri's arms in February of 1631, a victim of the political infighting in Liege. Henri had promised to look after Simon's family. Henri had taken Colette and Colas back to his home in Magdeburg when men associated with the political machinations began hunting them.

"I will, Colette. I promised your father I would take care of you. But do not expect to see me for several months. I will send word by post when I have accomplished what you ask. Do you want me to wait for return messages from your aunt and uncle?"

Colette shook her head again. "No. I trust my aunt and I know that what I have written to my Uncle Louis will be sufficient for him to come here as soon as he can. He may be in Sweden at the moment, though. I expect him in Amsterdam within the next few months." She smiled at Henri. "You would not mind waiting a few weeks in Amsterdam?"

Henri laughed. "No, not at all."

Colette reached across the table, serious now. She clasped Henri's arm. "This is very important to me, Henri. But so are you. Ride safely and may God be with you."

Henri sighed. Oh, to be twenty years younger.*You would have a fight on your hands for this young woman then, Joshua Modi. Indeed you would.*

* * *

In the second week after the Ring of Fire Josh met with the machine shop owners and their employees. Colette and Amy Kubiak sat in the back of the audience to provide moral support. The most critical points in Josh's lecture concerned the importance of good cast iron with a high silicon content for steam engine cylinders and the need to make their own cast steel, since that process in Europe hadn't been introduced until the mid-eighteenth century. When alloy steels were brought up, Josh laughed.

"That will take some time. Tungsten we can get from the tailings of tin mines, according to the encyclopedias. Chromite would be damn useful, but the deposits are spread all over the place, from Kemi in Finland, to Turkey, to Baltimore. If we could get to Maryland, the deposits there would be pretty easy to get. Vince Masaniello even has a brochure of a nature preserve where they used to mine it. Just a few problems, of course. Like getting to the sea and then crossing three thousand miles of ocean."

Josh nodded towards Greg Ferrara. "Here's Greg to help refresh you on metal chemistry."

Josh moved to the back of the room. Amy moved over so he could sit next to Colette.

"How'd I do?" he whispered to Colette.

"Excellent," she whispered back. "Having Vince and Monty speak was a good idea. They seem to be respected masters of their guild."

After the meeting, Bart and Josh walked back to town. Amy and Colette walked ten feet in front, occasionally laughing and looking back at them.

"Thick as thieves those two," Bart said musingly. "Thick as thieves. I think you're in trouble, Josh. They're scheming about something."

Josh sighed. "I know it. I just don't know how much resistance to put up."

Bart chuckled. "Knowing my daughter and judging from what I've seen of Colette, I don't think they're going to settle for anything less than unconditional surrender."

The two women turned to look back at him again.

Who knows, thought Josh.*Unconditional surrender can't be too bad, can it?*

Chapter Two

Joe Modi lapsed into a coma on August seventh. He died six hours later. The funeral was on August tenth. Josh Modi kept his composure throughout the ceremony, accepting condolences and murmurs of sympathy.

Men, after all, don't cry.

"Keep a stiff upper lip."

"Be a man."

"Grin and bear it."

Society frowns on men who cry.

But men do cry. Often it is late at night or upon awakening from a bad dream. Then the walls come down.

For Josh Modi the walls came down the first time he slept in his grandfather's bed the night after the funeral. He woke from a sound sleep and found himself staring at the ceiling. He began remembering the simple things he and his grandfather had done. The chess games. The shared meals. The laughter.

Brick by emotional brick his wall crumbled. Loneliness seized his soul.*Ah, Gramps!*

Josh began to cry. Not simple tears, but the wracking sobs of a man who had kept things inside for too long. Josh didn't know how long he cried that night, but he would always remember when he stopped.

A hand with long supple fingers began stroking his hair. Colette slid into the bed at his back, spooning him.

"I'm sorry I woke you."

"Shhh," she said. "Shhh. Sleep now."

Slowly his body relaxed. Alone no more, he slept.

* * *

The next day they began to clean out the basement using the inventory lists that Joe had developed over the previous three months. The first place they went to was the large brown metal container Joe had shown him back in May. When he opened the container for Colette and Colas he was surprised to see the BM-59 still there.

Colas' eyes were round as Josh took the rifle out of the container. "What is that?"

Josh laughed. "I had to ask Gramps, myself. This is a BM-59. In the universe we came from there was a war called World War Two. Every army had its own main battle rifle. The American Army's rifle was called the Garand. It was a good rifle, one of the best. But it had limitations. The Italians created a main battle rifle based on the Garand but with twenty round magazines and in a different caliber. That's what this is."

Josh handed the battle rifle to Colas after checking to see it was empty. "I thought Gramps gave this to the army but apparently he forgot or decided not to."

After Colas had looked at the BM-59 for a minute Josh took it back and placed it in the container.

Colas pointed to the comic books on the left side. "What are those?"

Josh smiled. "Those are called comic books, but these are the rare ones, so we should leave them in the slip covers. Gramps said there were a few plastic containers of less valuable ones. Once we find them you can take a look at them. You'll have to learn to read English, though."

*Might not be a bad way to learn English, now that I think about it*Josh thought.

After relocking the container Colette, Colas and Josh began organizing the basement into three different piles: things to be sold, things to be kept, and other. Throughout the day Colette and Josh would sometimes touch or smile at each other. Occasionally they even embraced, when Colas wasn't looking. When it came time for bed, Colette yawned.

"Good night, Josh. I'm very tired." She smiled. "I didn't get much sleep last night." Colette came over and gave him a platonic kiss on the cheek, then went to her bedroom and closed the door.

Josh sighed.*Well what did you expect, dummy?* An hour later he went to bed.

* * *

This time, when he woke up, things were different. First off, he was hard and aching. Second, Colette was naked and her feverish hands were definitely not stroking his hair.

"It has been a long time," she murmured, swinging her legs over to straddle him. "You will forgive me if I am not very good at first?"

"Ahhhh, yes!"

They made love until, finally satiated, they fell asleep in each others' arms.

* * *

When Josh woke the next morning, Colette was gone.

*A dream?*But it had been no dream. The sheets were rumpled and the bed smelled of sex. Besides, he was still a bit sore. He'd never thought a woman born in the seventeenth century would be so gymnastic in her lovemaking.

After his shower Josh found Colas in the kitchen eating breakfast. "Seen Colette?"

Colas nodded. "She went over to Amy's house. Can I borrow your mountain bike again?"

"Sure." For the past month Colas had been riding Josh's bike nearly every day, exploring the streets, alleys, and paths in and around Grantville with newfound friends.

"Can you help us after lunch though? We're almost done with the basement."

"Okay, Josh." Colas looked over his shoulder as he walked out the door. "After lunch."

*So why wasn't Colette here?*thought Josh.*After last night . . .*

Then he realized what she was doing. Giving him time alone to make a decision. To decide what he was going to do without the pressure her presence would provide.

So what was he going to do?

* * *

Two weeks before, Gramps had brought up the same question. They had been washing dishes and Josh had been the dryer.

"You really ought to marry the girl, Josh," Joe had said, handing his grandson a dripping plate. "She's smart, she's pretty, and she plays a mean game of chess. Not to mention, she's got a fine business sense. You know what she said I should do with those houses on Clarksburg?"

Josh shook his head and took another plate from Joe.

"Since Vince has found places for almost all the relatives and guests from his wedding anniversary party, she thinks it could make a great inn. Grantville is going to grow and Clarksburg Street is centrally located. We could turn the partial basements into rooms and build a large common room in between the two houses."

"I don't know, Gramps," Josh said. "It feels like it's too soon."

"I know, Josh, I know." Joe's voice was soft. "But this is a new world we're in and Colette can help you adapt. It's time to move on, boy."

Josh shrugged. "I'll think about it." He smiled. "She is pretty darn attractive in a lot of ways."

"Well, if you do marry her . . ." Joe handed him another plate. ." . . just remember Joe's Maxims for a happy marriage."

Josh laughed. "I have had girlfriends before, Gramps."

Joe looked at him with a mock scowl. "You're still wet behind the ears as far as women are concerned, so listen up." He handed Josh another dish. "First thing, never discuss previous lovers. Never. No comparisons. She's the best ever, period. Second, if she's the touching type, touch her a lot. She'll appreciate it. Third, respect her privacy. If she doesn't want to talk about something, don't keep pressuring her."

Josh nodded. He'd learned that one with his last girl friend.

"And lastly, put a little romance into the relationship. Women love that kind of thing, especially on anniversaries and birthdays. And whatever you do, don't forget those." Joe shuddered. "Fate worse than death, boy, if you forget a birthday or anniversary."

Joe became thoughtful. "If you do decide to marry her, you can use grandma's ring. It's in the knick knack box on my dresser."

It was that last admonition that Josh remembered now. He looked around the living room and smiled. Joe had been right, time to move on. Now let's see, if he put the couch

there . . .

* * *

When Colette walked into Amy's house that morning, Amy knew something was different. "Okay, Colette, fess up. What happened? You're positively glowing. Did Josh give you a present or something?"

Colette laughed. "I would say it was the 'or something.'" She got a far away look in her eyes. "Oh, yes. Several 'or somethings.'"

Amy's eyebrows started climbing up her forehead. "You jumped his bones, didn't you? All right, girl! It's been a long time for you, hasn't it?"

Colette nodded. "Yes, we made love. And it was the first time since Etienne."

Colette flopped on the bed. "And it was very, very good."

Amy laughed. "So how many times did you . . . what was it Shakespeare called it . . . the little death?"

Colette smiled dreamily. "I don't remember. At least, if I am with child it will be a boy."

Amy cocked her head. "What?"

Colette waved her hand. "It is often said that for a child to be a boy, the woman must have an orgasm during the lovemaking."

"Well . . ." Amy laughed. "Did he propose this morning?"

Colette grinned. "That would be difficult since I left before he woke up."

Amy looked at her through her eyelashes. "Damn, girl. Men are most vulnerable when they're just waking up after sex. Now you have to start over from scratch. He did tell you he loved you, though. Right?"

Colette smiled. "We didn't exchange a lot of words last night. We made love and then fell asleep."

Amy looked at her critically. "I'm surprised you're able to walk. So what now?"

"Now, I think. . ." Colette grinned a bit. "It really is Josh's move."

They didn't have long to wait. The phone rang. Amy answered it. She handed the phone to Colette and mouthed*It's him* .

"Hello?"

"Colette, can you come home?" Josh asked. "We need to talk." His voice seemed cool.

"Certainly, Josh. I'll be right there."

"And Colette?"

"Yes?"

His voice turned soft. "I love you."

Her heart sang. "I love you, too, Josh."

"Oh," added Josh, "and bring little Miss Matchmaker with you. I'm sure she'll want to see the fruits of her labor."

* * *

Both Colette and Amy saw that the curtains were closed when they reached the house. They walked into the living room. Several lit candles were spaced around, giving the room a soft glow.

"Josh?" Colette's voice sounded nervous.

"Be right there. Have a seat on the couch, please."

Amy and Colette sat down. When Josh walked in he was holding something behind his back.

Josh switched to French.*It is the better language for this.*

"Colette Dubois, I have loved you from the first day I saw you in the parish hall. I tried to tell myself that it couldn't happen, that love at first sight is impossible, an illusion. But it isn't. I want to share my life with you, and be a part of yours."

Josh brought his hand out from behind his back and got down on one knee. In his hand was a wide-mouthed brandy snifter with a flower floating in water. On the flower was a diamond ring.

"Will you marry me?"

By then both Amy and Colette were crying. In the back of his mind he could hear his grandfather's voice. "Good job, boy. Good job."

Through her tears Colette smiled. "Yes, Josh, I will marry you."

* * *

Five minutes later they had their first fight.

"Lawyers!" Josh stomped around the room. "We don't need any stinking lawyers!"

"It's customary," Colette said stiffly. "I made a mistake with Etienne, I was young and immature. But we each must hire an attorney to negotiate our marriage contracts." Colette's voice softened. "Please Josh, this is important to me."

Josh sighed. "Tell you what, we can play a game of chess. Whoever wins gets their way."

Colette laughed. "I have a better idea." Her eyes turned smoky. "A wrestling match. Whoever dies the little death the most, wins."

Colette turned to Amy. "Would you mind waiting on the porch for Colas? Josh and I need some privacy to discuss this." She grabbed Josh's hand and began leading him into the bedroom.

Colette won. Josh found he didn't mind losing at all.

What he did mind, however, was that Colette insisted on real negotiations for their agreement. And that, while negotiations were going on, Colette felt it would be unfair to sleep with him since it might affect his judgment.

Wonderful, he grumbled to himself. *I rediscover how great sex can be with a woman I'm in love with, and she cuts me off.*

Fortunately, the negotiations only took five days. Father Mazzare, rather ruefully adapting to the times in which Grantville found itself now, abbreviated the six months of premarital counseling that had become standard up-time to what he could fit into calling the banns on three successive Sundays. On September 10, 1631, they were the first persons to be married in St. Mary's church since it was renamed.

* * *

"No, no!" shouted Henri. "Thrust, not slice! And watch your balance! You look like a headless duck flapping its wings!"

Colette smiled. A brief scuffle with ruffians in Erfurt on their honeymoon had prompted Josh to seek Henri's assistance in learning the proper modes of seventeenth- century combat. Henri had arrived back in Grantville in early September. He had also brought the first disbursement of Simon Dubois' estate, some two thousand guilders.

Colette turned back to her conversation with Amy. "So you don't like this Walter Miller?"

In July Greg Ferrara had convinced Amy to become an apprentice chemistry teacher at Grantville High School. What he had not told her, however, was who the teacher she was apprenticing with would be.

Amy rolled her eyes. "God, the man belongs in a geriatric ward! He actually fell asleep in sixth period yesterday!"

"What about Alexandra?" Colette smiled. Alexandra Selluci was the other new chemistry teacher at the high school.

"She's not too bad," Amy said. "I think I could actually learn something from her. I told Tonya today that we have got to switch at the end of the quarter. No way I'm putting up with Miller for an entire semester."

Colette looked over at the stove. "So how does the chicken look? I'm getting hungry." Colette had never learned to cook. Even when her mother had been alive Simon Dubois had hired servants to do both the cleaning and cooking.

Amy opened the oven door for a quick peek and then closed it. "Looking good. I just wish we had more spices."

Most of the spices available in Grantville when the Ring of Fire struck had been either used up or were being hoarded by cooks unwilling to part with them. This was particularly true given the fact that many spices taken for granted in the twentieth century were very expensive.

Colette moved to set the kitchen table and glanced back at Amy. "Where's Bart? Still working at the foundry?"

Amy nodded. "Yup, since he helped Josh get the two beehive ovens and the shell of the crucible steel building up, he's spent all of his time on getting the cupola furnace and the foundry started. He's got some partners for that, but they don't know much about casting. The smelting season is about to start and he wants to be ready in case they can get some cast iron from the local blast furnaces."

At that moment they heard Bart's voice in the living room. "Hello, anyone here?"

"Back in the kitchen, Dad. Is Mom coming?"

Bart walked into the kitchen and shook his head. "Nope. Colette Mora got sick at the café and Sebastian begged her to come in and help. Business is picking up for them."

Amy opened the oven door again and smiled at what she saw. "Chicken is ready. Better call the boys, Colette."

* * *

After dinner, conversation turned to the major topics of the month . . . Breitenfeld and business.

"I really don't see how our arrival could have changed the outcome at Breitenfeld," Josh pointed out. "Gustavus Adolphus will win and Tilly will be driven from the field. But the farther away in time we move from the Ring of Fire the more likely things will change, especially as we begin interacting with people outside Thuringia."

Colette nodded thoughtfully. "So my letters to Annette, my uncle, and Marie de Gournay will change history?"

"How could they not?" Amy asked. "In our history you were probably killed, from what you told me. Things are going to be way different now that we're here. And that probably means that a lot of the people who were born in our history, even the famous people, won't even exist in this universe. No Newton, no Einstein . . . nobody we're familiar with who was born after the 1630's."

Colette sat up in dismay. "But that means no Euler!"

Bart laughed at the expression on Colette's face. "Right, no Euler. Who's Euler?"

Colette glanced around the table. Every single person had a blank look on their face. She sighed.

Jerry Calafano had loaned her numerous books on mathematics including biographies, textbooks and problem books. She had spent hours each day reading, problem solving and pondering the mathematics of the future. Of all the mathematicians she had read about, she most identified with Euler. Not because she thought she had the same genius, but because Euler had seemed to love all of mathematics as she did, for the mere ability to challenge the mind.

"Euler," Colette said, "was the most famous mathematician since Archimedes. He averaged more than eight hundred pages of manuscript a year. Even when he lost his eyesight in 1771 he still kept publishing, dictating his thoughts to a secretary." Colette shook her head sadly. "No Euler. I will miss him."

Josh laughed. "Colette! He hasn't even been born yet!"

"True, but still . . ." Colette got a thoughtful look on her face.

Oh oh, thought Josh, *I'm beginning to understand that look.* "Colette, what are you scheming?"

Colette's face turned innocent. "Scheming? Nothing. Just thinking that I must do something to make sure people do not forget Euler in this universe." She patted Josh's hand. "Do not worry my husband, it will not affect us."

Colette was seldom wrong in her judgment. But Josh would remember the conversation later in life and point to it as a clear sign that there were times when she was not infallible.

The remainder of the dinner conversation centered around their various businesses.

"Well, I've got an idea for a name for the crucible steel business," Josh said. "I found a reference to a Pittsburgh firm that was one of the biggies. What do you think of Black Diamond Steel Corporation?"

Colette frowned. "I like diamond, and steel makes sense, but black is not good. People will think of death."

"What about blue?" Amy asked. "My favorite color."

Colette shook her head. "Too French. You will turn off the Germans."

Bart grinned. "How about yellow? I like yellow."

Colette shook her head again. "Too Swedish. All the Catholics will refuse to buy from you."

Amy laughed. "God, Colette. Is there any safe color?"

Colette thought for a moment. "White. White is a good color. Pure. Bright. The color of leadership."

Josh smiled. "White Diamond Steel Corporation it is, then."

"What about this inn you're planning on Clarksburg? Got a name for that yet?" Amy asked.

In their pre-nuptial agreement Colette and Josh had agreed to establish an inn using the two houses on Clarksburg. Money from Colette's inheritance would be used to renovate and maintain the properties and profits would go into a joint account.

For several minutes names were bandied about, but no one seemed satisfied. Colette had a thought. "We were planning to have chess club meetings at the inn when it opens, correct?"

Many members of the parish chess club were too busy with work to have time to play chess. So, Colette and Josh had started the Grantville Chess Club back in July.

"Yeah," Josh said. "We should have enough space since we're building the addition with two stories like you suggested. Why?"

"*Échecs de la dame enragée*," murmured Colette.

Josh laughed. "Perfect!"

Amy looked puzzled. "Chess of the madwoman?"

Colette shook her head. "No, no, it translates better as 'Chess of the Maddened Queen.' It was the name for the modern chess that we play. It was introduced in 1580 in Italy, some say, and everyone in Europe loved it, except for the Russians. So we will call our establishment . . ."

"Inn of the Maddened Queen!" blurted Amy. "I like it! And we all know who the Queen of the inn is going to be, don't we?" She grinned.

Josh smiled. "Are you sure we shouldn't call it Inn of the Maddening Queen instead?"

Colette hit him.

* * *

That night Colette dreamed. In her dream the souls of dead mathematicians and dead scientists flashed by her, vanishing into a stygian abyss. There were thousands, but a few she recognized because their names appeared in bright red above their heads.

Newton. Leibniz. Bernoulli. Bohr. Einstein. Euler. With nothing but her will she tried to keep them from vanishing, but it was useless. In her dream she cried tears that turned to diamonds that flowed into the abyss. Suddenly a light appeared in the abyss. As it drew closer she saw that it was the figure of a man dressed in brilliant white holding a steel crucible. In the crucible were her diamond tears.

"Can you save their souls?" Colette asked.

The man in white smiled. "No, but you can. No soul is ever lost to me so long as their name echoes through the corridors of time. That will be your mission, my daughter. Let their names echo through the corridors of time. Do you accept this mission?"

Colette nodded. "I do."

The man in white placed his hand on her head. "When you are ready, I will send you a messenger. Your name for this mission shall be . . . Crucibellus."

When Colette woke the next morning she remembered the dream.*Crucibellus,* she thought. It could mean so many different things. Perfect crucifixion. Tormented warrior. Torture of war. Crucible. Still, it was euphonious. She decided she liked it.

* * *

It was late November. Colette was in her office on the second floor above the common room of the Inn of the Maddened Queen when someone knocked on her door. She was going over the accounts of the inn and was happy to see that the inn was already making a profit. Not a large profit, it was true, but still a profit.

"Yes? Who is it?"

"John Dury," said a voice. "May I come in?"

"Sure, come in." When Dury entered Colette motioned to a chair next to her desk. "How can I help you, John?"

John Dury was an idealist. He had attended the Leipzig Colloquy in the hope of uniting all Protestants in a common front behind Gustavus Adolphus, but his hopes had been dashed. In July he had begun to travel around Germany trying once again to convince Protestant princes that the unity of all Protestants was the only means through which the Habsburgs could be defeated. In early November he had heard about a strange colony of Englishmen in Thuringia who had supposedly arrived from the future and decided to investigate.

When he stopped a stranger on the streets of Grantville and asked him where he might find lodging, the stranger looked him up and down and asked, "You interested in a good time or some peace and quiet?"

Dury had smiled. "Peace and quiet sounds nice."

"Then try the Inn of the Maddened Queen. It's on Clarksburg Street."

Dury had been very pleased with the accommodations at the inn. The rooms were spacious and the linens were clean and fresh. There was a fireplace, as well as a number of cozy chairs and couches in the common room. Several chess games were ongoing at all hours of the day and there were always guests around to engage in pleasant conversation. Bread, cheese, and wine were provided for guests in the evening.

It was there that he met Colette Modi, co-owner and manager of the inn. They struck up a conversation over a game of chess and he listened in fascination as she told her story of how she came to be in Grantville. Later that day he met her husband and it was clear that the love they felt for each other was deep and lasting. Over the next two days Colette and Josh Modi explained much about Grantville. He had been most impressed by Grantville High School since he had long been an advocate for education reform.

The day he was to depart he felt moved to return the kindness that had been extended to him. "Perhaps I can help you, Colette. Do you remember yesterday when you told me that you had prepared a manuscript on the mathematics of the future?"

Colette nodded, her eyes suddenly bright.

"Well, one of my friends is Samuel Hartlib. I think he would be interested in publishing such a manuscript. Samuel is endeavoring to be what is called an Intelligencer, someone who communicates new science and new ideas to others around Europe."

"That would be fine," Colette said. "I want anyone to be free to copy my manuscript. And this would be the first of eleven. Do you think he would still be interested?"

"I think so," Dury said, "although that might limit the number of copies that he decides to make. Don't you want any money for this?"

Colette shook her head. "No, my purpose is to disseminate the knowledge as widely as possible, not to restrict it. And I am just the synthesizer. Most of this knowledge is easy to come by here in Grantville, if you know where to look."

Dury smiled. "Well then, since I am headed to England tomorrow, perhaps I can place some copies in the right hands. How many do you have?"

"Three plus the original." Colette reached into her desk and pulled out three large envelopes and handed them to Dury. "One is for Samuel Hartlib, one is to be mailed to Nicolas Peiresc, and the third to Marin Mersenne." Colette smiled. "I believe you know those gentlemen?"

Dury gave a start of surprise. "How did you . . ."

Colette grinned. "I was told that a messenger would come, John." She looked up at the ceiling and then back at Dury.

Dury understood immediately. "Mysterious are the ways of God, Colette. Mysterious, indeed."

Before he left, Colette Modi made him promise one thing. "Initially I want no one to know that I wrote these, John. So please promise me that only the name Crucibellus will be connected with these manuscripts. The address I have left in the manuscript is Inn of The Maddened Queen. That way many will assume it is simply a postal drop."

Dury smiled. "I promise."

Two months later John Dury was in London. It was there that he mailed a copy of Colette's manuscript to Marin Mersenne in Paris and Nicolas Peiresc in Aix-en-Provence. The third he took to Samuel Hartlib.

* * *

To say that the Crucibellus Manuscripts took the European mathematical community by storm would be a vast understatement. In early 1632 many Europeans were still unaware that something unusual had happened to their universe. Even those who had heard the tales of a community of Englishmen in Thuringia tended to discredit the idea unless they had actually traveled to Grantville themselves. But when the Crucibellus Manuscripts began circulating in 1632, people's minds began to change. It was not that all of the concepts were totally new and different. But it was the style and the breadth and the mystery which set intellectual circles abuzz. For Crucibellus had outlined the topics of future manuscripts and promised that each would appear at approximately three month intervals. Mathematical Symbology of the Future. Analytical Geometry. Differential Calculus. Integral Calculus. Differential Equations. Matrix Algebra. Probability. Statistics. Fractals. Special and General Relativity. Quantum Mechanics.

The style was often brutally terse. While only the most essential concepts were given, the example problems in the manuscripts were explained in clear and exquisite detail and were often taken from problems the reader could imagine from everyday life.

And then there were the challenge problems. Theorems unheard of. Problems never dreamt of. Problems no mathematician in the seventeenth century could solve, especially in the ninety days before the answer would appear in the next manuscript. The first challenge problem set the stage for the rest: Prove the existence of the Euler Line. That is, that the orthocenter, centroid, and circumcenter of any triangle must lie in a straight line, with the centroid exactly twice as far from the orthocenter as from the circumcenter.

Soon, of course, a number of mathematicians had discovered the real name of the author and were

studying in Grantville themselves.

But without the Crucibellus Manuscripts it might have taken years to stir their curiosity.

Ask a mathematician three hundred years later who Mike Stearns was and many would give you a blank look. But ask them about the Crucibellus Manuscripts and watch their eyes light up with recognition or listen to them discourse for hours on their impact.

The Crucibellus Manuscripts.

Long will they echo across the corridors of time.

NON-FICTION

The Mechanical Reproduction Of Sound: Developing A Recorded Music Distribution Industry

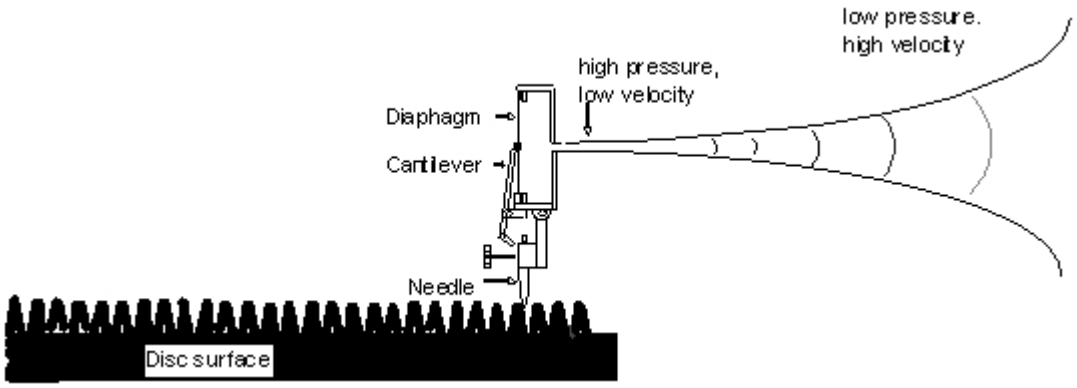
By Chris Penycate and Rick Boatright

Part 1. Preparing pre-recorded material for distribution

Sound, no matter how complex, is just waves like the ripples in a pond. It can be considered as the displacement of molecules from their place of rest. A more technical definition would be: Sound is a series of compression and rarefaction waves in a substance, solid, liquid or generally in our experience, gas. Our aim in recording is to precisely reproduce these waves in another place and/or at a different time. As exact, absolutely precise reproduction can't be done even today, we must be satisfied with successive approximations and keep aiming to improve. A cheap, bad telephone will make something that sounds "sort of" like you. A mechanical phonograph will sound "better" but still not exactly the same as you. We can successively improve our approximations until, with modern speakers, decent amps and CD quality recording it would be*very* difficult to tell which was "real" you or the recording. But you might still be able to tell that there was a*difference* .

First exercise for students—take an inflated balloon, hold it in front of your face, and sing at it. You can feel the vibrations through your fingertips (and in good lighting, by singing loudly, watch them travel over the surface). As the sound hit's the balloon it wiggles, which is about how the ear drum works. If we were able to attach a needle to our balloon with glue or tape, we could have made it inscribe a wiggly line on a soot-covered piece of paper, which shows that we can make a record of the sound. This would demonstrate that enough energy is being transferred to do mechanical work.

How to turn Wiggles on a Disk into Sound



Air seems very easy to move, but trying to move it fast requires energy—as any manufacturer of sports cars could tell you. They call it air resistance, we call it acoustic impedance, but it comes down to the same thing. Despite what residents of Florida might believe, air prefers staying in the same place to chasing around. In the above drawing, our needle wiggling along the groove will move a tiny bit of air in contact with it, but that moving air doesn't have enough energy, enough "oomph," to make sound that can be heard throughout the room. If we hook the needle up to a lever, and use the lever to wiggle a thin diaphragm (like a drum head) back and forth, then the diaphragm moving back and forth moves*more air* , which then has more energy, (more oomph) and can be heard more clearly. This uses more energy. We need to push the needle back and forth harder against the grooves. Pressing harder means that there is more friction. That causes more wear on the record, but we get a louder sound. This is a good thing. But we can't keep making the lever longer and longer, making the diaphragm bigger and bigger, because eventually, we would just snap the needle off. Needles aren't infinitely strong. There has to be another way to turn the small weak wiggles of the needle into a loud sound that can fill a room. To do this, we can use a bit of physics in the form of a horn.

Those big flower shaped horns on old crank up record players weren't just decorative. They were very important to hearing the music. Without the horn, you have to put your ear right up against the diaphragm as though you were listening to a telephone. The horn is critical. A horn works as an acoustic impedance converter. It converts high velocity, low-pressure waves at the wide end into low velocity high-pressure waves at the small end. Or vice-versa, it converts low velocity, high-pressure waves at the small end into high velocity, low pressure waves at the wide end. Look at the diagram. We have a little needle wiggling back and forth, getting some energy from the turning of the record player; (we're literally moving the needle back and forth with the energy from the turning of the record. That is what powers the wiggling.) So, our needle wiggles back and forth, and moves the lever, and the lever wiggles the diaphragm. So far, so good. But the diaphragm moves back and forth fast, literally hundreds to thousands of times a second. (The "A" above middle "C" on the piano requires the needle to wiggle 440 times a second.) So, the air right beside the diaphragm is nearly being torn apart. The pressure spikes up fast, and then, as the diaphragm moves back the other way spikes back down fast. So, you have very high pressures right next to the diaphragm. Now. If we put a properly shaped horn next to it, the horn can take this signal and "spread it out."

If you're a physics geek, the horn acts as an impedance transformer. If you're a poet, the horn takes the thin, reedy sound at the diaphragm and makes it "bigger." This is exactly the same sort of thing that happens in a trumpet or a saxophone. The trumpeter's lips going*bzzzzzz* make a thin, reedy sound that has no carrying power. The "trumpet shaped" trumpet takes those sound waves and transforms them into Louis Armstrong's powerful music. The sound horn on a record player does the exact same thing. The horn on the record player modifies the output of the diaphragm, making it more listenable.

It has long been known that a trumpet could annoy people a lot further away than a flute. The first record players, (phonographs) used horns that were like cheerleaders megaphones. They were small simple cones. They were adequate for speech, but didn't reproduce highs or lows well. The people building phonographs pretty quickly changed the horn shape. They settled on what turns out to be the theoretically perfect shape - that big-belled flower you've seen in pictures. It's called an "exponential horn." The Grantville developers don't need to know why this shape is best, they can merely copy an existing design, which had been polished by previous trial and error.

We can use the same horn, diaphragm and needle to CUT records if we want to. Attaching a diaphragm across the narrow end of a horn concentrates the sound energy and allows the needle to cut the wiggly line into a piece of wax—or, as in the original, a piece of tin foil wound round a drum (Please look up Edison, Phonograph on the web). So, at this point in our development of a recorder, we're up to where Edison was in his patent. We have a line on a soft surface which exactly follows the movement of the diaphragm (and slightly less exactly the variations of air pressure at the diaphragm, and even less exactly the variations in the room, but it's a start. We can do intelligible speech already).

If we reposition the system and drag the needle back across this groove we'll get a sound at the mouth of the horn which sounds at least a little bit like the original. The problem is, as we do that, it destroys the recording we made. That's not exactly what we're looking for.

If we use a lighter needle/diaphragm assembly, we get a sound much more like the original, and we will be able to play our recording several times before our master wears out. Still, we would like to be able to play a recording many times. We would also like to make many copies of a recording. Even so, the principle of the recording system is simple. We take something soft moving at a constant speed past a needle which is vibrated by the energy from the air. If this something soft hardens with time (like cheese or play-doh) or with varying temperature, or can be treated to harden chemically, or can take a hard, regular surface coating, we have the basis for a permanent medium. Simply dragging a long candle past the diaphragm won't work, however. For two minutes of sound, linear motion requires about fifty meters of candle. Storing and carrying them would be inconvenient. The solution was to coil the recording up some way. Two techniques were tried.

First: Edison's solution: Spin a cylinder and wrap your groove around it like thread on a spool. If you build a drum that you can slide thin cylinders onto, you can "change the records." This has the distinct advantage that the speed of the groove past the needle is constant. It has the disadvantage that making the recording play longer takes more and more "tube." An Edison tube "LP" would be six or more feet long.

Second: The Victrola solution. Use a flat disc (a 'record'). The groove coils from the outside in towards the center. Unfortunately, since the disk turns at a constant angular velocity, when the needle is in the groove near the outside edge, the speed of the groove past the needle is much higher than the speed near the center of the disk. More about that later.

In both cases the play head was moved by the groove itself. Disks became the de facto standard, in the OTL for two simple reasons. They stack better. Tubes have all that annoying space in the middle of them. And they are more copyable. (More on that later.)

Problems remained. The signal had to be fairly loud at the cutting head for anything to record at all (Bessie Smith powering away at the blues in front of a big band gave acoustic levels which are hard to believe in this age of universal amplification) and as to subtle, delicate performances, you can forget about them. Before amplifiers came to be, recording engineers had to constantly balance opposing desires.

On the one hand, they wanted the recording media to have good mechanical stability. A stiff material could accurately record subtle details of the sound. On the other hand, they wanted the recording media to be soft and malleable. Softer material could record weaker, softer sounds.

Similarly, the engineers were torn between higher rotational speeds, which allowed more accurate recording, especially of high pitched sounds, and lower rotational speeds to extend playing time. Placing the grooves closer together also extended playing time, however, wider groove spacing allowed bigger wiggles to be recorded, and thus, louder sounds. Larger discs extended playing time, but increased storage and transport difficulties. It was in everyone's interests to have a standard. The standard that was settled on was ten to twelve inch disks spinning at 78 RPM. A lot of interesting (loud) music was recorded like this.

Let's return to the advantages of disks. If you record on tubes, they are very hard to copy. Each tube has to be recorded individually. Bessie Smith had to belt out another one for every record sold. Good for Bessie, regular employment. Actually, not that good for Bessie. It was a boring, hard, low-paying job. (Of course, in the New Time Line, we won't be recording Bessie directly, we'll be recording a recording of Bessie. Still, it's not the best alternative.)

On the other hand, disks can be "pressed." When the recording process was finished, the master was cleaned of any small bits left over from the cutting process, coated with graphite, and plated with metal. This gave a negative of the original which could be used to produce multiple copies. In the case of popular artists, the process could be duplicated again and again. That way you could have sub-masters and archive masters. This was necessary since the masters could only be used a certain number of times.

Record players in houses had steel needles or blackthorn thorns attached to a diaphragm. The diaphragm was located in a cavity leading to a horn. The narrow part of the horn was hinged so that the playback needle could track the groove, or be lifted off and folded back to change the disc. The horn was made as large as practical. It was often built into a large cabinet like a sideboard or hutch, coiled back on itself and filled the furniture. The larger the horn, and the slower its flare rate, the better the bass response. Just like up time, speakers with big booming bass have to be large. The same is true of horns in mechanical players.

It is important that the speed be constant or the music goes Wow-wow-wow. This is considered bad. Constant speed was controlled by a centrifugal rotating watsit. The watsit reduced power when the arms swung out to a predetermined point. It's probably easier to copy the speed governor in an existing mechanical phonograph than to reinvent it. It is far less complicated than a watch. Many of these mechanical record players were still in use in the 1950s, half a century after the invention of the vacuum tube. Victrola's may not produce the great sound of modern CDs, but people were happy with the results and could listen to their favorite artists at home without paying a months salary to go to a concert (assuming there was a concert on) Still, one couldn't say that the illusion of "being there" was excessive.

At the beginning of the twentieth century came the next major development—the thermionic valve, or vacuum tube. 1907 saw the triode, and gave us electronics. Electronics was important, even if the players were still mechanical. Recording engineers could now start building decent microphones and amplifying them up to reasonable levels. They were now able to amplify quieter music and cut records electrically. Early electrical cutting heads look a lot like the old mechanical ones (with the horn removed, of course) but the diaphragm is made of iron, moved by an electromagnet which is driven by an amplifier.

As the engineers started to use electronic recording heads, they noticed a that the electricity flowing through the head caused it (and the needle) to get warm. The engineers kept increasing the electric power to the head so that they could increase the amount of back-and-forth wiggle. This let them cause the

cutting needle to more and more accurately follow the real sound waves in the air. The more power they had, the less the stiffness of the medium mattered. They could force that little needle to wiggle the way they wanted.

The more power they put in, the hotter the needle got. Hot cutting heads became common. This turned out to be a good thing. The hot needle softened the recording substrate, and made it easier to cut the record exactly the way they wanted. After the hot needle passes the disk cools and hardens again. Of course, if the cutting head gets too hot, it melts the solder and the disk under it, so high power cutting heads have to be cooled with pipes of water or oil.

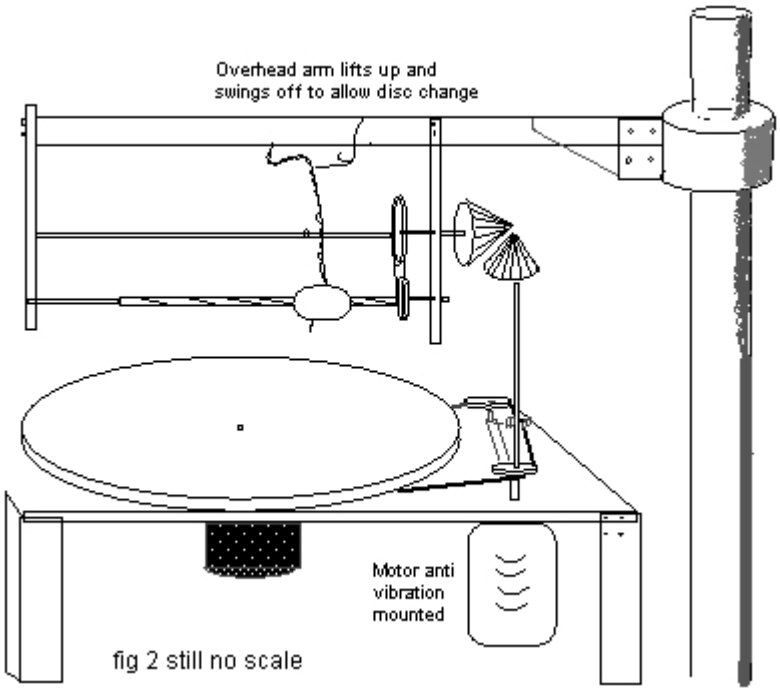
There are two advantages to the hot cutting head. One: the records sound better because they more accurately track the sound from the microphone. Two: we can use harder cutting blanks. With harder cutting blanks it becomes possible to play our cuttings (not too many times) and check that what we recorded is what we wanted.

Even if the majority of people were still listening to them on acoustic gramophones, the range of what could be recorded had gone up enormously. Glenn Miller could play some mezzo pianos, rather than being stuck in forte and above. We, by using the modern electronics we have available, can use two microphones, one for the band and one for the vocal. Politicians speeches can be retained for posterity (no advance can be all positive). Radio broadcasts can be recorded during the transmission, and rebroadcast ad nauseam without having to pay the performers again, a golden age!

What will Grantville build?

What follows is one man's attempt to design a record mastering facility for Grantville. It presumes that the mechanical gramophones described above are being produced, and that a market for the classic 10" and 12" 78 rpm disc recordings exists. This design concentrates on the cutting room, since the earliest records will mainly be reissuing pre-existing recordings from up-time recordings. Our recordings of up-time CD's are going to be the best recordings we produce. They will be better in all ways than down-time reproductions of those same songs, simply because of the quality of the sound. Eventually, though, down-time composers will arrive in Grantville, eager to have their music be distributed by the new network of record stores and dealers. Even when producing records of down-time compositions, they will be recorded to tape or hard disk and then cut rather than cut live as long as our tape recorders and computers continue to function. The cutting studio will be equipped with the most reliable amps and speakers we can get. There is no reason that the up-time components of our cutting studio shouldn't function for thirty years or more.

The Record Cutting Lathe



The record cutting lathe is going to be expensive, and will take some machining, but it's a one off job (maybe two or three if this really takes off, but minor, anyway).

Start with the turntable. This is what will hold the record blank we will be cutting. It needs to be heavy, perfectly balanced and dead flat. It can be specially machined if necessary, but we should be able to find something. Perhaps a brake drum from something large? In any event, there is a 14 inch flat circular plate that will hold our record blank. It needs to be heavy so that it acts as a flywheel. As the cutting head cuts, the heavy turntable keeps the speed constant while the pressures change. Also, heaviness helps control any changes caused by variations in power reaching the turning motor.

Directly below the turntable is the bearing that supports it. We need one really good bearing, as rumble free as can be managed. We're recording in mono, so rumble problems are reduced, but the cutting head is pressing down forcefully on one side of the rig, with nothing balancing it on the other. If the bearing isn't perfectly smooth, as it grinds and rumbles, those sounds would be cut into the record. It's very important to avoid this.

To the right of the turntable and its bearing is the motor. The motor is going to be very oversized. This will ensure that it will run at a constant speed because the strain of cutting is small compared to the mass of the motor. Up-time, the motors for cutting lathes are hysteresis synchronous or feedback controlled. Although those are better, a big, powerful, simple three phase motor is more likely to be findable than anything sophisticated, and it saves us trying to design the fancy controls to go with the fancy motor we don't have.

The geeks are going to ask: How do we measure the speed of the turntable? The tuned reed technique is good for checking the frequency of the motor drive current, but short of sticking a series of fridge magnets round the rim (not, I suppose, impossible) it doesn't work for the turntable. There is another simple answer. Strobe markings round the edge combined with a light source driven by a known frequency (perhaps a tuning fork) should work as long as the lathe is not in sunlight.

The cutting head has to be held*just* over the blank record, and moved to the side as the record spins so

that it cuts a spiral groove. The mechanism holding the cutting head must be very rigid and accurate. What we do is suspend the cutting head from an arm, and run a threaded rod through the carrier. The carrier is machined to engage with the threaded rod, and an overhead bar improves rigidity and carries the flexible cabling and cooling fluid to the cutter head. A vertical shaft and gears carries the rotation of the motor up to the rod so that everything moves together. All this stuff is heavy, carefully machined and fussy, but as we said, we only have to make*one* .

Everything is open for ease of cleaning and maintenance, rather than enclosed for protection, which means that if the operator has long hair, he or she wears a hair net. There will be no baggy clothes, nothing that can get caught in the mechanics. This thing will fail any health and safety inspection, so operators have to be careful. We don't want any scalps clogging up this mechanism.

The fanciest bit is going to be the cutting head and drive electronics. The easiest thing to modify into a cutting head we have is the speaker assembly from an old telephone handset. It has a moving iron driver that is simple to attach a needle to. The telephone handset has some problems; it's somewhat low power for the purpose, has higher impedance than would have been optimal, and it doesn't heat the cutter as much as I would like, while overheating itself too easily, finally because we've (oh, all right—*I've*) selected a moving iron design, very little of the heat is conducted to the cutting point where it would do some good.

Cutting heads on late generation stereo LP lathes were frequently cooled with liquid nitrogen, which gives an idea of how much heat is generated. So I'm going to damp out the cavity with some high temperature lubricating oil. I'll install a thermostat and a pump to move the oil around when the temperature goes above reasonable. Also mounted on the cutting head will be a sensor wire (for the temperature), a pair of flexible plastic pipes carrying heating/cooling oil, a vacuum cleaner tube to suck off the swarf, power wiring for the needle heater, and hopefully a microscope to check the groove (nothing too esoteric, a child's first biology set, maybe even a reading lens—I get enough magnification by taking my glasses off). None of these, nor the second lightweight arm for checking cuttings are marked on the diagram, to avoid it becoming too muddled—a photograph showing the final setup would be virtually incomprehensible.

One of the hardest things for a recording engineer cutting records is to keep the signal to the cutting head adjusted so that the groove doesn't cross over itself. If the needle wiggles too far, the grooves can touch, allowing the record to skip. Limiting the dynamic range of a modern digital master to what is available on our somewhat less sophisticated final medium is going to have to be manual at first. The cutting engineer will be doing three or four rehearsals with current running through a meter, but the cutting head will not be in contact with the disc. The engineer will be raising and lowering the volume control to compensate for the differences in level of the original. This is a major advantage with pre-recorded material. If this were a direct recording with musicians, we would have to cut lower levels so as not to risk the groove crossing over into the adjacent one

Making Records

The cut lacquer master disc is brittle and would wear out if played much, so the next stage is to make a metal master from it. A thin finish of graphite or silver is applied to the master and used as a conductive element to allow electroplating. The electroplating is done slowly to avoid softness or sponginess. The longer you run the electroplating system, the thicker the plate. In this case plating continues to an unusual thickness, which will take hours to weeks. Then you remove the lacquer master and you have a stamp. Put the stamp on a hot iron plate and you can stamp out records like a printing press.

Now let's make records. We take our copper negative and attach it to a rigid iron plate, so it doesn't

deform under pressure (These plates used to be mass produced. I once met a crate of them and thought it would require antigravity to shift it) Since we want to hot press, we mount a good thermostatic hot plate and a thick copper plate to get an even distribution of the heat with a short spike mounted in the middle to keep everything centered

I propose that we make our records single sided on a turned hardwood disc. The disc should be about a quarter inch thick. I suggest the hardwood, first, because wood is easily and rapidly machined and quality woodworkers are easier to find than, say, plastics people. Second, the wood is tougher weight for weight than anything else we're likely to find and transports well. I suggest that the hardwood disc will be less expensive than many other materials. If the hardwood is well seasoned and coated with the same lacquer we're using to press to, the discs shouldn't warp.

So, we've got a nearly disc size lump of lacquer, preheated till it's soft, and a slightly oversized varnished wooden disc. We squeeze the lump onto the plate, and it forms into the grooves in the copper master, and*bingo* ! We've got a record.

For testing, we need a decent playback system on hand. This will probably*not* be a mechanical transport—one of our standard export turntables—but a light modern pickup arm and cartridge, equipped with an oversize sapphire needle (if available—if not we screw in a metal needle) so we can play finished discs with minimum wear. Certainly the first of any series of records will be played end to end, as soon as it is sufficiently cool and before we start pressing the series. We'll want to compare it with the original recording, to make sure it sounds right. From then on, a certain percentage will be tested, just to know when the mold is wearing out and needs replacing, or the lac is going bubbly, or the lubrication needs to be more frequent or any one of a thousand other problems.

I've glossed over a hundred problems with the process I described. There will be problems of cleanliness (medieval clean room conditions), of finish, homogeneity of mixes of ingredients, labeling and packaging, of getting surfaces into decent thermal contact (electroplating gives a rough, lumpy finish which will have to be smoothed before mounting in the press—but without deforming the grooves on the other side), of waste material that needs cutting off without either deforming or dirtying the disc. All of this needs fastidious care, but is fairly obvious. Since individual discs can carry about five to seven minutes of music, or perhaps nine or ten minutes of speech, the labeling and transport of a symphony or a Shakespeare play is a non-trivial exercise, but it's all standard problems, nothing special.

I find I have filled my allotted space with transfer of already recorded material. Recording new original material will have to come in a later article (if anyone is still interested).

Finally, I cheated in this article. I wrote it entirely from memory, as if I were there, but discovered certain gaps in my knowledge, which I filled by looking up details on the web. The following sites I found particularly interesting.

www.shellac.org/ <http://www.shellac.org/nri/index.html>

www.recordcollectorsguild.org 1 <http://www.recordcollectorsguild.org/v_pressing1.html>

www.recording-history.org/HTML <http://www.recording-history.org/HTML>

OTL

1857—Leon Scot in France demonstrates the Phonoautograph system for recording sounds. It uses a diaphragm flexible enough to respond to strong sound waves, attached to a fine stylus, which presses

against a glass plate, cylinder or disc. In the cylinder form of the device, the glass cylinder was coated with black carbon (smoke) and rotated, recorded sound as a wavering line.

1877—In July, Edison files his first patent in Great Britain on a sound recording and reproduction of sound. A full specification for the phonograph was filed in April, 1878.

1878—The first 600 or so tin foil phonographs are made by several small machine shops at Edison's request. These were distributed to demonstrate the principle of phonography

1886—Alexander Graham Bell and an assistant, C. S. Tainter, patent important improvements on Edison's original phonograph. They call their machine the Graphophone

1889—January—Columbia Phonograph Co. begins its commercial life, based on the patents of the earlier Graphophone Co. Before 1894, Columbia and the Edison company are part of North American Phonograph, but later they split to become rivals. Both companies begin selling phonographs for use as dictation machines

1894—Emile Berliner introduces the Gramophone in the US (1889 in Europe), using a disc instead of a cylinder and a groove cut from side-to-side (laterally cut) instead of Edison's "hill and dale" (vertically cut) method. [Edison had experimented with discs in 1878, but decided not to use them, and many believe that the vertical cut method resulted in better sounding records]. The Gramophone is aimed at the entertainment market, and home versions are not capable of making recordings.

Victor Talking Machine Company formed

1906—Victor Talking Machine Company, a relatively recent entrant, offers its first "Victrola," a disc phonograph [we use the term phonograph generically from this point on] which placed the horn inside the cabinet instead of outside it

1907—An early attempt at sound amplification, the Parson's Auxetophone, used compressed air to increase the action of the diaphragm in phonograph reproduction

1912—Edison, at long last, begins offering disc type phonographs and records for sale, in recognition of the large number of discs on the market. Cylinder machines and records, however, are still produced until the demise of Edison's Entertainment Phonograph division in 1929.

1924—In October, Columbia Records experiments with "electrical" recording equipment developed by Western Electric. Electrical recording employs electronic amplifiers, microphones, and electromagnetic record cutters.

1925—Victor releases its last phonograph disc made by the original acoustic process. Thereafter, it uses electrical recorders and releases the discs under the name Orthophonic.

1926—Edison announces a long-playing, 12 inch disc capable of holding 20 minutes of music per side. This format does not become a commercial success. In 1927, the company markets its first electrically-recorded discs.

1927—Edison offers a phonograph capable of reproducing either Edison vertical cut discs or his competitors' more popular lateral cut discs.

1929—Edison introduces a series of electrically recorded, lateral cut discs, a reflection of the

increasingly marginalized market for acoustic and vertically-cut records.

1929—Edison ceases production of vertically-cut records and pulls out of the home phonograph business. Thomas A. Edison, Inc. continues to be a major force in the dictation equipment business, and continues to use cylinders through 1945

1931—RCA Victor introduces its version of the long playing disc, which is also a commercial failure (see entry for 1926)

1948—Columbia Records introduces the 33 1/3 rpm Long Playing record disc

1949—RCA Victor introduces its 45 rpm disc and a special record changer on which to play them.

Circa 1950—Introduction of 16 rpm discs for books-on-disc, recorded voice releases, etc.

ROF

1631—No energy available for non-survival based projects

1632—The press could be built in a week, with minimal up-time labor required. However, with nothing to press, and no machines to play it on anyway, this would be a bit futile. The electroplating baths need to be set up as fast as possible. It would be worth getting hold of some old 78 rpm discs, and start by duplicating these, before the cutting lathe is ready, as no-one has any experience in this field (and OTL many decent cuts were spoiled by inadequate electroplating, including a couple of mine). The room in which we're going to be cutting is chosen, and structural members mounted. Probably the old Victrola machine will be stripped, tested and measured (dimensions and performance). If several machines are available, all of them undergo this treatment, and third angle diagrams are copied onto tracing paper for comparisons of different models.

1633—The lathe is built into the room, and the electronics wired and tested. First test cuttings are done, listened to and adjustments made (adjustability—bolts rather than welds, variable heights, weights, pressures are to be built in everywhere. Even if this is a production facility, it's a test bed, too—perfectibility, not ultimate design is our watchword) Prototype turntables leave the machine shops, are assembled and tested, and a price for the production run worked out. Tests are done on bubble free production of shellac, both with and without carbon filler. All of this goes on in parallel, and shouldn't require more than a couple of months. It does require rather a lot of up-time help, so there might be some big gaps in the process while essential contacts are otherwise occupied. I don't know what machines will be necessary for building the turntables, but having a set of these machines built and training a team of down-timers in their use is a high priority. Castings for turntables will be needed. Also, cabinet makers must be contacted. We'll have to explain why they have to use twice as much glue as for anyone else (a rattle or buzz in one of these units is intolerable). Where is felt available? The enthusiast who started all this is by now sleeping three hours a night, eating only socially, divorced from friends and family as well as spouse and offspring, and, in future years will look back on this period with nostalgia—which says something about humanity, but I'm not sure what.

Then the dead period. Everyone's working, things are happening. The first turntable has come off the production line, the first records have been pressed, there are no immediate disasters, but nothing much is being sold because, for the time being, there's nothing much to sell. After the previous hysteria the lack of adrenaline leaves everyone suspecting they've died, and just not noticed.

1634—Having a phonogram in the corner of your withdrawing room, and five or six discs, is*the* fashion

accessory. Only those who are disgustingly rich and progressive need apply. Music conservatories are begging their rich patrons to obtain them one. Crises as excess demand tends to erode quality control. Quantities are still small enough that transport is not yet a problem, but the search for cabinet makers in Italy and France, capable of getting the acoustics right while adapting the aesthetics to the local market, and incidentally meaning that only the mechanics need to make the long voyages. Explaining what is going on to a woodworker, who doesn't speak any language you do, has no idea what makes sound function, works to a different measurement standard, and, worst of all, has several days travel to ask a question—well, challenging might not be an adequate term. Composers are already begging studio time to immortalize their creations—and the recording section is still at the "Mary had a little lamb" stage.

Mass Media In The 1632 Universe

By Gorg Huff and Paula Goodlett

This article is to run in conjunction with Chris Penycate's discussion of the material technology required to produce down-time records and record players. In addition to Chris' hardware, this article discusses the software of the media industry down-time, the challenges and the requirements to create a "mass media" in early modern Europe.

In the days, weeks, months and years after the Ring of Fire, the people of Germany will, in one way or another, be increasingly exposed to modern mass media. The VOA goes on line not long after the Ring of Fire. Crystal radio sets can and will be made by down-timers, based on a pamphlet. The pamphlets are being printed and distributed before the first year turns over. Some people believe these pamphlets. Some don't. Of those that believe that you can make a device to listen to voices from miles and even hundreds of miles away, some will build the device—and some of them will work. Some won't, either because they are built wrong or because they are set up in a broadcast shadow. It doesn't matter. It doesn't matter at all. Enough will work.

Most that do work will be listened to by dozens of people. More crystal sets will be made. Expertise will develop in the making and setting up of crystal radio sets. More people will listen. More people will believe. Those people will make still more crystal sets. For the first time in history—that history—all the people within the footprint of the VOA are going to have a new place to get news. Not all of them will use it, but enough will. This will be news from the wider world. News that is not days or weeks old, either. If it's from Grantville, the news will be delivered fresh and piping hot.

How much is rye selling for? Well, in Grantville it's selling for so many dollars a bushel. Not*was* selling for that price three weeks ago according to cousin Adolph's father-in-law.*Is* selling for that much as of last nights' commodities report. The result? Comments that go much like this: "Don't try to con me, Adolph. I listen to the radio."

That isn't the only effect. Aside from news, there is entertainment. Characters in radio plays and singers will become popular. Within Grantville there will be cablecasts not only of old movies that people have on tape, but live broadcasts of plays and tapes of new video movies made since the Ring of Fire. Will all this cause seventeenth-century Germany to produce its own stars? Look at Becky in the book*1632* .

This isn't going to go away anytime soon. In the year 2000, when the Ring of Fire happened, there were probably a couple of dozen video cameras in Grantville as well as a thousand VCRs and twenty thousand video tapes. Most of them had Aunt Josephine's wedding anniversary or the latest action adventure movie. Tape cassettes, video and audio can be erased, reused, and even repaired. It will be

years—or decades—before Grantville TV either goes off the air or loses the ability to video tape what it feels it needs to.

The same is true of audio tape recording of music. Even more true, there are more audio recorders than VCRs. Which means more audio tapes. As of the Ring of Fire, the formerly disposable tapes became worth repairing.

Within the Ring of Fire, the ability to record and preserve sound and sight, not to mention the ability to broadcast—or in the case of TV, cablecast—is not going to go away. The most fragile of technologies, the TV cameras and tapes, will last for at least a decade. Audio reproduction, and broadcast are permanent fixtures of the new time line.

* * *

That just leaves the rest of the world as the problem area. Minnie and Bennie. Reba Macintyre. Various and sundry down-time musicians. All of these can be heard over the VOA radio anywhere within a hundred miles of Grantville. Two hundred miles on a good day. Grantville TV is available anywhere the cable goes. Teleplays can, and will, be made for that limited market. By 1634 or 1635, the Voice of Luther goes on the air out of Magdeburg, changing yet another 100 mile footprint. (There's a slight overlap. Some lucky folks will have to decide*which* radio station to listen to.) But . . . recordings that can be played outside the Ring of Fire? Movies that can be shown outside the Ring of Fire? That will be harder.

Not that much technically harder, but cost harder. Marketing harder. It's called "mass media" for a reason. Mass media needs a massive audience to work.

There is already one form of mass media in the seventeenth century; printing. Printing has a couple of advantages over the other forms. First, of course, printing is already there. Second; printing doesn't need a player of some sort. When you buy a book or a newspaper, you don't have to stick it in anything to find out what it says. You can just read it. That means the potential market for any given book is limited to those who can read. Not to mention, those who can afford to buy books.

A record, a tape, a movie on video tape or film, all require a special piece of equipment to be of any use. Radio would seem, at first glance, to have the same problem. It doesn't, though. Once you buy or build a crystal radio you get the content for free, which makes it a better deal than buying a book. The same is true of buying a TV, if you're somewhere the cable goes.

The potential market for a record is the number of people who own a record player that plays that sort of record. The value of a record player is measured in terms of the number of records that you can play on it. Buying a record player puts you at the mercy of the record producers. Are they going to have the records you want? How much will records cost next year? And, if you don't have the record player, why on earth buy the records?

For movies, it's worse. There you're effectively asking someone to set up a business that is utterly dependant on another business. You'd be asking someone to spend the money to set up a movie house, a not inconsiderable expense, without a guarantee that there will be more than a couple of movies a year. How do you do that? "Here, kitty, kitty. I have some swamp land in Florida you'll love."

So, how did the businesses get started in our time line?

Partly by a lot of people going broke. At the very least, a lot of people lost a fair bit of money. Partly, it

happened because of the novelty. And, lastly, it happened by fairly massive investment. Starting in 1907, Victor would spend $50,000,000 on print advertising and $17,000,000 on catalogs and brochures by 1929. Doing this created the generic name Victrola. Today, Victrola is a name that is applied to all phonograph players that are designed as furniture.

Note: That is first quarter of the twentieth-century dollars. To do the same thing in 1632 means several billion over about twenty years. The investors in Victrola, of course, made a great deal of money. That doesn't change the fact that we are still talking about massive startup costs. Remember, the figure mentioned above was*advertising cost* . That was what was spent before the Victor Company even got to the cost of producing the record players and records to play on them.

Additionally, making that fortune took decades. Some of that time was "inventing time." Not a problem for Grantville, that. For the most part, Grantville can skip the time taken to invent a Victrola. There are several within the Ring of Fire. Inventing time, however, isn't the whole story. Quite a bit of the time required to recoup an investment was the time it took to establish the industry.

Why would that take time, you ask? Good question. To have an adequate recording industry you first need a collection of recorded music that is large enough to support the industry. Easy, that, right? Well, no.

Grantville can, to an extent, use up-timer music as a base for recordings. A fairly small extent, however. Up-timer music is in the wrong language, both linguistically and musically, for mass appeal. Modern music uses slightly different tonality and tends to be more rhythmically complex than European music of the seventeenth century, generally. The result? Grantville will need down-time performers. A lot of them. And a lot of music.

Each record recorded makes the record player worth a teensy bit more. Each record player sold makes the records have a slightly larger potential market. That word—potential—is especially important here. The market for any given record is less than the number of record players. It could be anything from a few less for a real blockbuster hit, to a lot less as in it sells only to the people who are both personal friends of the artist and own a record player. Which could be one . . . or zero, for that matter.

The same thing is true of movies, when you think about it. Only, in a way, the situation is worse. In another way, the situation is better. A movie needs electricity. It needs a reasonably powerful light source that even after spreading will be much brighter than the light in its surroundings. The light must be enough brighter to paint an image on the screen. Ah, the screen. Movies also need the screen. If the movie is a talking picture, it needs a better sound system than a Victrola. In part, this is necessary because the projector is likely to be a bit on the noisy side. On the upside, however, up-time movies are unusual and should have a bit of novelty value.

So, if you're going to run a movie house in a town or take one on the road, you're talking a fairly significant investment. Quite significant, really.

This means that you, who wishes to have a movie house, have to spend the money to start a business. And, it's totally up to someone else whether you're going to have product—movies—to sell. This is not the same as cloth merchant dealing with a weaver to get his product. There are a lot of weavers to deal with. It's an established art. Unless the movie industry is very well funded, then the movie house proprietor is looking at one—or at most a few—guys with cameras. Perhaps half a dozen movies a year, if he's lucky. That's not enough to turn a profit. Not even for a part time side business.

This can get to be a vicious circle. Even if the movie making company funds the start of the movie house,

how much willingness will the owner of the movie house have to limit himself to only those movies made by "his" movie company? This attitude, in turn, takes away much of the motive for a movie maker to back a movie house.

* * *

In addition to the problems above, there's another difficulty. This is the problem of standardization. As an illustration, suppose you're in a war. Your enemy's primary weapon is of a certain caliber. You make your guns fire a slightly larger caliber than the enemy guns. That means you can use their ammunition, but the enemy can't use yours.

Similarly, suppose you are in competition with Smith Record Player Co. Smith makes records to play at 70 RPM. The Smith Record players only play at that speed. Opportunity here. You can make your record player to play records at 70 RPM and at 80 RPM. As well, you make your records play at 80 RPM, which makes your record players a much better buy, since it can play the Smith records as well as your own.

The same thing is true of movies and projectors, in terms of film size and frames per second. Most of these little differences are factors that either don't really matter, or are judgment calls. Perhaps the slightly better sound quality you get at a higher RPM is worth the slightly less time the recording will last . . . or perhaps not.

Most of theses tricks were used by one company or group of companies or another in the evolution of the media industry. Sometimes, they were used to gain access to the other fellow's inventory while denying access to him. At other times, these differences were designed to lock subsidiary businesses like movie houses into using only one product.

Such tactics worked, sometimes. Sometimes they didn't, but this kind of tactic almost always resulted in delay and extra cost. For instance, the guy who was first credited with putting sound on film stole the idea from another guy. In turn, the guy who stole the idea was run out of business before the process he developed went into use. Delay for sound in movies? Approximately five years.

This dog in the manger attitude was a result of the simple fact that it is really easy to ride to success on the other fellows coattails. In this particular race, the last guy across the finish line has most of the advantages.

Also, there is a*bleeeping* lot of money to be made. A*lot* of money. Ah. Did we mention that there was a %^&&^%%% ((&^**%&*lot of money* to be made in the entertainment industry?

Well, there is. The sort of money that can make people a bit crazy.

* * *

In addition to money, there is power. The power to decide which songs and stories are made readily available to thousands of people would be in the hands of the major investor.

Music, sung or performed by the best entertainers in the world, is a tremendous influence over what people are going to believe.

Which brings us to the government . . .

In modern terms; do you show "Queer Eye for the Straight Guy" or avoid mentioning homosexuality? In 1632 terms, things will be said a bit differently, probably. The question will be: do you portray a Catholic priest as a hero, as in*The Bells of Saint Mary's* , or do you insist that the script be rewritten to make him a Lutheran pastor? Do you make the movie with the Committee of Correspondence character as the hero and the noble as the villain or do you portray the CoC guy as a fanatic and show the noble as, well . . . noble?

The government of the USE is not going to want that sort of power in the hands of any small group or individual. And it certainly will not want that kind of power in the hands of investors from some other nation.

We tend to doubt that Mike Stearns would want this kind of power in his hands, either. Especially since he already has stated that he is unlikely to win the next election. Which is probably almost certainly going to mean that anything that even looks like a media trust is going to get very little sympathy from the government. In fact, up-time antitrust laws will probably be invoked. That could mean forced sale at a loss and or fines.

Which means, if you're the primary investor and you're looking for government help in blocking the coattail riders that flock after you, you can just forget it. It just isn't going to happen.

Ultimately, if you're thinking of investing a medium size fortune—which is what it's going to take—in the media business, you have a very big problem ahead of you.

How do you deal with the guys that are coming along behind you? They're getting rich off your investment and putting you out of business while they do it.

Mostly, the answer is: you don't have an option. You may be able to stay in business, but a whole bunch of people are going to get rich off your dime. That fact will probably make your very expensive start-up quite a bit less profitable, at least in the short run.

Then again, there's the long run to consider. Fine. Johan Schmidt, or half a dozen others are making records that will play on their player as well as your own. What's the answer? Make your player play any record. The Schmdits find a really good recording star? Find your own, or hire her away from Schmidt.

By this time, she's got an agent to do the negotiating for her.

These things may or may not be practical. In any case, they are going to cost a lot of money and take time. Both are things that as an investor or manager of a media company you would rather avoid. You have a market by 1633. The VOA has provided you with at least half a million customers who want what you have to sell and will pay for it if you can provide it at anything like a reasonable price. You have, at least potentially, product. Everything from the 1632 version of Bob Viela's*This Old House* to its version of Brittany Spears. You have the technology by 1634. The pieces are in place to make records and record players, movies and projectors. Everyone else has that same opportunity. And, in this case, most of your investment will benefit the guy behind you almost as much as it does you. Even if he isn't trying to cheat, it just makes sense for him to make his record player play your records or his records play on your record player. If you're looking at this as an investment, your best course is to stand back and let someone else spend the money to get there first. Then, you can spend a great deal less on initial investment, step up and take your share of the profits. Besides, if you do that, you can spend the money you didn't spend trying to do it all by underselling him in one area and gaining market share.

In conclusion, to counteract the "last is best" effect is going to take a lot of money. Not a medium

fortune. A couple of really, really big fortunes. To avoid the media trust that it's a safe bet the government will not allow, you either can't control the various companies involved or your control of them must be very limited. Avoid a controlling interest like the plague. Seek preferred non-voting stock. You can, as a condition of investment, probably get away with agreements about format. Don't try for any control over content. The court will throw out the whole contract.

The start up money is there. By 1633 both Grantville and Magdeburg are competing with Amsterdam and Venice as financial and industrial centers. There are both businesses and individuals with the resources to do it. There will be movie studios, plural. Record producers, plural. Record player manufactures, plural. Movie houses, plural. Very plural. Both the traveling show sort that visit a village for a day or two and go on to the next and the in-place sort that have a movie projector and rent films.

How will they come about? Messily. Even if a consortium of some sort arranges an agreement on formats, the only people who will be obligated by it are those that signed on the dotted line and took the investment money. Even they will not necessarily follow the agreement if it starts costing them money.

This information is available to the up-timers and down-timers who have access to Grantville and its books. It isn't available all in one place or one article, true. But a careful study of the media and its history by use of the modern encyclopedias and other books will find information on the subject. Other books, perhaps biographies of stars like Clark Gable and Katherine Hepburn, may mention aspects of the media in passing. Carefully piecing these articles and passing comments together will tell the avid student or potential investor all he needs to know to see the pitfalls and advantages.

Agreements will be reached about format for records and film. Record players and film projectors will be designed with the possibility of upgrades in mind. Sometimes. Companies will start making their particular brand of record player and go broke. Which will, of course, leave the record producer for records of that type in the lurch. It will happen faster this time, because one of the obvious lessons that even a fairly slight perusal of the history of media brings is the desperate need for content. Nothing can really prevent it. The stars are going to shine. Because—as much as people need food and shelter—they *want* entertainment just as much. Or more.

Note: This essay describes the result of one individual's research into the possible routes and expansion of railroad in Germany after the Ring of Fire. This plan should be regarded as a proposal, and not as an edict. Canon in the 1632 series is established by stories. As you write your stories, you may choose to use this plan, or not. It is up to the author.

— The Editorial Board

Railroading In Germany

By Carsten Edelberger

"The railroads are about to make a big comeback in the world."

Eric Flint, *1632* .

Introduction

The railroads will be the steel backbone of the inter-modal rail/water transportation system of the United States of Europe (USE). The first rail line will provide a link for Grantville into the existing road-and-river transportation network and to the capitol in Magdeburg. The tracks will then spread across the State of Thuringia-Franconia (SoTF), more tightly connecting its important towns and providing them with easier access to the rivers of Elbe, Weser and Main.

* * *

Railroads, together with improvements of other infrastructure, will create a system capable of real mass transportation. They will reduce transportation times from weeks or months to days, and will vastly improve the reliability of the transportation system. At the same time, they will drive the cost of transport down, thus allowing vendors to produce for a greater market. Finally, railroads act as a classical military "force multiplier," by improving the speed at which armies and their supplies can move.

* * *

We don't have enough oil to fuel lots of cars with internal combustion engines. Granted, there are oil wells near Wietze, but it will take much time and effort to develop them. In the first few years, only some 150-200 barrels a day are expected, and that's definitely not going to impress a Texas oil tycoon. Moreover, even if we had the fuel, we would still need to upgrade the highways. In most parts of the USE, the roads, outside the immediate vicinity of towns and cities, are unfit for horse-drawn carts, let alone motor traffic.

Rivers might be an alternative for transport in many parts of Europe, but not for Grantville. The nearest river is the Saale, which runs north, past Saalfeld, Rudolstadt, Jena, Naumburg, and Halle, and empties into the Elbe (the junction is 18 miles upstream of Magdeburg, the USE capitol). Unfortunately, the Saale cannot meet our rising demands for transport. Upriver from Naumburg, transport with barges is almost impossible because the Saale is small and shallow. It is a nice trout stream, not a navigable river. Even rafting has to wait for snow melt for enough water. The Saale river can be improved to a certain degree, but the process would be laborious, costly and time-consuming. Going in any direction other than straight north with waterways from Grantville is absolutely impossible anyway.

Thus, railroad is not the best, but rather the only, solution to Grantville's high volume transportation needs. The first rail line will provide a link for Grantville into the existing road-and-river transportation network, and in particular to Magdeburg. The tracks will then be spread across the SoTF, more tightly connecting its important towns and providing them with easier access to the rivers of Elbe, Weser and Main. Ultimately, the railroads will be the steel backbone of the entire USE.

* * *

Starting the railroad infrastructure will be the first really big infrastructure project outside the immediate scope of Grantville. As most up-timers with appropriate knowledge are committed elsewhere, the project will rely heavily on, and be run mostly by, down-timers.

It will not be in the top priority list but will be ranked perhaps just after the military, very high in the secondary list. That's because we already have lots of most important projects to do. Projects like winning a war while retrofitting an army and simultaneously building our own army, navy and even our air force, just to name a few. But this project has great importance both in military and economic terms, so in the end it will get what's needed.

The General Plan

We should initially establish a railroad system comparable in capabilities to an 1870-vintage secondary railroad.

Our focus will be on transporting freight. Initially, we will make only a bit of additional money by transporting passengers. Average people from this time rarely leave their village or town if not forced to do so by war or other urgent circumstances. And the ticket for a train ride will be very expensive at first. So, at first the principal passengers will be up-timers, novelty-seeking nobility, very bold and rich businessmen and couriers.

There are two exceptions to this rule. First is transporting military units. But in most wars in which trains were used to transport soldiers, they were given only a modest increase in comfort in comparison to their horses. So, we too will consider them as freight, if a valuable and demanding one.

The second is public transport in urban areas. Industrialization tends to draw workers into the city; public transport becomes a tool to reduce the concentration of people. Commuting helps to keep prices in urban housing lower and allows for greater flexibility in working while maintaining a more stable private life.

So, when a railroad is already present, it should also be used to run cheap commuter trains, if possible. In major centers such as Grantville, Nürnberg and Magdeburg, tramlines which share the railroad track, either with the same gauge or in a double gauge track, might be established. If the big employers and the railroad company coordinate shift times and timetables properly, a few trains can transport a lot of people.

Grantville Starting Materials

Railroad didn't start from zero in Grantville. A rail line went into Grantville for servicing the power station. Also, some rolling stock and even a kind of a small car workshop came with us through the Ring of Fire. Regrettably, there was not a single engine in Grantville.

Later, some forty miles of two feet rail track and other equipment were salvaged out of old abandoned "dog hole" mines around Grantville. But it was put into good use by the establishment of the 141th Railway Battalion (See Ernest Lutz and John Zeek, "Elisabeth,"*Grantville Gazette,* Volume 4).

Most of our precious heavy rails from normal gauge track is going to become armor for the ironclads of Adm. Simpson's navy which is being built in Magdeburg, but we might be able to preserve at least some track for our railroading needs. We have to give up all double track, all unnecessary sidings and a lot of rails in the stations. Perhaps we can convince the Powers That Be to let us keep the switches intact, as switches are difficult to make and not so readily converted into armor. But we have to strip the whole system to a bare skeleton.

The overwhelming majority of all the stuff for the railroad will have to come from down-time. The use of up-time tools for building the high-tech items of the engines and perhaps the track is more effective in the end, anyway. Even with critical items we will rely on down-time manufacture as much as is technically and economically possible. These solutions might be less effective than up-timers are used to, but it's more sustainable in a long term perspective.

Financing

We expect that the railroads will be built and operated by corporations, that is, companies which raise at least some of their money by selling stock (ownership shares) to the public, and which offer the shareholders the legal protection of limited liability (that is, their potential losses are limited to their investment). The stocks will probably be sold primarily to governments (including those of towns and cities along the proposed route), wealthy merchants, and other companies (including the mutual fund, "Other People's Money,"*Grantville Gazette,* Volume 3). The railroad corporations can also borrow money, either by obtaining loans from bankers or by selling bond issues (these pay interest until they mature). Bonds, like stocks, will tend to be purchased by governments and the like.

Governments can also provide indirect financial assistance by granting tax immunities and other benefits.

The traditional animosities between rival cities could work to our advantage, as they will bid against each other to sway the railroad company to run the line to one and not the other. We have to bundle our resources with others. For example, every major railroad needs a telegraph system for managing the line. We will have to team up with a company like AT&L (See Dave Freer, "Lineman for the Country,"*Ring of Fire*) for telegraphs. To cater to the needs of our passengers we will license some peddlers to offer refreshments in trains and at the stations, as is done in India today.

We can improve the financial footing of our railroad by contracting, in advance, to carry mail for the USE, the SoTF, and so forth. Of course, we cannot safely enter into these contracts until we are sure that the facilities and personnel will be ready to meet these commitments, on schedule.

Route Planning

We have to build the whole railroad on a very tight budget. So, structures which are costly and time-consuming to construct, such as bridges, tunnels and dams, have to be avoided whenever possible. But lines should be designed with potential for growth in speed and better track in the future.

All turns on the main track should have a radius of 650 feet (200 meters) or more.

Branch lines to mines and factories should be considered only for later extensions. A company paying for its own branch is always welcome and will a get higher priority.

The stations will always be outside the walls of a town and be aligned in a way to skirt around the town if the existing track will be extended later.

Surveying

We need one or more survey teams to find the best route for the railroad. The necessary methods and personnel have been already defined in Laura Runkle's article "Mente et Malleo" (*Grantville Gazette,* Volume 2). It may be advantageous to add local*Markscheider* to the survey teams.*Markscheider's* job is to plan and survey the construction of shafts and tunnels in mining. They should be up to the challenge. Planning track lines for a mine is also common. In neighboring Saxony, the mining is actually in decline in

1632, so*Markscheider* should be available.

Acquiring Rights-of-Way

For building a rail we need land in a very long small line and also unlimited access to it. The tracks will go straight through land belonging to hundreds of different owners and landlords. It will belong to nobles, commoners, towns, abbeys and other entities. Why should an owner sell you this particular piece of land or a right of way? What would be the price? We will need some really good land agents, who can acquire the land quickly before the locals realize that you are making major purchases and raise their prices.

The Legal Position of the Railroad

Germany is a confusing patchwork of many different administrative entities and special legal situations as well as local taxes and customs. If we start negotiating separate deals with every single landowner we are doomed from the start. For a clean approach, we need an imperial law providing the railroad with a general exemption from ALL old prerogatives, customs and taxes. A immunity from impoundment of railroad track and rolling stock will also be necessary. Issues of right of way, policing in trains and blockading of these tracks should be solved here, too. Eminent domain, allowing the government to take private property for public purposes, with compensation, but without the landowner having the right to refuse is unknown in the period.

This law is a*"Conditio sine qua non."* Without this there will be no railroad. To get this law the USE will most certainly have to swap a lot of horses with all those very nice and very petty nobles.

Railroad Standards

So far we have discussed the "freedoms of the railroad." But the railroads will also have responsibilities. They will need to adhere to "*Eisenbahn Normalien*" (Railroad standards) both to ensure public safety, and also to avoid expenses (e.g., "gauge wars") that we can ill-afford. The standards will need to address gauge, track laying, masses & dimensions of vehicles, coupling devices, signals, brakes, engines and a lot of subsystems. The standards might be developed through open system with public proposals from participating engineers like the "Request for Comment" for defining the standards of the internet. We will certainly avoid several costly detours made in development in OTL. We will need to set standards early and avoid the blind alleys of the past.

Different rail companies will have to connect their tracks and be interchangeable in rolling stock from the beginning. As Jere Haygood says in "In the Navy,"*Ring of Fire* : "we're going to make damned sure that when we get around to building our railroads, 'standard gauge' means just that—*standard*gauge. . . . None of that business of every outfit building its own private set of rails to whatever gauge suited it."

Track Design

The USE should introduce only three gauges. Standard gauge*(Standardspur)* 4 ft 8.5 in (1435mm) will be standard in this world, too. Narrow gauge*(Schmalspur)* 3ft 3in (990mm) will be for cheaper track on secondary branch lines. And then there will be Tactical gauge*(Grubenspur)* 2 ft (610 mm) for military tacrail, mining and temporary industrial purposes. Together, these should satisfy almost all needs for the foreseeable future.

The best compromise, balancing functionality against scarcity of resources, is to use steel rails weighing forty pounds per yard. The length of an individual rail will be sixty feet. But rail is only the most obvious part of a track. We must start by creating a foundation; grading the land to create a level track bed. This bed is typically elevated, and slopes down on both sides to allow drainage. On top of the bed we have six to nine inches of ballast (gravel). Then we need sleepers, which are the wood ties which are perpendicular to the actual rails. Sleepers will be 25 to 30 inches apart, and thus there are about 2,100-2,500 sleepers in a mile of track. The rail is spiked onto the sleepers; we need at least six spikes per sleeper.

So, for each mile of track we need about 140,800 pounds of rail, 2,100 sleepers (weighing over 100 lbs each), 12,600 spikes and 18,900 cubic feet of ballast.

For the sleeper, a treatment with either creosote or mercury compounds is necessary. Otherwise the sleeper will not last for long. Both substances are expensive, poisonous and difficult to acquire. The additional cost will be more than the price of the sleeper but will actually pay off because a treated sleeper will last about 25 years while an untreated sleeper will last only five years. Creosote is essentially coal tar or wood tar. Because we still don't have enough industrial capacity in the chemical industry, we have to import wood tar from Sweden. Mercury is more difficult to obtain as it comes mainly from Spain or Tuscany.

Track Construction

Building the track will be an incredibly laborious, costly and time-consuming task. While the bar-topped track from Grantville to Halle has acted as our test bed, the real railroad will have much higher demands in durability and reliability. Despite the track having been planned with regard to the work involved, there will be a lot of logging, gravel moving, grading and building little bridges. Most work will be done by hand.

Initially there will be only one construction site advancing through the countryside. In later years it will be possible to advance with much faster pace, due to building bridges or dams well in advance.

Considering the situation in Germany in 1634, our workforce will be comprised of three parts. The core force will be permanently employed workers, probably those refugees who do not mind a hard but honest job. Job training for a trade should be offered as incentive. This may cause conflicts with the guilds, but is important for a high quality of work. In the longer run, many educated personnel from our crew will be lured out by better opportunities and settle down elsewhere. This will provide an additional bonus for the development of the country. But another part of the permanent workers will remain and form the backbone of the whole organization. The guys who get bitten hard by the railroad bug will oversee the whole moving construction site. They have to find a good solution to every challenge, really quickly. They will be true engineers by trade, if not by education.

There are lots of lessons about railroad construction, logistics and organization for them to master. Consider the monumental logistical challenge to have all the many parts and huge amounts of material

needed for only one mile of track ready at the right place at the right time, and within budget, too.

The second component of our workforce will be seasonal workers, mostly farmers who seek employment between seeding and harvest. This will funnel a bit of money into war torn rural regions. If given a free ride in the employment contract, it will expedite their transfer and make them available much earlier.

The last part of the labor force will be local farmers ordered by their nobles to do work in the construction site. There is no use in complaining about this system right now. For the nobles it might be the only way to earn some money, for the farmers it's the way to pay their rent for their land and for the railroad company it might be the only way to get enough transportation capacity and draft animals. If the farmers get fair and decent treatment on the site and the work is organized well enough, they might be fairly effective while picking up some new ideas.

The main season for large scale ground work will be in summer and after harvest. In winter the frozen ground will prevent such activities but might enable us to work in some previous inaccessible swamps. In spring, the mud after snow melt and labor shortages due to the planting season will hamper our progress. But even in the midst of winter there will be much work to do.

Engines

What sort of locomotives can we build? Replicas of huge American "Big Boys"? The fast British "Flying Scotsman"? Sturdy workhorses like the German "01" or "50" Series? No, not for another fifteen years or more. A reasonable decision would be to settle initially for a moderate top speed of 25 miles/h (40 km/h) and average speed 10 miles/h, a modest weight of ten metric tons per axle, and a respectable endurance of about 50 miles for coal and 25 miles for water while running a train of 300 tons on even ground for the first engine type. A engine class with three powered axles like the German Baureihe 89 should do nicely. This robust simple and flexible engine will weight about 32 metric tons when in operation. When used in short hauls a tender is optional. With modifications, this type was in use in OTL for over 80 years. It had about 290 horse power (215 kW).

Aside from this workhorse, a small engine for switching in the Grantville area and other nodes like Magdeburg is all that's needed for the moment. The classical "Western Style" engine design familiar from a lot of movies is better suited for fast passenger trains. It will have to wait for later.

For the switcher we need a really tiny engine class with two powered axles. With a power of about 100 hp, it should be capable of hauling about 100 tons at low speed. As it works only in a station, endurance is not so important. The type could be tailored in two variants. One for standard gauge and another suitable for narrow gauge.

Any engine will have to be able to use a wide range of solid fuel such as wood, peat, lignite or coal. Therefore we need a spacious firebox. We have to rely on low pressure (wet steam) because the boilers are easier to build and safer to operate. Water supply is abundant in Germany, but it might be useful to mount a steam powered vacuum pump (called a pulsometer) on every engine to get it on board. Some device to fight sparks out of the chimney is needed and real "bells and whistles" for signaling.

The first engines will be rather low tech, with boilers having leakage problems because they are riveted and not welded. Only the controls, cylinders, pistons, pins, bearings and suspension systems will be built with the help of up-time tools. Most parts will appear crude. The engines will most likely be unruly even

at moderate speeds, either over- or under-boilered, prolific in their consumption of coal, water and oil, and prone to a lot of general mishaps. But that is to be expected.

It might be possible to build some Heissler or Climax type engines with the help of unused truck transmissions. This type of engine, with its central mounted steam pistons, has a lot of very favorable qualities. It can cope with light, uneven track, and steep grades, and would be usable on bar topped rail lines.

The ability of Grantville's industry to supply appropriate, durable bearings and transmissions after the initial stock is gone is doubtful. So for now we will be able to build only a small number of Heissler/Climax, if any.

For secondary tracks and branch lines, cars drawn by draft animals or hand cars might be a good idea. Those could service marginal freights or a few passengers. A steam engine or a vehicle with a rare internal combustion engines is much too valuable to use for this purpose.

Rolling Stock

The engines just provide the motive power; it is the rolling stock (cars) which carry the passengers and freight. After the start of operation there will be a steady increase in demand for rolling stock. For every goods car hauled in a train, there are a minimum of five cars just being loaded or unloaded. So when we consider only five engines running with five cars each, we're talking about one hundred fifty cars total.

Box cars, cars for livestock and flatbed cars will be needed first. It would be very nice if we could copy those special tipping cars for ore and coal. That type of car has a really short loading time.

Passengers, mail and express freight may initially share a hybrid car. Perhaps it will be the caboose at first. Growing demand will make it feasible to put dedicated passenger cars on the road, and a more elaborate fare system will develop. Look at the airline classes or passenger classes in trains in the nineteenth century for inspiration. The average level of comfort will be much lower, of course. For instance, glass for windows is very expensive. Glass windows for coaches appeared as luxury items in urban centers like Amsterdam only a decade ago, because clear, flat glass plates are ridiculously expensive (See Iver Cooper, "In Vitro Veritas,"*Grantville Gazette* , Volume 3).

For all cars, only the truck and the main structural elements will be made from steel or iron. The rest will be built mainly from timber.

Private cars might be sold to nobles and wealthy merchants for whom it might be a symbol of status. For "merely" wealthy persons, we could offer private cars for lease.

The railroad would need to be able to assemble an imperial or presidential train from time to time. This would probably take the form of a government-owned private car for the emperor or the president, with several standard passenger and freight cars reserved for their entourage.

Subsystems

The interconnections of engines and cars are an example of a problem for which it is both desirable and

feasible to adopt the standard twentieth-century solution, i.e., the knuckle coupler. The spring inside a modern coupler which enables automatic coupling will not be available initially but everything else will be just the same. One exact position for coupling will be mandatory for all railroads of the same gauge. And interconnection between both coupling systems should be considered from the beginning, too.

For other problems, such as steam injectors to force water into the pressurized boilers, good proven designs exist but might be more difficult to recreate with down-time technologies. The experienced workers, up-time tools and workshops of Grantville will be needed to overcome these difficulties.

Braking will be a problem for which we don't have an easy fix. For switching duties a mechanical brake on the engine might be enough, if barely. The brake itself is not a big problem. Press something on the wheel to slow it down. To do this at each and every car in the trains with the at the same time with the same power poses the challenge. Up-time, braking a train is accomplished by air brakes, air pressure keeps the brakes from engaging, while springs cause the brakes to press against the wheels. There are strong doubts that the challenges of manufacturing such a system, with its steel pipes, valves and flexible pressurized connectors, can be met in 1632. It would be very costly in terms of resources and time. Employing a lot of brake men to hop from car to car to operate the individual brakes is very inefficient and dangerous. Early on, it will be the only choice Eventually the engineers have to find a better solution.

In essence, they must develop an automatic*mechanical* brake for the whole train. One possible design is that of the Heberlein Bremse. It was developed in Germany around 1850 as one of the first automatic braking systems for the whole train. The system was fairly low tech to build. It was effective if the speed was not too high; it even prevented runaway cars. So it would be excellent for our use, but it's highly unlikely that more than a tantalizing general description could be found in the railroad books in Grantville.

Until engineers can come up with the desired brake, the speed and the size of trains will be limited.

Crew

The railroad has to win a reputation for punctuality, reliability and fairness. Toward this end, the rail companies may organize duties for its employees in clear structured quasi-military manner. Each railroad company will develop a set of procedures, which have to be drilled then into the employees. This would cover a variety of topics, such as using the telegraph, counting axles of bypassing trains and bookkeeping. Hopefully, either retired railroad folks or model railroaders will have a*Guide to Operating Procedures* around. Possibly it will be more of a problem to stop the up-time folks from inflicting this on the poor, unsuspecting Germans all at once.

To give future down-time operators and crewmen a better understanding of railroad operations, some of the model railroads from Grantville could be used. This training could start well in advance of the real operation. Every lesson learned here will probably prevent an error that might have to be paid for in blood. Promotions should be given only on account of meritorious railroad service and relevant training and education.

A normal train crew would consist of an engine crew of at least two men, a conductor crew of two, and, if necessary, a security crew of several gunmen . If no central braking system is being used, we have to add a braking crew with one man for every other car. The engine crew will consist of a driver doubling as machinist. The assistant will act as brake man and the principal mover of coal.

For every station we need at least a crew of four persons to maintain a 24 hour availability. As a station

keeper is responsible for the work, he should be allowed to hire additional hands out of his budget. His family will most probably do a lot of the additional work. But unscheduled audits will have to be conducted to make sure that the station is always up to the standards of the railroad company.

Signaling and Communication

It is conventional to divide a track into blocks. A block may be empty, it may hold a train which is stationary, or it may be in use by a train moving in either direction. Transmitting information concerning the status of various blocks of a track is essential for operating a railroad.

The chosen device to deliver this service is the telegraph. Every track has to be accompanied by a telegraph line. Every block needs a telegraph station. A newly founded or cash strapped company will be tempted to avoid this big initial investment. But when trains become more frequent, the telegraph becomes a must for managing the track. For the challenges and costs associated with a telegraph line, see Rick Boatright, "So You Want To Do Telecommunications in 1633"(*Grantville Gazette,* Volume 2).

Some of the cost of the telegraph line can be recouped by telegraphing other communications for a suitable fee. Of course, train messages would normally have priority.

After having obtained information of the status of a block, we have to convey it to the train crew. Here we use some combination of various hand or flag signals, whistle sounds and, of course, signs. The actual form of a sign could be taken out of a up-time book of railroad code but may have to be adapted and simplified. The colors for all the signs may cost a small fortune. All fixed signs will be moved by hand and no remote control will be employed at first. Station keepers will walk a lot.

As railroads rely on timetables, providing a reasonably accurate time everywhere on the track is very important. Every station and siding has to have a clock. Worse, no universal time exists in Germany. Every town sets its own. The railroad have to use big, easily visible standard clocks, that perhaps look like those famous, not yet invented "Cuckoos." Time synchronization will be done by telegraph. Imagine: "Eight PM at the next click . . . Click" The keeper has to check at least every morning and evening. As the Grantville time will be the standard time for the railroad, it will set a standard for Germany.

Every major station should measure and record meteorological data as soon as basic instruments become available. This will allow us to predict the conditions on our tracks and will become the foundation of USE Meteorological Service.

Buildings

All station buildings with a common purpose should be built according to a common plan to reduce costs and to render them recognizable. If possible the buildings should be modularly designed, which facilitates later upgrades.

For stopping points we only need a closed shelter and a ramp for passengers and loading goods. No personnel will be here, as ticket sales and loading/unloading will be managed by the train crew.

On a siding we should build one standard house, either from stone or half timber. It would be two stories, with a waiting room, a ticket/telegraph counter and a kitchen on the ground floor, and the

apartment for the caretaker family above. Don't forget the public outhouse. A truck garden for the caretaker would be very helpful.

A true station has a bigger core building, with more room for people and employees. The station complex could include additional buildings, such as a dining room/inn, a hostel, stables, a carriage hire, and warehouses. If a town wants to have buildings in a special style, it's welcome to do so, as long as it comes out of their purse and doesn't obstruct the function. The building usually will become property of the railroad company after a certain period of time.

For water supply we need a basin near the track. An iron pipe is needed for connection to the pulsometer of the engine. Raised basins with windmill powered pumps will only work in some flat areas.

For coal supply, a gravity feeder for quick reloading will be built. The coal will be supplied by box car. Refilling the coal supply will be a tedious but necessary task for the caretaker.

At stations where the route ends, we need a turning Y because most steam engines don't run well in reverse. If space is restricted, as in most hilly areas, a turntable might be a better but much more costly solution. Another alternative, of course, is to build an engine that doesn't need to be turned around.

Bridges

Bridges are a special case. We have to build a lot of small constructions over little creeks and smaller stuff but we should lay out the track so as to avoid bridging the big gaps. If a big bridge is absolutely necessary, we have to consider investment, time for construction and expected service life carefully. For low investment we should build a detour. Most bigger bridges will be trestle works. They can be built in a short time and are suitable for the intended train weights. Treatment with creosote will prolong the service life. For really high weights and big gaps we should resort to concrete and stone pillars with wooden or iron grinders.

Consumables

Our railroad companies need a steady feed of the following materials to operate.

Fuel: It would be only lignite in most cases. Lignite is available in many areas of Germany. Notable resources are known near Merseburg, Halle and Stassfurt. It is always very helpful to have local sources. Otherwise we have to transport the coal to all stations by trains. This will cut in the revenues. Railroad companies are encouraged to buy some*Kuxe* (shares) in promising mines to secure supply.

Water: Water is rather easy to come by in Germany but to always get a steady, clean supply we need the above mentioned buildings.

Lubrication: We will need a lot of lubrication for all those axles and bearings. We might settle for oil out of oilseeds for some purposes, but for the majority we will need a chunk out of the daily production of Wietze Oilfields.

Batteries: We have to recharge all those telegraph batteries and to deploy them in time to the stations. Some suitable stations could be equipped with a small water powered generator to serve as a local hub

for this task.

Painting, Adornment & Naming

Trains and engines are symbols of progress and of the power of the USE. They are highly visible throughout their daily travel. Before railroads settle into normality for the general public they will set the trend and be very much "en vogue." Trains or engines could be named. This will give the fearful and doubting public something familiar to cling to.

The name for one of the very first engines will certainly be The Eagle =*Der Adler* . Names of towns, battles, states or mythical animals could be appropriate. Old biblical names might be a very good idea, too. But engines are items of business. Opposed to the contemporary style there will be no bright works. The color will be mostly black with some red part in the carriage. Black is convenient because the smoke will give the engines this color anyway. The red paint will probably be red lead (*Mennige*). It's easy to produce and not dangerous to man and environment if not subjected to abrasion.

For accounting purposes, each engine will have a numerical designation. The number could look like < 01 004 > where the first two digits identify the type and the rest are the individual engine.

The signs will be simple numbers and letters of brass riveted on plates. Thin brass, as we are on a budget.

Operation

One train per day for all major stations can be considered a good level of service, initially. An appropriate size for a regular train would be five cars. The trains will load only previously contracted freight because of the limitations of cars and space. But a "catch-all train" will collect goods from all those local branches and stopping points at least once per week.

The basic economic measurement unit for every railroad is the price for carrying a certain good over a distance of one mile. Fares, utilization, revenues, costs and profitability will come down to the very figure of how much shall be transported how far. Fares will be published as so much per cubic foot per mile for "measurement" (low density) goods or so much per ton per mile for "bulk" goods. The price is usually set so that the fare is the same for one ton and for somewhere in the neighborhood of 40-100 cubic feet. Passenger fares, expressed on a per person and per mile basis, are in essence the same.

Additional charges for special or dangerous goods, as well as for priority shipment will have to be considered. Big customers such as US Steel could negotiate special freight rates if they are willing to pay in advance for a large block of transportation capacity. Indeed, the railroad may find that it needs to grant rebates to customers that give it a lot of business.

To reduce operating costs and ensure safety, the railroad will limit its operating hours and conditions. No trains should go at night or in really bad weather, when visibility is impaired. We can add illumination systems, and then extend operating conditions, once the trains are bringing in some revenue, and the cost of lighting has been brought down by industrial development.

After heavy snow, we will have to accept a closure of some or all tracks as long as this condition lasts,

maybe for some weeks. Eventually, purpose-built snow plows will alleviate this problem but for now keeping a track open immediately after a major snowfall boils down to the question: You and what army?

Military use

Theory says that railroads will enable fast moving of troops over long distances. Praxis will show that a major amount of testing and training will be necessary to use this capability effectively. How many trains will be needed to transport one regiment? Which sequence of loading men and material is the most efficient way to get a combat ready regiment to the other station? Has all the shiny new equipment been designed to fit on railroad cars? What about regiments with legacy stuff?

I expect that rifle, cavalry and particularly artillery regiments stationed near Grantville will endure many loading-unloading exercises. They will make the trip between their barracks and an unloading place in their designated training area quite often just to give the generals some hard facts to count on.

The military, besides using the civilian railroad for long-range, strategic purposes, will also avail themselves of the railway battalion to construct temporary, narrow gauge railways (TacRail) for smaller scale, shorter duration, operations.

Timeline

By early 1633 there will be two rail lines operating in the SoTF. One will be the local track around Grantville while the other will be the bar topped rail line to Halle, constructed by order from the government as a interim measure. Parts of the track around Grantville came with us in the Ring of Fire.

Our first task will be connecting the coal mine to the power plant by rail. Over the course of 1633, the iron and limestone mines at Kamsdorf will be linked up as well.

The track to Halle is a jury rigged, desperate attempt to get at least some transportation capacity to a halfway decent harbor. It will be ready in 1633 if resources permit. Initially it will use converted pickup trucks for engines and whatever can be improvised for rolling stock. Like most stopgap measures built on a shoestring budget, it will have a lot of issues from the start. It will have serious operational shortcomings and wear out fast. Maintenance problems for the track, like the use of poor or green wood, insufficient bedding, shortages of converted trucks and very heavy use, pushing the link to the limit, will see to a quick degradation after only a short time of operation. But it will raise the transportation throughput by about tenfold while freeing a lot of men, carriages and draft animals for other purposes. Reloading goods at Halle will be the limiting factor then. So the bartopped rail track will act as a bootstrap for the real railroad.

1634 will be a breaking point for the railroad. While steel will be available then, there will be many demands for it. Because of the great military and economic importance of the railroad, it will certainly get some of that precious steel, but it will not be able to move forward with all of the proposed lines at one time. We have to make some very careful choices whether to update the Grantville-Halle track first or to start the Halle-Magdeburg section. About 25 % of track nominal length has to be factored in for sidings and connection to mines, mills etc. Building various tramlines for passenger transport in Grantville will make our raw material problems even worse. Hopefully we will eventually get enough steel to get the whole Grantville-Magdeburg line completed in late 1634 or the first half of 1635.

In 1635, at least parts of a "Saxon Highway" should be built, too. Connecting Erfurt, Weimar, Jena and Gera will be an economic imperative by this time. Afterwards, we can afford to choose projects a bit more freely. Some rail construction may still be by government fiat, but a growing percentage of rail should be sold without a predetermined purpose. The companies will now know where they can enjoy good business.

The two most likely options for expansion in the 1636-1639 timeframe will be going south to Nürnberg or going west to Kassel and eventually to Frankfurt and Mainz.

When all of the lines proposed below have been built and demand is surging, we might think about improving the rail and rail telegraph systems.

Possible System Improvements

Heavier rails will enable both faster trains and heavier cars. So, over time, the major lines will certainly be rerailed and repackaged. The old rail could be put into some local branches. In the Grantville-Jena section double track will be started.

If our business is booming and customers demand faster connections between our major stations and other points, then there are lots of possibilities for improvement:

* Introducing an engine which needn't stop as frequently for water and coal.

* Deploying some kind of lighting system could allow the trains to travel at night.

* Changing train car mixes. (New express trains with only one passenger car and one for express freight/mail could go much faster, approaching the technical speed limit of the track. If the express has priority over the other trains, it should be possible to go from Magdeburg to Nürnberg during the day and back overnight by 1642.)

Rail tracks in Germany

These rail lines are suggestions for future railroad lines. For obvious reasons Line No. 1 and No. 2 will be built first. The mentioned additional sidings are future updates to allow more crossings and overtaking of trains.

Line No. 1: Grantville & Eastern Railroad

Track length: 12 Miles

We should first revive the railroad in Grantville. It can be used to transport both coal and commuters. We need coal brought from the mine to the power station. According to the maps of Grantville, we don't have a direct branch line to the mine. This must be changed first, to enable the transport of coal. Coal will go from the mine first south east , then change direction and reach the power station on the eastern rim. The coal mine line is a branch or "annex" line off the main line running from USE Steel to the power plant.

A second big consumer of coal will be the steel factory. The construction site for the steel plant is just outside the eastern rim of the Ring of Fire. So the existing line will almost go there already; it needs only a small extension. Inside US Steel many things certainly will be moved by rail. So they will have to use heavy (up-time) rail, too. The coal mine will initially have an output of less than 50 ton/day of coal. We would only need a few railcars. A few (3-4) up-time rail cars with gravity assisted unloading would be absolutely marvelous.

The continuing track of the main line (3.5 miles to northwest) will be abandoned and totally reclaimed.

So we have initially four stations on line No. 1:

Line No. 1a: Grantville Local

Mile 0

Grantville Junction

near the USE Steel construction site outside the western rim of ROF

Mile 1.3 (annex)

Grantville Annex

at the coal mine. Branched off the mail line at Mile 3.5

Mile 3.9

Grantville Central

in downtown Grantville

Mile 4.6

Grantville Station

at the power station near the eastern rim of ROF.

As the existing line runs through the Grantville area, it seems worthwhile to use it for transportation of people, too. We need only some light rail cars and a small engine. Stations will be very simple, consisting only of a platform and some kind of shelter. The station track will consist of a siding for crossing trains or switching directions. An additional stop could be built near the North Central High School on mile 1.0. It would only be a walk of about 1/4 mile uphill.

* * *

Line No. 1b: Kamsdorf Mines

Track length: 6 Miles

The branch to the mines at Kamsdorf is the next logical step. We have to start at Grantville Junction, heading south along the western bank of the Saale to the northern part of Saalfeld. We could either cross the Saale via the Island in Saalfeld (with two bridges) or just north in one longer bridge. The latter bridge needs to be 65 feet long and should be usable for trains, carriages and persons. After that we go west along Weira creek to Gorndorf and Unterwellenborn / Kamsdorf. Constructing these tracks would allow us to use the railroad to feed US Steel with almost all needed bulk resources. Additionally we would be able to link up Saalfeld and Kamsdorf to our public transport system.

Initially we should be able to service these tracks and US Steel with only 2-3 small engines.

The planned stations for Line No. 1b are as follows:

Mile 0

Grantville Junction

near the US Steel construction site outside the western rim of ROF

Mile 2.7

Saalfeld

on the northern Border of Saalfeld near the bridge

Mile 6.1

Kamsdorf

Near the mines and quarries. Another village nearby is Unterwellenborn.

Line No. 2: The Capitol Line from Grantville to Magdeburg

Track length: 156 Miles

This line will be the backbone of the new CPE as it connects its two centers. While building the track we should attract additional transports as much as possible. Therefore, we will connect all towns on our way if they accept the offer.

* * *

Line No. 2a Grantville to Halle

"The Lifeline"

This line will be started at first as the bar topped wooden rail line to Halle. These pickup drawn cars are only suitable as stopgap measure. When demand surges up for the growing industries in Grantville this setup will not be able to cope. The line has to be converted to a real rail track as resources permit. The bar topped rails and rolling stock should be sold as horse drawn rail line to some secondary projects elsewhere.

* * *

Mile 0

Grantville Junction

major station, with water and coal supply, train

depot, engine workshop, turning Y.

This is the railroad HQ.

From GV we head north on the western Bank of Saale to Rudolstadt. Just before Rudolstadt the track turns east, following the Saale, turning north further downriver. Notable places along the way are Burg Leuchtenberg, belonging to the Wettin family, and the town of Kahla with nearby resources of Kaolinite (white clay).

Mile 2.9

Rudolstadt

stopping point

The track will pass between the town wall and the river Saale. A station and additional track to provide access to the lumber mills is will be built. Rudolstadt should be part of Grantville's public transport system. Possible further sidings are Uhlstädt (mile 10) and Kahla (mile 17.5).

Mile 27.8

Jena Göschwitz

station, water supply

The station will be built a bit north of the actual town, bypassing it on its western borders. On the journey to Jena we follow the Saale closely . Sometimes the valley is rather narrow.

Mile 40.75

Bad Kösen

Town with salt deposits and some industry. Possible further sidings are Camburg (mile 39) and Saaleck (mile 49).

Mile 56

Naumburg

station, siding water and coal supply, harbor

Here we are on the wrong side of the river. Naumburg is on the confluence of Saale and Unstrut. The Saale makes a turn from north to east while the Unstrut comes from the west. A bridge over Unstrut has to be built. The station should be just behind the confluence on the actual "north shore." It will be about 1-2 Miles to Naumburg. Here is the first point where reloading goods would start to make sense economically. So we should use the little harbor here. A new ferry over Saale to Naumburg city is also a good idea. As the valley widens, we stay hard on its left side.

Mile 63.5

Weissenfels

About 10-15 Mile east from here are lignite resources. After it has been studied by the Geologic survey, the railroad company may wish to build a branch line and to buy a share of the mine. Ensuring a second source of coal is important.

Mile 74.75

Leuna

On our way to Merseburg we pass by a little village named Leuna. In OTL this was the site of big ticket chemical industry. As geographic and logistic factors are the same now and then, this promises the village a great future. A branch line to the big resources of Lignite in this valley should be considered.

Mile 76

Merseburg

siding, water supply

Merseburg is known for producing and exporting a good beer. Good news for the Thurinigian Garden

chain and all those thirsty fellows. The valley is becoming wider and also a swamp in some areas. We stay hard on the western side of the valley and the track will cut all those bends the Saale river does, but we will have to reinforce some ground before laying the track.

Mile 78.5

Schkopau (Buna)

Here it's the same as with Leuna. Artificial rubber was invented here in OTL.

Mile 88.25

Halle Salineinsel

major station, siding, water and coal supply, harbor, turning Y

The station in Halle is outside the town on the western bank of the Saale. The Salineinsel is an island with wells of brine. On the opposite side is the center of Halle. A bit south of the town in Ammendorf are small resources of coal, but bigger ones of lignite. Bigger resources of coal are in Wettin on the right (eastern) bank of the Saale about 12 miles to the north of Halle. Establishing some coal mines here would be very convenient because we don't have to carry our own coal. If a mine is being established it should be connected with the existing line. But for that we have to build a bridge over Saale or rely on transport with carriages.

* * *

Line No. 2b: Halle to Magdeburg

The Copper Track

We now have two track-laying alternatives. The direct way to Magdeburg is shorter only 53 miles but must cross the Saale twice, once in Halle and again in Bernburg. The other route, which is 67 miles long, could be called the copper track because it makes a detour to the mining area west of Halle while going around a bend in the Saale. It is the preferred path because it give us access to an important industrial area, and allows us to avoid building two bridges and laying our line over a lot of muddy ground at the price of just 14 extra miles of track.

* * *

Mile 88.25

Halle Salineinsel

major station, siding, water and coal supply, harbor, turning Y

From Halle we have to find a gently sloped way out of the Saale valley. The height difference to the countryside in the west is about 85 to 100 feet. With a sharp bend just before the village of Kröllwitz, we change direction from north to west and venture into a small valley. Here a considerable amount of groundwork will be necessary to allow for a track with a moderate grade.

Mile 90.5

Teutschenthal

Here are resources of Halite (rock salt, NaCl) and a bit of Sylvin (KCl). The place feeds its products into Halle. We might able to expedite that.

Leaving Teutschenthal, we pass alongside the Süsser See (Sweet lake) on our way to Eisleben.

Possible further sidings are Teutschenthal and Röblingen (mile 101).

Mile 108

Eisleben

siding, water supply

From here it's only about 40 Miles west to the manganite mines of Illfeld.

Mile 112

Helbra

Mile 114

Kloster Mansfeld

Mile 119

Hettstedt

siding, water and coal supply

From Helbra to Hettstedt, in about 7 miles we cross an area of intensive mining and processing of copper. Two fifths of this area belongs to Magdeburg, the rest is owned by the Wettins. The copper ore is being transported to the various smelters in the area. If there are branch lines to the major mines and smelters we should station one engine here to carry copper from the mines to Line 2b.

The towns and mines have been devastated by plundering armies and neglect but are trying to rebuild. One major limiting factor of growth before the war was the lack of wood to feed the furnaces. Some lignite might be welcome here.

Another problem here is the processing of copper into goods. It is being sent into the Harz mountains, where a lot of water driven rolling mills , such as the ones near Harzgerode and Mägdesprung, are in operation. These could be replaced with steam powered rolling mills and hammer works. In fact, in OTL the first steam engine in Germany was erected here in 1783-85. The Hettstedter Maschinenwerkstätte (Hettstedt maschine workshop) played a prominent role in copying the Watts steam engine.

From Hettstedt, we head south again. For about 15 miles there are no notable towns except Aschersleben about 7 miles away from the track. A possible further siding is at Mile 126 near Gross Quenstedt.

Mile 134

Stassfurt

siding, water and coal supply

Stassfurt is a place of great interest. This city seems to be one of the best places to start a chemical industry. The main reason are the valuable resources of Halite (NaCl), Sylvin (KCl), Gypsum (CaSO4), Bitter Salt (MgSO4), Glaubersalt (Na2SO4) and lignite only two miles away. Because of this abundance of resources, in OTL a serious industry started here and some discoveries regarding the soda were made in Stassfurt.

If the decision is made to establish an industry here again, we could gain early access to a river transportation link by building a bar-topped rail line to the Saale at Bernburg. The line would be about 7.5 miles, and would run over flat terrain. The cars should be drawn by horses. Bernburg has also big resources of limestone and therefore could become a center of lime and cement production. A branch line of two miles from Stassfurt going northwest to the lignite mines of Löderburg may be desirable too.

For the next 17 miles we go north. There is nothing important around here—except for the most fertile soil in Germany. Wheat, corn, oil seeds and sugar beets grow here very well. Imagine, Sodawerke Stassfurt could even offer some additional fertilizer in some years. But for now farming is still depressed here because of the devastation brought by Tilly and others.

A possible further siding is at Mile 126. It's about 2 Miles west from a village named Biere.

Mile 151

Salbke

siding

A little village that will get an big upturn, because land for housing can be obtained cheaply. Work is nearby in Buckau and access into Magdeburg will be easy because a tramline through Magdeburg will be established on our rail track.

The area between the villages Buckau and Salbke in the west and the river Elbe in the east should be used as place for establishing industry. The area is about two miles square. The banks of the Elbe are suitable for getting sand for construction works. Near Buckau, a small harbor or even yard might be possible.

Some miles of track will be needed for branches to connect newly founded companies. Two miles west of Salbke is a promising spot for the airfield of Magdeburg.

Mile 153

Buckau

station, water and coal supply, train depot, engine workshop, turning Y

Mile 155

Magdeburg Central

major station, harbor

The station is at Fischerufer at the banks of the Elbe. It's just below the*Alter Markt* (The Old Market) right in the heart of Magdeburg. All important places in downtown Magdeburg are just nearby.

Passenger ships to Hamburg and also up to Dresden can depart from a pontoon just in front of the station. Just prior to the station we will pass the Domfelsen in the Elbe. This underwater rock is a major obstacle to shipping. Even if the rock is blasted away we still have to cope with a strong current. In OTL they used chain tugging to get the ships over this point.

Mile 156

Magdeburg Harbor

harbor

Magdeburg Harbor is also the place where the new shipyard is being built. It's just a mile downriver (north) of Magdeburg Central, between a part of the town called Neustadt, and the Elbe. The banks of Elbe are much wider here than in downtown Magdeburg. While the old harbor is at Magdeburg Central, here there is much more room to grow and to use heavy equipment. The suitable area goes up to the next village.

Mile 158

Rothensee

stopping point

The village of Rothensee is the last stop of the track for now. It is a suitable area for loading livestock and other very bulky freight. Easy available resources of fine sand as well as the possibilities for building houses will make this place viable.

* * *

Further tracks from Magdeburg will most probably go west to Braunschweig, Hannover and, of course, Wietze. Later this will undoubtedly extend further west into the Ruhr area and eventually to Amsterdam. But from Magdeburg to Braunschweig there are no valuable goods or big towns for about 60 miles. We would have to build this track only for Wietze oil or for strategic reasons. In the short term, a track starting in Hettstedt and going along the northern rim of the Harz Mountains to service centers of mining and milling such as Mägdsprung, Thale, Ilsenburg and Goslar, eventually reaching Hannover, would be much more promising.

To go east to Berlin we would have to cross the Elbe and its muddy valley. As Havel is a navigable river all up to Berlin, and Brandenburg is not our best ally anyway, we should think twice about this track.

The Elbe courses north and later northwest from Magdeburg. It's a navigable river all the way down to the North Sea. Some towns like Lauenburg might pose a problem with customs and tariffs. But after having a closer look at one of the new monitors/ironclads, they will listen to reason. With a channel going from Dömitz to Lake Schwerin, we can go almost to Wismar. Ideally, the yard in Magdeburg would be able to build some steam-powered dredges for digging the channel. Shipping on the Elbe could be sped up when we start tugging the barges.

So, building a railroad seems not so important here, at first. But certainly the telegraph line will spread out to west to Wietze and north to Wismar, Hamburg and Bremen. From Hamburg it will be extended to Ritzebüttel (aka Cuxhafen in OTL) on the mouth of the Elbe.

Track 3: The Thurinigian Highway from Gera to Eisenach

Track length 113.5 Miles

Needed rail about 240 Miles.

Trip time (one way): One day

Most of our allied cities like Jena, Weimar and Erfurt are actually towns just north of the Thüringer Wald. They are lined up east to west. So it seems wise to interconnect these towns by railroad, even if the roads between them are improved.

For service reasons, the Jena station should be updated to include a coal supply and a turning Y before starting Track 3.

* * *

Track 3a: East Branch

Mile 0E

Jena Göschwitz

station, water supply

North of the station the track branches east, crossing the Saale over a new combined rail and road bridge and then gently climbs a side valley. Passing Stadtroda, we reach Hermsdorf at the very end of this valley.

Mile 12.5E

Hermsdorf

siding

Hermsdorf is a village in a poor area, with only about a dozen houses. The siding here is only for traffic purposes. We go into a little creek valley for the next 10 miles to Gera. Just for the last half mile we turn south into the valley of the Weisse Elster. We stay on the western side to avoid having to construct a bridge.

Mile 23 E

Gera

siding, water supply and coal supply, turning table

The town of Gera is near the border of Saxony. It's a center of production for wool and linen and associated manufacturing. In the hills around here, sheep farming is very common. Gera has escaped destruction in the TYW rather well. The ruler, Heinrich Posthumus Reuss, did well in the last decades, too. His realm belongs nominally to Bohemia but in practice is rather independent.

A branch line to Eisenberg may be desirable. Near that town are resources of red clay which might be usable for pottery, bricks and roof tiles. It might be that usable resources of iron ore are underneath the sediments. Geologic survey will have to check this.

The Eisenberg branch line would go north from Gera along the valley of Weisse Elster, then turn west after 8 miles into the Rauschebach valley. This valley is dotted with several mills of various kinds. The line reaches Eisenberg after another 4.5 miles.

* * *

Track 3b: West Branch

Mile 0W

Jena Göschwitz

station, water supply, coal supply, turning table (see below)

About a mile south of Göschwitz and west of the town of Jena, the 3b line will branch from the Capital line, and head west into a side valley. After about 2.5 miles, it will turn southwest for a short while and pass Gross Schwabenhausen. Swinging back to west it enters the valley of the Ilm. Crossing the Ilm shortly thereafter, it goes along the far bank, eventually reaching Weimar.

Mile 13W

Weimar

siding

In Weimar we go west around the city to the siding north of the town.

Mile 27W

Erfurt

station, water supply

In Erfurt, we stay south of the town. The Erfurt region is the center of woad production which gives a nice blue dye. With Lothorien Farbenwerke producing aniline colors out of tar we might encounter a bit more resistance to the new times here.

Between Erfurt and the next stop, Gotha, is a small but fertile plain with some prominent hills. On three of them are Castles called "Die drei Gleichen."

Mile 45W

Gotha

siding, water and coal supply

The economy of Gotha is similar to that of Erfurt. Woad is the cash crop here too, albeit on a bit smaller scale. The station is south of the town, and is reached just after crossing a little creek.

Two miles west from Gotha we leave the valley and climb up a bit to the valley of the Hörsel. We will stay in this valley all the way to Eisenach and Hörsel. But we have to be careful because this little creek is known for flash floods. We stay on its right side (north shore) as there are fewer tributaries to cross there. Just before reaching Eisenach we cross the Hörschel. A possible further siding is at Mechterstedt (Mile 55 W).

Mile 65W

Eisenach

Station

A bit of woad, a bit of copper, a bit of timber. It's a small sleepy town. About 10 miles south east is the town of Ruhla, renowned for its knives.

We stay between the river and the walls of Eisenach and go west for 4 miles. The valley opens up to the Werra river here.

Mile 69.5 W

Hörschel

siding, water and coal supply, turning Y loading point/small harbor on the Werra

This station is built only to facilitate loading to ships on the Werra river. The neighboring village Wartha (1Mile) might be suited as well. The Hörschel (or Wartha) siding will give access to the river system of the Weser, which allows waterborne traffic downstream to Bremen and to Kassel. By using the Weser river we are able to go even to Minden, about 35 Miles West of Hannover.

Upriver, Werra goes around the Thüringer Wald and meets Schmalkalden and Meinigen. But it soon becomes too shallow for any shipping. An upgraded ferry or a combined bridge for carriages and railroad here in Hörschel would help all road traffic that goes further west to Kassel and southwest to Fulda and Frankfurt.

* * *

Track 3c: The Suhl Annex

Track length 14 Miles

This is a typical example of a branch line. The only special feature of this track is that it sits on the best way to Suhl, a town important for its gun making business.

Mile 0

Gotha

siding, water and coal supply

The track branches from the mainline just west of the siding. It turns south and passes some small villages. After four miles, it meets a small creek with a collection of mills. It follows the creek for about a mile, then turns west and climbs a bit for half a mile just to turn south again to get into Ohrdruf.

Mile 10

Ohrdruf

siding

Ohrdruf is a town with craftsmen, lumberjacks, a bit of sheepfarming and a small smelter.

From Ohrdruf the line goes along the Ohre creek. This creek is lined with over twenty water wheels in mills of various types over the next few miles, as the water supply is good and steady here. One of the mills is the famous Tobiashammer.

Mile 12.5

Luisenhain, el.450m

stopping point

Lumberjacks and hands for the mills live here. Their beer is well regarded.

Mile 14

Schwarzwald, el.480

station, water supply

Small village with five lumber mills. Just above is the Käferburg. Our track ends here because the conditions for railroad make it too difficult to continue. To get to Suhl on the other side of the Thüringer Wald with rail we should use a different valley and we still would need a tunnel about two miles long. So, it's not possible now.

But we have a road (the "*Leubenstrasse*") passing through to Suhl here. It's fairly old and well regarded. It can be refurbished to create a 1634 version of an "Autobahn." Two broad lanes, drainage along both side of the road, reliable bridges over all small creeks, the surface sealed with cobblestones and all maintained regularly. This road of 16 miles should go via Oberhof (elev. 800m), Zella St. Blasi (elev. 500m) to Suhl (elev. 450m). A pickup with a snow plow and spike wheels/snow chains should be able to keep this track open for much longer in winter. The telegraph line will go with the road and "island" stations will be established in Zella and Suhl for acquiring freight for the railroad.

The main track could be extended on the west end to Kassel, the capital of our ally the Markgraf of Hessen-Kassel. We would start in Eisenach and go via Bebra to Kassel. Another idea is to go from Bebra via Bad Hersfeld, Fulda to Frankfurt/Main and Mainz. But politics are not clear here for now. On the Eastern Part the line could go from Gera to Zwickau (Coal), Chemmnitz, Freiberg (Silver), Freital and Dresden. All this track would go though Saxony. We have to wait until the political situation has improved and the Saxons are firmly on our side.

Line No. 4: Franconia Line (from Grantville to Nuernberg)

Track length 75 Miles

The Franconia line will cover our southern connections. Access to Bamberg would give us access to the Main and therefore to all rivers of the Rhine. Bamberg is the traditional port where the road transit to the Danube River starts. Nuernberg sits on this way.

Our biggest challenge will be the crossing of the Thueringer Wald. With the chosen track we will have a average grade of 1.5 % for about 10 miles. To get a train to the other side with its full load, we could use the help of double traction or a bank engine. But I think for most trains that would not be necessary.

As the higher regions get more than a meter of snow for about two to three months of the year, we should consider some snow plows to keep the track open as long as possible.

Mile 0

Grantville Junction

near the US Steel construction site outside the western rim of ROF Elevation 230m

Mile 2.7

Saalfeld el. 240m

stopping point on the northern Border of Saalfeld near the bridge.

Line 4 starts just after this stop. It stays south while the line to the Kamsdorf mines branches and turns east. Line 4 proceeds on the left bank of the Saale for about two miles. At Kaulsdorf the track leaves the Saale river and heads south up into the rather small valley of Loquitz creek.

A possible further siding should be at mile 8 at the village Loquitz (elevation 277). Along the Loquitz creek are some water mills and we have the opportunity to build some more.

Mile 17.2

Probstzella el. 340m

siding

There are slate mines here. This durable and light material is used on roofs and walls in the region. (Probstzella is barely visible in the southeastern corner of the biggest of John Biel's maps.)

Mile 19.7

Lauenstein

stopping point

This is a small border village between Thuriniga and Fraconia, with a castle brooding on a hill nearby.

Mile 21.5

Ludwigsstadt el. 446

siding, water and coal supply, meteorological station

Just before Ludwigsstadt, we crossed the highest point in our track; we are in Franconia now. We have access to the path/road of Rennsteig on top of Thüringer Wald.

We have to construct a big bridge (650 feet long, apex 85 feet high) over the Trogenbach valley. A detour is not viable as it would need two very steep climbs. For the bridge I propose a wooden construction, as it could be built fastest. Because of the long building time, the bridge has to be started well in advance of the actual laying of track. The trestle work has to last for only ten years as it will be replaced with a stronger structure once there is enough traffic to justify it.

As we are still high in the mountains, the bridge will be subject to strong winds. The keeper of the nearby station will have to act as a keeper of the bridge, too. When the winds become too strong, or ice is on the bridge, the track has to be closed.

From the bridge, the track continues straight south. A possible further siding is at Mile 29 in Förstenberg.

Mile 35

Rothenkirchen

stopping point

This little town and its surroundings belong to Bamberg. Notable is the big Rittergut Hasslach (manor Hasslach) nearby which escaped the destruction of the war. It might be an notable customer before long.

Mile 39

Stockheim

station, water and coal supply

A source of coal! Not only in this valley but just 100 meters away from the track. After Stockheim, the track heads southwest.

Mile 44

Kronach

stopping point

Just before Hochstadt we cross the Main river. Here, it's still small. We are now in the Main valley and will stay on its left (southern) bank.

Mile 55

Hochstadt el.268m

The best road to Bayreuth starts here. It's in essence up the Main in direction southeast. The Main is going in the general direction west but with many bends. We follow the valley but cut the bends for our track.

Mile 56

Michelau

stopping point

Mile 58

Lichtenfels el. 271m

station, water and coal supply

Lichtenfels and Michelau have business of making cane furniture and are starting points for rafting timber down the Main. The area we crossing now is called Fränkischer Jura. The Main comes gradually from direction west to south in the next 20 miles. We will follow the Main until it makes another a sharp bend to west, where the city Bamberg is situated.

The whole area to and around Bamberg is well suited for growing vegetables. A possible further siding is a Mile 69 in Zapfendorf.

Mile 77

Hallstadt

station, major harbor

Just north of Bamberg, on the confluence of Regnitz and Main, we should build a major service center to exchange freight between ships, trains and carriages. While the Main has a lot of bends, it gives easy access into virtually all western parts of Germany and as well as Alsace and the Netherlands. The river is also well suited for chain tugging.

Establishing a small yard here to build ships either of local resources or out of parts prefabricated in Magdeburg seems to be good idea, too.

Mile 78

Bamberg

station, water and coal supply, train depot, engine workshop, turning Y

We go further south from here and stay as usual on one side of the river, in this case, the Regnitz. The general direction is straight south. The Regnitz doesn't have many bends but the area is swampy. The whole area around the Regnitz valley up to Nürnberg is rich in places for mills.

Mile 85

Hirschaid

stopping point

Cane furniture, like that made in Lichtenfeld, is also made here.

Mile 89

Eggolsheim

siding

Mile 93

Forchheim

stopping point

Mile 97

Baiersdorf

station, water and coal supply

The area is renowned for its horseradish. A dire necessity if you consider the price of other spices and the dubious taste of salted meat after a few months.

Mile 103

Erlangen

Station

This town is now rather small but in OTL was well known for its university and its breweries. As Erlangen could become a kind of a suburb for Nürnberg in the future, Erlangen should be part of any railbound public transport system that is being established for Nürnberg.

Mile 112

Fürth

station

A industrial town. Mirrors, glass, furniture, needles and jewelry are being made here. Fürth is under simultaneous rule of the bishops of Bamberg, the count of Nürnberg and the elector of Brandenburg. A bit complicated, even by German standards.

The area between Fürth and Nürnberg is called Garlic Land (Knoblauchsland). Here is the battleground of Alte Veste. Here Gustaph Adolph won, with the help of new guns "Made in Grantville," a decisive victory over the imperial troops. With the help of his American allies, he was able to break Wallenstein's army, having Wallenstein himself disabled by Julie Sims in the process (See*1632* by Eric Flint). Probably some more permanent military installations will be built here, as the place remains of strategic importance.

Just before Nürnberg, we cross the tributary river Pegnitz. The bridge has to allow for the passage of occasional boats out of the town.

Mile 117

Nürnberg (Nuremberg)

station, water and coal supply, train depot, turning Y

In Nürnberg, we will skirt around the southern part of the walled town and place the station on its southern outskirts. In view of its craftsmen's reputation for very fine and delicate work, it could be an excellent place to start industries in fine mechanics. Nuremberg also has a well known trade fair and good road connections. Having no guilds here is also fortunate for business.

From Nürnberg, one can go by road to various towns on the Donau (Danube). One of these roads could be replaced with a rail line. We could choose either Ingolstadt or Regensburg as our railhead later. Regensburg seems to be a bit more appealing, but we would need to build the station there on high ground because of frequent flooding. We should build this access as soon as resources and political situation will allow, because a rail linkup to the Donau gives us access to the biggest trade network into the Balkans, Turkey, Black Sea area and even southern Russia. If we ever come to more friendly terms with Austria this link will see a lot of traffic to Turkey and over the Brenner Pass to Venice and Italy. Until then, we will see a lot of military transports. The distance from Nürnberg to Regensburg is about 30 miles.

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Harnessing The Iron Horse: Railroad Locomotion In The 1632 Universe

By Iver P. Cooper

Railroading in 1632 Canon

At the first "cabinet meeting," Mike Stearns says, "We got rail tracks leading most of the way from the mine to the power plant, but as far as I know there isn't a locomotive anywhere around. We may have to haul it by truck." (*1632*, Chap. 8)

The principal focus of this article will be on how the USE will design its first locomotives, but first I will explain what Canon (the entire set of*1632* series novels and anthologies) tells us about railroading after the Ring of Fire (RoF).

Mike decides that Grantville's best survival strategy is to use its "modern technology, while it lasts, to build a nineteenth-century industrial base." Mike muses, "Steam engines, steam engines. The railroads are about to make a big comeback in the world." (Chap. 11)

By the time of Becky's first cablecast (Sept 10, 1631), some kind of new track had just been laid to the new foundry, "but the first steam locomotive was still being built." (Chap. 33). That was still true as of the October 8 cabinet meeting (Chap. 40).

The next reference to railroads in "canon" is in the David Weber story, "In the Navy" (*Ring of Fire*). There, Eddie Cantrell lobbies Mike Stearns to turn over enough miles of salvaged railroad track to armor several ironclads, prompting complaints from Quentin Underwood about undermining the economy.

Nonetheless, the up-timers did lay steel rails between Grantville and Halle. Although incomplete, the line was in use as of a September, 1633 cabinet meeting (*1633*, Chap. 34). The trackwork was not modern steel T-rail, but rather "dinky wooden rails with an iron cap." Quentin is equally contemptuous of the motive power; the "pathetic" cargoes are "being pulled as often as not by 'locomotives' made up of a pickup truck—or even a team of horses."

By June of 1634, when Iona left Grantville, the trains were running all the way to Halle ("Until We Meet Again,"*Grantville Gazette* , Volume 4).

Besides the civilian railroad, there is also a railway battalion in the U.S. Army, commanded by Major Elizabeth Pitre. Its mission is to build and operate narrow gauge military railroads (TacRail). Pitre's activities are described in "Elizabeth" (*Grantville Gazette,* Volume 4). TacRail will not be discussed further here.

However, there are a few important references to the civilian railroad in "Elizabeth." At the beginning of the story, in summer 1633, Frank Jackson complains that the rail line to Halle had not yet been

completed. Nonetheless, at that point Charlie Schwartz had already "worked on the railroad link to the coal mine and helped to build the steam locomotive." The story ends in spring 1634, when the railway battalion rides civilian flatcars to Halle.

Grantville Railroading Knowledge

Having some track is nice, but it is not enough. We have to know how to plan out a rail network, manufacture and lay track, build locomotives and other rolling stock, and operate the railroad.

Naturally, there will be some information on railroads in the public libraries. Of the documented sources (those known to exist in Mannington, or mentioned in canon), the most useful from a locomotive design standpoint are the encyclopedias (especially the "Railways" [EB11/R] and "Steam Engine" [EB11/SE] articles in the*Encyclopedia Britannica* , Eleventh Edition) and Alexander's*Iron Horses: American Locomotives 1829-1900*.

* * *

There is more knowledge of railroads than just book knowledge stored in the libraries, of course. The first group to whom would-be railroad barons may turn for help are the retired railroad workers. According to the Up-timer Grid, there are ten such people in Grantville. These people have practical, first-hand experience with real railroads. They may also have souvenirs of interest. But bear in mind that a ticket taker isn't going to know how to build a firebox.

* * *

Next, there are the mineworkers. Some of them may have laid narrow gauge track to service the mines, or operated and repaired the mine cars or even locomotives. ("Elizabeth" says there were a couple of locomotives used in the Joanne mine.)

* * *

The third group are "rail fans." They may go out and watch (and perhaps photograph) real trains in operation, try to ride behind particular locomotives or on particular tracks, collect books, videos and railroad memorabilia, or build and operate model railroads.

There are at least three rail fans (Hardy, Pitre, and Szymanski) so identified on the Grid; there may be additional hobbyists. A town the size of Mannington (the model for Grantville) is likely to have five to seven model railroaders (Atlas Model Railroad Forum).

Of the rail fans, "Monty" Szymanski is of particular interest because he "helped restore locomotives for the Cass State Park Scenic Railway and had built several one-eighth scale models of steam locomotives." (Up-timer Grid)

* * *

Even up-timers who are not retired railway employees may have something to contribute. There are the steam engine buffs, of course. People who rode a scenic railroad may have home videos of the experience. Movie lovers who have videotapes of any of the many movies, including Westerns, mysteries and thrillers, which contain locomotive or other railroad footage. We know that*The General* (1927) is available; that is the movie which introduced Buster Keaton to the down-timers.

Motive Power

A train, running on rails, may be propelled by any of several different means. Despite Quentin Underwood's sneering, animal power is actually a pretty reasonable propulsion system, at least for moderate speeds and loads. A draft horse, with a body weight of 1,200 to 2,000 pounds, can, for as long as ten hours, exert a pull of 180 to 220 pounds. If the load is carried in a wheeled vehicle, riding on rails, the rolling resistance of the load is perhaps 1/100th to 1/250th of its weight. In other words, a 200 pound pull moves a 20,000 to 50,000 pound (ten to twenty-five ton) load, i.e., 1000% to 2500% of the body weight. (See Cooper, "Transportation Cost FAQ,"www.1632.org <http://www.1632.org> .)

Teams as large as thirty horses were used in the American West to haul heavy loads. Even an eight horse team can move 80 to 200 tons on rails.

* * *

Clearly, steam locomotion is one of the options the USE is considering. In the early days, the greatest advantage of steam locomotion was that it had a lower operating cost. For the horse-drawn trains on the B&O railroad, the "crew" was 42 horses and 12 men, and the total operating cost was $33/day. The horses towed the train at a speed of 10 mph. In contrast, the 1832 locomotive Atlantic (0-4-0, 6.5 tons), which replaced the horses, could go 20 mph, and its operating cost was just $16/day. (Dilts, 196). (Alexander, PL4, says that it hauled 30 tons at 15 mph.)

Eventually, the locomotives became powerful to pull trains too heavy for normal draft teams. As early as 1839, a Gowan & Marx (4-4-0, 11 tons, 9 tons on drivers, driving wheels 42" diameter, cylinders 12 1/8" x 18," anthracite coal burner) hauled a train of 101 loaded four-wheeled cars, weighing a total of 423 tons, from Reading to Philadelphia at average speed of 9.82 mph. (Alexander PL10).

* * *

Why not jump directly to diesel-electric (DE) propulsion? Modern locomotives use a diesel engine to power electric motors; the latter turn the wheels. DE locomotives are more fuel efficient, and less labor intensive to operate, than steam locomotives. They can exert high tractive forces at high speeds, and they can be wired so that one DE's crew can operate several at one time.

The problem is that we lack the infrastructure to support DE's. A diesel engine requires diesel fuel, and we don't have it yet. The oil fields of Germany are small, and we probably won't have a large, reliable supply of oil until we have control of the North Atlantic and can import it from the Middle East, Africa, or the Americas. In other words, we have to win the war first.

Then there is the electrical system. We will need insulated copper wire. The best insulation is rubber or plastic and, in 1632, neither rubbers nor plastics are commercially available. In OTL, the natural rubbers and plastics were obtained from non-European sources.

Finally, there is the issue of start-up costs; DE's are perhaps five times as expensive as a steam locomotive of equal horsepower. (NOCK/RE 203)

* * *

Even if we recreate the steam locomotive technology, that doesn't mean that it will be suitable for all purposes. During World War One, Major Connor warned against use of steam locomotives to directly supply the front line, because a "steam locomotive would indicate too clearly its position by its smoke."

As one possible alternative, Connor provides data on Vulcan gasoline locomotives. Even the smallest can haul over 150 tons. It therefore is not so strange as it seemed at first blush that the USE is using "a modified pickup truck cab section" to draw Iona's train. Canon doesn't specify the modifications, but it probably has been equipped with locomotive-type wheels so it will run on the rails.

Gasoline locomotives were first developed for coal mines (WLW). If the Joanne mine locomotives (*Elizabeth*) passed through the Ring of Fire, they were presumably narrow gauge gasoline machines.

Fuel

Historically, fuel was the largest operating expense item for railroads, and the choice of fuel was based primarily on cost. The early American locomotives mostly consumed wood; it was not until 1870 that half the steamers in service were coal-burners (White 85). Fuel conversion was driven by both deforestation, and the opening of large new coal fields.

Early seventeenth-century Germany is experiencing a wood shortage because of the heavy use of wood as a fuel in home fireplaces and industrial furnaces, and as a raw material for carpentry.

On the other hand, because the Ring of Fire encompassed several up-time coal mines, and the up-time equipment for mining them, there is a readily exploitable coal supply in the Grantville area. There is also a lot of coal in Germany, notably west of Hannover, near Zwickau in Saxony, in Saarland, and in the famous Ruhr region.

So it is something of a no-brainer to prefer coal to wood. (What wood we have available for railroads is best employed in the wood-ties which support the rails.)

* * *

The USE is rich in coal but impoverished in petroleum. Consequently, we cannot expect to have large supplies of either gasoline or diesel fuel within a reasonable time. Our gasoline locomotives are likely to be limited to rebuilds of up-time vehicles, and used only as a stopgap. And we aren't likely to consider building a diesel locomotive at all—at least, not until we are importing oil in large quantities.

Steam Locomotion

We have completed the first stage of the engineering process: conceptual design. The principal motive power for the new railroad is going to be a coal-burning steam locomotive.

Both the*Encyclopedia Americana* and the modern*Encyclopedia Britannica*provide a basic cutaway view of a steam locomotive. These diagrams show, and label, certain major components of the boiler system (the firebox and its grate, the water circulation, the steam dome, and the superheater tubes), the engine system (the steam chest, the valve, and the cylinder-and-piston), the transmission system (the crosshead, main rods, and connecting rods), the driving and leading wheels, the valve control system (the eccentric crank and rod), the exhaust system (exhaust pipes, smoke box and smokestack), and the control system (throttle valve, throttle lever, safety valve). Other parts are recognizable to a railroader (e.g., the ashpan), but are not labeled.

In a steam locomotive, fuel is burnt in the firebox, evaporating water in the boiler. The resulting high-pressure steam is directed by the valve slide in the steam chest to either the front end or the back end of a cylinder containing a piston. If the steam enters the back end, it drives the piston forward and, at

the completion of this forward stroke, the steam is allowed to escape. Steam then is redirected to the front end, moving the piston backward. Then the front end is exhausted, and the piston is ready for the next cycle.

This to-and-fro movement of the pistons is converted by the rods and cranks into rotary motion, each piston turning the driving wheels one half turn on each stroke of the cycle. Another linkage, driven by the rotation of the axle, controls the position of the valve slide.

The process may sound simple, but it is important not to underestimate the difficulties of building a practical steam locomotive. There are no steam locomotives in Grantville. That means that the design for the USE's first steam locomotive must be based on inspection of books and videos.

* * *

The next engineering design step is called "preliminary design" or "embodiment design." That is when engineers decide things like the size and weight of the locomotive, the fire grate size, the desired boiler pressure, the diameter of the cylinders, the piston stroke length, the number of wheels, the wheel diameter and so forth. These in turn determine how much the locomotive can pull, how fast.

To make those decisions, we have to determine the tractive force (pull) necessary to overcome the expected train resistance to motion.

Basic Train Resistance to Motion (Straight, Level Track)

The "basic" resistance on straight, level track is the result of rolling friction between wheel and rail, friction among all the mechanical parts driving the wheel (cylinder and piston, bearings and axle, etc.), air resistance, and other factors.

The starting resistance is about 20 pounds per ton of load, but the engineer can bunch up the cars and then take advantage of slack, starting the train one car at a time.

Resistance drops once the train is moving slowly. It then climbs again as train speed increases.

EB11 provides some formidable equations, of dubious relevance, for calculating resistance. I instead quote two simple historical formulae which are likely to be known to model railroaders. The resistance, measured in pounds of force per ton of load, equals

(1) 2 + (speed (mph) / 4)(the "Engineering News" formula; Ludy, 131), or

(2) 3 + (speed (mph) / 6)(the Baldwin Locomotive Company formula; Connor, 89).

Equations (1) and (2) are useful at the speeds the USE will be operating. However, for high speed modern trains, air resistance becomes important, and this introduces a factor which is proportional to the

square of the speed.

Extra Train Resistance (Grades and Curves)

In nineteenth-century America, poorly capitalized pioneer railroads economized on track building by taking the path of least resistance: going up and down, or around, hills. As a result, American locomotives had to be engineered to cope with steep grades and sharp curves. This could be true in the USE, too.

Total train resistance is the sum of the basic resistance mentioned above, and extra resistance attributable to grades and curves.

* * *

Grade (Slope). If it is going uphill, the locomotive has to overcome gravitational force as well as rolling friction. This grade resistance is roughly 20 pounds per ton of load, for every 1% of slope. (Armstrong, 20)

* * *

Curves force the train to reduce speed (so it doesn't derail), and also result in an effective increase in resistance. A curve with a turning radius of 5,729 feet (called a one degree curve) increases resistance by 0.8 pounds per ton of load. Halve the radius, and you double the resistance.

Rated Tractive Force

EB11/R explains how to calculate the average tractive force (in pounds) exerted at the rail by the driving wheels of a two-cylinder steam locomotive engine: it is the product of the mean effective pressure (p.s.i.) of steam in the acting cylinder, the square of the piston diameter (inches), and the length (inches) of the piston stroke, divided by the diameter of the wheel. (See also Ludy, 131). The mean effective pressure at start-up is usually assumed to be 85% of the boiler pressure.

In this article, when I refer to "cylinder diameter," what I really mean is the size of the bore, which is, roughly, the piston diameter. Also, I may express the cylinder bore diameter and piston stroke length in shorthand form as, e.g., "16X24" (16 inch bore, 24 inch stroke).

The drawbar pull—which determines the load that the locomotive can haul—is its tractive force at the rail, less the resistance imparted by the locomotive itself.

The steam locomotive develops the rated tractive force made possible by its boiler and engine only if it can adhere to the track.

Maximum (Adhesion-Limited) Tractive Force

The effective tractive force applied to the wheel rims cannot exceed the "adhesion," which is the product of the weight which the locomotive places on its driving wheels, and the "coefficient of adhesion." This coefficient (Armstrong and others use 0.25; EB11/R, 0.2.) expresses how well the wheels resist sliding on the rails; higher is better. The engine can apply more force to the wheels, but they will just slip, not turn.

Consider the rail-riding pickup truck on the Grantville-Halle line. We are probably talking about a 200-300 horsepower engine, and a vehicle weight of around 5,000 pounds. At 10 mph, that engine could develop a pull of 9,000 pounds—if only the wheels didn't slip. But its maximum tractive force, thanks to the adhesion limit, is just 1,250 pounds. That means that it is way over-muscled, relative to its adhesion. Of course, "its muscles are designed for rubber tires on pavement, which have a much higher coefficient of friction." (Douglas Jones comment)

Designing for Adequate Traction

The desired tractive force can be calculated if we know how much tonnage the locomotive must move, over what grades and curves.

We then first ensure that the weight on the drivers is sufficient to generate adhesion at least equal to that desired tractive force. We distribute this weight across a sufficient number of axles so that the rail can handle the load.

Next, we must size the engine and boiler so that the rated tractive force is sufficient and sustainable. A logical starting point would be to use the design parameters of an old timeline (OTL) locomotive. EB11/R provides some useful comparative data for thirty-six different locomotives: wheel configuration, the position (inside or outside), diameter, and stroke length of the cylinders; the diameter of the driving wheels, the weights of the engine and its tender; the weight carried by the driving wheels; the grate area and total heating surface of the firebox. In fourteen cases, it also states the boiler pressure.

While EB11/R has something of a British bias, Alexander provides significant design parameters for over fifty American locos.

* * *

It should be evident from the discussion of rated tractive force that this can be increased (up to the "adhesion limit") by

1) increasing the mean effective pressure (usually by increasing the boiler pressure),

2) increasing the cylinder diameter or the piston stroke length, or

3) decreasing the driving wheel diameter

Decreasing the drive wheel diameter is the only way of increasing long-term tractive effort which does not require that the boiler and firebox be enlarged to pay for it. However, it, too, has a price: reduced speed.

Large wheels are reserved for express passenger service, while small wheels are used on freight locomotives to maximize tractive effort. But the wheel diameter cannot be made too small, because it must remain larger than the piston stroke length.

For a freight locomotive, 42 inch driving wheels are typical. On a general purpose locomotive, a typical wheel diameter might be 54 inches. A little more speed, a little less tractive force. For a dedicated

passenger locomotive, wheel diameter is likely to be in the 60-90 inch range, resulting in a more pronounced tradeoff of hauling ability for speed.

* * *

If you want to increase the boiler pressure, you will have to evaporate water at a faster rate. This will require various firebox and firetube modifications. And to contain that pressure, you will have to use thicker boiler and firebox walls, which will make the locomotive heavier.

* * *

If you increase the cylinder diameter or piston stroke length, you increase the engine's steam requirements. If the boiler is mismatched to the engine, then the boiler pressure will drop, the engine will gulp for steam, and the tractive force will decline. So changes in the engine ultimately affect boiler and firebox design.

Increasing the cylinder diameter or the boiler pressure also increases the force on the piston so the piston rod must be made larger and heavier to withstand the stresses imposed by piston motion. Which in turn affects the size of the main rod, the coupling rods, the axles, and even the frames.

Making the reciprocating parts (e.g., piston) more massive will increase shaking, which will mean more wear and tear on the engine, the running gear, the wheels and even the rail.

Increasing the stroke length necessarily increases the length of the piston rod, and hence its diameter must be increased so it doesn't buckle when compressed. The rest of the running gear then needs to be scaled up, too. With the same consequences as before.

Any mechanical engineer (there are at least ten in the Grid) will have studied, and will have textbooks describing, the basic mechanics of columns and beams, crank-and-rod mechanisms, etc. and hence will appreciate the mechanical limitations on piston rod length and cylinder diameter. It is no doubt because of the forces at work that cylinder diameters and piston strokes on locomotives rarely exceed 30 inches, even though a more massive design would increase tractive force.

Weight and Size

Because of the role of adhesion weight, lightening a locomotive is not necessarily advantageous. Indeed, in 1835 Baldwin built the first locomotive (*The Black Hawk*) in which the tender was integrated into the locomotive body, so that part of its weight would contribute to the traction. (Alexander, 50).

A locomotive is likely to be designed so that the weight it places on its drivers is at least four times the desired tractive force. Of course, its boilers and engines should then be sized accordingly.

However, the basic rolling resistance of a locomotive is still proportional to its*total* weight. There is substantial additional resistance, again proportional to total weight, when the locomotive steams up a slope, or accelerates.

* * *

We also need to consider wheel weight. The greater the weight, the greater the wear on the rail, and the risk of rail failure.

The quality of the track is the principal limit on wheel load. EB11/R (847) says that a weight of 37,000 pounds "could be easily carried on one axle," and that implies 19,500 on each wheel. The heaviest rail mentioned by EB11/R is 100 pounds per yard, so a conservative rule of thumb would be to allow a wheel load of 195 pounds per pound of rail weight.

A contemporary Baldwin Locomotive Company catalogue states that if steel rails are properly supported by cross-ties, they can support a maximum wheel weight of 225 to 300 pounds for each pound per yard of rail. Thus, if a rail is dimensioned so that its weight is forty pounds per yard, no more than 12,000 pounds weight should be placed on a single wheel.

For a given weight on the drivers, wheel load can be reduced by increasing the number of driving wheels. In OTL, there was an increase in the number of coupled driving wheels.

One 1893 locomotive (Alexander PL87) had 84,000 pounds on four driver wheels, and thus the individual wheel load was 21,000 pounds (suitable for 70 pound or heavier rail). In contrast, another (plate 90) had 172,000 pounds on the drivers, but it was spread over*ten* wheels, and thus it could actually run on lighter track.

* * *

The wheelbase is the distance from the first driven axle to the last one. If the normal axle spacing and wheel diameter are maintained, increasing the number of driving axles lengthens the wheelbase, which makes it more difficult for the locomotive to handle a curve. (Clarke, 122). Or turn around in a turntable or wye.

If the wheelbase is made too short, the locomotive becomes unsteady at high speeds. This was a problem with four-wheeled locomotives. (Clarke, 112-3).

* * *

There are constraints on height and width, too. The so-called "loading gauge" (the clearances provided by bridges, tunnels, road cuts, stations and neighboring track) comes into play here. In America, the rolling stock can be as wide as 10'10" and as high as 16'2." (NOCK/RE, 208-9).

The width is constrained, not only by the loading gauge, but also by the track gauge (the distance between the inside edges of the rails), as a large vehicle on a narrow gauge track may tip over when running a curve. The standard American track gauge is 4'8.5."

Likewise, the height not only cannot be so great as to be "clipped" by the roof of a tunnel, it cannot be disproportionate to the width, or the locomotive will topple over.

* * *

Increases in the dimensions of the locomotive will ordinarily mandate an increase in weight, too, unless a new, lighter structural material is employed. The materials presently available to the USE are wood, cast iron, wrought iron, steel, and a few other metals such as copper.

In nineteenth-century America, wood was used mostly in the cab and the tender frame, and as insulation. Copper was sometimes used for the heat exchange elements, because it conducts heat well, but it is structurally weak and thus copper tubing is thicker than the steel equivalent. Cast iron was used in cylinders, journal boxes, and valve boxes. For all other major components, the initial preference was for

wrought iron, but this changed once the Bessemer process (1856) made steel affordable. By 1900, virtually the whole locomotive was made of steel. (White, 29-31).

* * *

We cannot put into a locomotive the most powerful boiler and the most powerful engine available, only those whose power is greatest within weight and size constraints. And the engine and boiler compete for the mass and volume allotted.

Making Steam: Locomotive Boiler Design

The boiler is the stomach of the locomotive. It consumes fuel, air and water, and belches steam. The fuel is burnt to change chemical energy into heat energy; the air is necessary for combustion to occur, and the water is what is heated to generate steam. It is the expansion of steam which moves the pistons, and ultimately makes the wheels go round.

* * *

Coal is shoveled onto a horizontal grate in the firebox, which receives air from the "ashpan" below, as well as, intermittently, through the firebox door.

The first fireboxes were mounted "inside" the wheel lines, and were long and narrow (grate area 17-18 square feet). Later, they were placed on top of the frame, and were wide but short (30 square feet). Long, wide fireboxes (up to 90 square feet) were made possible by relocating them behind the driving wheels. (Forney; Bruce, 36-43)

The smoke puffing from the steam locomotive is photogenic, but it is also evidence that fuel is being wasted. In 1859, engineers solved this problem with two new elements, a brick arch and a deflector plate. Together, they controlled the airflow so as to improve combustion.

"Monty" should be familiar with these two firebox features.

* * *

There are two basic methods of using the released heat energy. Most railroad boilers were of the "fire tube" type, which means that the hot air rises from the coals and enters a multitude of pipes. These travel through the main section of the boiler, which holds the water. The heat brings the water to a boil, and the steam rises from the top of the water surface, ultimately collecting in the "steam dome." The fire tubes empty into the smoke box, and the smoke ultimately escapes through the smokestack. This creates a partial vacuum in the smoke box, which helps to draw in the air. EB11 "Boilers" shows two views of an express locomotive boiler (Fig. 10).

A few OTL locomotives were equipped with water tube boilers. Water is circulated in tubes through the firebox, rather than hot air through the water reservoir. Water tube boilers were much safer to operate, and potentially more economical, "but it was impossible to build efficient boilers of this type within the clearance limitations of the railway engine" (Sinclair, 691).

* * *

The most efficient boiler operation is at a relatively low rate of combustion, e.g., 30-60 pounds of coal per square foot of grate per hour, resulting in evaporation of 11-13 pounds of water per pound of coal,

and a boiler efficiency of about 80%. Burning 100-180 pounds per square foot of grate per hour, we obtain only about 6-8 pounds of water per pound of coal, and the boiler efficiency is about 40-50%. (EB11/R) Forney says that the most coal which can be burnt is about two hundred pounds per square foot of grate per hour, and then only at most six pounds of water would be evaporated by each pound of coal fired.

The size of the grate determines how much coal can be burning at one time. So a big grate seems like a good thing. However, there are problems of increasing its size. First of all, it means increasing the overall size of the locomotive. Secondly, once the grate exceeds a certain size, it becomes too difficult for a single "fireman" to keep it "fired" properly. (This was a problem with hand-fired "Pacific" locomotives, NOCK/RE 175.) You either need to provide two fire doors, for two firemen, or engineer a "mechanical stoker."

The firebox is positioned within the boiler so that there are water spaces to the sides and in back of the firebox, to maximize the direct firebox-to-boiler surface area (Alexander PL79). There is also water above the top of the firebox, the "crown sheet," and indeed the most common cause of a boiler explosion is that the crown sheet loses this protective blanket, and melts.

Heat transfer takes place not only at those walls of the firebox which are in contact with the water reservoir, but also at the walls of the tubes. So having lots of small diameter tubes is good—unless you are the fellow who has to make sure that those tubes are tight.

The longer the tubes, the greater the heat transfer area, but the weaker the combustion-promoting draft in the firebox. Having lots of tubes increases the heating area, but weakens the tube plate of the firebox.

* * *

EB11/R discloses both the grate area and the total heating surface for 36 locomotive designs. Disregarding the Stephenson Rocket, the total heating surface ranged from ~1,400 to ~6,100 square feet, and the grate areas from 20 to 100 square feet. The average ratio was 71:1.

* * *

The steam passes up into the steam dome, from which it is released to the cylinders by the throttle valve. Some locos had two steam domes, or other provisions for storing more steam.

The boiler pressure is a function of the rate at which steam is produced (evaporation rate), the rate at which steam is used, and the size of the steam reserve. Taking advantage of a large steam reserve to briefly make faster-than-normal speed or pull an extra-heavy load is called "mortgaging the boiler."

If you are producing a lot of steam quickly, the boiler pressure will increase. The pressure which the boiler can tolerate is dependent on the thickness of the walls, as well as the nature of its construction. Thicker walls can hold higher pressure steam, but the boiler will weigh more.

Alexander provides only limited boiler pressure data. An 1860 engine had 130 p.s.i. (PL47); locomotives built as late as 1882 had 125 p.s.i. pressure (PL76-7); three later locos were 180-190 (PL80, 85, 96). The highest pressure in the EB11/R table was 235.

* * *

Bear in mind that since the cab is behind the boiler, a large boiler limits the crew's view of what is in front

of them.

Putting Steam To Work: Locomotive Engine Design

Usually, the locomotive will have a pair of pistons, which operate one-quarter of a cycle out of phase, so when one is in "neutral" the other is ready to receive steam.

The cylinders can be mounted outside or inside the main frame. In general, during the nineteenth century, the British preferred to use inside cylinders, and the Americans, outside ones (Nock/RE 164).

There are some locomotives which have a second pair of cylinders, in which case it is very common to have one pair on the inside and the other on the outside. However, both pairs can be on the outside. (EB11/R).

There was experimentation with other positions in the early days, but the cylinders of late nineteenth-century locomotives were mounted horizontally, and at axle level.

* * *

Looking at the locomotive data in EB11/R, and ignoring both the primitive "Rocket," and engines with more than one pair of cylinders, we can see that the cylinders are 18 3/8-23 inches wide, and the piston stroke is 26-30 inches long. For the American locomotives in the Alexander book, if we ignore the pre-1840 models, cylinder diameter is 12-22 inches, and piston stroke 15-30 inches (save for one "13/54" locomotive).

For both the British and American locomotives, the stroke length was, on average, 50% greater than the cylinder diameter.

Cranking the Wheels: Locomotive Transmission Design

In the standard "rod" locomotive, the pistons are connected to cranks on the driving wheels, so two power strokes by the piston, make one turn of the crank, resulting in one revolution of the wheel.

* * *

The driving wheels of a high speed locomotive may turn at a rate of more than five revolutions per second. During each half-revolution, each piston accelerates to full speed (say, 35 feet per second) and then decelerates to a full stop. The necessary force on it is the mass times the acceleration. The piston weighs, say, 500 pounds (Forney), and the maximum acceleration is proportional to the stroke length and the*square* of the wheel speed (EB11/SE 837). The piston transmits that force to the piston rods, cranks, and other elements. They all must be able to withstand the resulting stresses, and, unless they are balanced, they cause unpleasant, perhaps dangerous, vibrations in the locomotive structure.

The engine and running gear include both rotating and reciprocating masses (some parts do both). The perturbations caused by the rotating masses (e.g., crank pin) can be completely balanced by a wheel-mounted counterbalance.

However, the reciprocating masses (e.g., piston head, piston rod, crosshead, main rod, coupling rods) would still cause the locomotive to yaw right and left. This horizontal disturbance can be reduced by "overbalancing" the wheels, but at the price of causing a vertical imbalance (pitching up and down). This alternately hammers the rails, and lifts the locomotive.

Usually, the compromise is to balance all of the rotating mass and 25-50% of the reciprocating mass, so that there is both horizontal and vertical imbalance.

The vertical imbalance increases with the square of the wheel speed (Addendum). The rails have to be able to withstand this dynamic load, not just the static weight on the wheels. And, of course, when the disturbance is upward, the locomotive must be heavy enough, and the balanced reciprocating mass light enough, so that the locomotive remains on the track.

* * *

Usually, with an outside cylinder, the piston rod fits into a crosshead, and the main rod connects the crosshead to the main crank pin, near the rim of one driving wheel. One driving axle is cranked directly, and the other driving axles are turned by the action of connecting rods, which run from one crank pin to another.

With an inside cylinder, the main rod will act on a cranked axle, rather than a crank pin. One advantage of an inside cylinder was that it could be mounted close to the center line, reducing the disturbances caused by the piston action. Another advantage is that the cylinder is warmed by the smokebox, and insulated by the frame. However, Ellis (51) warns the up-timers that "persistent breakage of crank axles" bedeviled inside cylinder designs. Crank axles were also expensive, large, heavy, and difficult to inspect and repair (White 208-9; EB11/SE 841).

* * *

The axle rotation also regulates the slide valve on the cylinders. EB11/R mentions five different mechanisms for this purpose, but for a description, you must turn to EB11/SE. The mechanisms are the Stephenson (Figs. 29, 32), Goochs (Fig. 30) and Allan (Fig. 31) type link motions, and the Joy (Fig. 36) and Waelschaert radial gears. EB11/SE also depicts the Hackworths (Fig. 33) and Marshalls (Fig. 34) valve gears. One 1887 valve control mechanism is depicted in Alexander (PL79); I believe this is a "link motion."

In the modern Waelschaert gear, the movement of (1) the crosshead, together with that of an "eccentric crank" connected to (2) the main crank pin, serves to move forward and back the valve rod (which directly controls which valve is open). However, the valve rod leads the piston rod.

Rolling Forward: Locomotive Wheel Design

In the EB11/R table, the driving wheel diameter ranged from 54 to 85 inches. Among Alexander's American locomotives, the range was 30 to 96 inches. In general, the bigger the wheel, the higher the intended operating speed of the locomotive. With typical locomotive designs, and adequate track, maximum speeds (mph) were usually 75-150% of the wheel diameter (inches).

Big wheels also have the advantage of a larger wearing surface (proportional to diameter). So the abrasion by the rail is spread more broadly.

However, if you increase the wheel size, you need to increase the size of the connecting rods, the cylinders, the frames, and so forth. Which means, given size and weight constraints, that much less room and weight allowance for the boiler. (Forney)

* * *

The wheel is not a single piece construction. Rather, there is a wheel proper, over which is mounted a metal "tire." This is the "wearing surface" of the wheel, the part that is gradually worn away by the action of the rails.

The tire also includes a flange, a thin, flat, short metal projection. A flanged wheel looks a little bit like a stovepipe hat; the crown is the wheel, and the brim is the flange.

In nineteenth-century America, the tires were made of wrought iron, case-hardened cast iron, or, once the price came down, steel. Steel tires were preferred because they lasted at least five times as long. (White, 175-83).

* * *

There are a number of little expedients used to make it easier for the driving wheels to hold onto curved track. One is to put non-driving pilot (leading) wheels in front of them.

Secondly, one or more of the axles may be allowed "sideplay," that is, the ability to shift left or right. The Bavarian Ep 3/6 had an inch or so of sideplay in several of its axles. Side play was even more marked in Baldwin's 1842 flexible-beam engine (Alexander PL14).

Thirdly, the wheels can be tapered. Wheels are slightly conical (standard "taper" is 1 in 20), with the narrowest diameter on the outside. As the train moves onto a curve, the wheels shift outward, so the outer wheel's diameter at the point of contact increases, and that of the inner wheel decreases. That corrects for the curve.

Finally, one or more pairs of driving wheels can be "blind" (flangeless)(Alexander PL20, 83, 84).

Locomotive Wheel Arrangements

Locomotive wheels are mounted on axles; the transmission system turns the axles, which in turn rotate the wheels.

Some of the axles are driven, directly or indirectly, by the engine. Others turn passively as a result of the action of the car on the wheel. If your car has front wheel drive, then the front axle is a driven axle, and the rear one isn't.

* * *

Locomotives are described according to a standard wheel configuration nomenclature which, usually, but not always, uses three numbers, like so: X-Y-Z. The X value is the number of leading wheels. These wheels are not driven by the engine, but help to give stability to the ride. They are mounted on what is called a "truck" or "bogie," which can turn if the wheels encounter a curved track. X might be 4 for a passenger locomotive, 2 for a freight locomotive, and 0 for a switching yard locomotive. The American-style four wheeled leading bogie is mentioned in EB11/R.

The Y value is the number of driving wheels. Usually, the main rods directly drive one axle, to which the other driving axles are coupled. The driving wheels transmit the power of the engine to the rail and, by adhering to the rail (if there were no friction, the wheels would just spin in place), create the reactive force which impels the locomotive forward. A freight locomotive will usually have more driving wheels than a passenger locomotive of equal horsepower.

The Z value is the number of trailing wheels. Like the leading wheels, these are unpowered. However, by providing additional support, they permit a locomotive to enjoy a long, wide firebox. It can produce steam at a greater rate, and thus supply more power to the cylinders. Like the leading wheels, the trailing ones are mounted on a rotating truck.

If a train has both a leading and a trailing truck, that means that it can back easily into a curve. This can come in handy on a branch line serving a mining area.

Occasionally, a locomotive has a wheel configuration necessitating more than three numbers. This implies that there is more than one set of coupled driving wheels

For example, instead of a 4-8-4, you could have a 4-8-8-4, in which one pair of cylinders drives four driving axles, and a second pair drives the other four.

Puffing Away: Locomotive Smokebox Design

The waste steam leaving the cylinders passes through a constrictive blast pipe, and jets out. This creates a partial vacuum in the smoke box, which in turn elicits the draft which fans the flames in the firebox. The smoke box subsequently discharges the waste furnace air and steam through the smoke stack. EB11/R goes into an amazing amount of detail (see Figs. 18-20) as to the design of the smoke box, as well as that of its spark arrester (so the locomotive doesn't set the countryside on fire).

The basic problem with spark arrester design was that to be effective, it had to obstruct the smoke box, which in turn reduced the draft.

Speed

Just as the speed (in feet per second) at which you walk is the length of your stride (in feet) times the number of strides you take per second, the speed of a locomotive is the circumference of the wheel times the number of times the wheel turns each second-and it turns a half-turn on each piston stroke. For high speed, you need big wheels or fast-moving pistons.

The maximum speed is that at which the tractive effort exerted by the locomotive is only enough to overcome the movement resistance of the locomotive and its tender alone.

* * *

In 1911 (EB11/R), the following train weights (long tons, ignoring locomotive) and speeds were considered typical:

Coal train (GB), 800-900 tons, 18-22 mph

Goods train (GB), 430 tons, 25-30 mph

Express goods train (GB), 300 tons, 35-40 mph

Mineral and grain trains (US), 2,000-4,000 tons, ~12 mph

Goods train (US), 600-1,800 tons, 15-30 mph (with 40-60 mph bursts)

Power

When the heat of burning coal converts water into steam, it's like putting money into a bank. The compressed steam stores energy, just like a bank stores money. When the engine uses that steam to move the pistons and, ultimately, the wheels, it's like withdrawing funds from your account. Some of the stored energy is used to do work, and the rest is lost.

Power is the rate at which energy is produced, converted, stored or used. If the engine is using "steam" energy faster than the boiler is producing it, then eventually it will use up whatever reserve the boiler had built up previously, and the locomotive will literally "run out of steam," and come to a stop. There is no overdrawing the energy account!

The maximum sustainable horsepower is the product of the combustion rate (the number of pounds of coal burned per hour), the energy value of the coal (BTUs per pound), the combined thermal efficiency of the boiler and engine (typically 0.06), and a conversion factor (0.00039)(EB11/R, 843, 847). The combustion rate is the product of the number of pounds of coal burned per hour per square foot of grate), and the square footage of the grate.

* * *

Now power also equals force times speed. The power (in horsepower) corresponding to a particular tractive force at a particular speed is

Speed (mph) X tractive force (pounds) / 375

The tractive force when you start up the engine is determined by the formulae we looked at earlier. Initially, as you increase the speed, traction remains constant, so the power applied to the wheels increases.

Eventually, you reach the critical speed at which the rate at which the engine consumes energy equals the maximum rate at which the boiler can deliver energy to the cylinder. The latter determines the maximum sustainable power exercised by the engine at the rail.

Above the critical speed, the sustainable power is constant, so the sustainable tractive force must decline as the speed increases. (Krug)

* * *

A parallel equation dictates the horsepower required to move the train against level, grade and curve resistance; we just set the tractive force equal to the total resistance. A further complication is that, as speed increases, so does resistance. So doubling the speed could double the required tractive force and thus*quadruple* the required horsepower (Clarke, 127).

The Steam Balance

Just as we can construct an energy balance for the locomotive, we can do the same for the steam which carries that energy. We multiply the combustion rate by the evaporation ratio (pounds of water evaporated by each pound of coal burnt), to get a water vapor production rate in pounds per hour. And we multiply the steam capacity of the cylinders by the piston stroke rate, and the density of the steam at cylinder pressure, to get the steam demand rate in the same units. For a given water vapor production rate, there will be an equilibrium speed at which steam demand equals steam production.

Assuming that the fuel and the grate are satisfactory, the ability of the boiler to properly supply the engine with steam can be judged by looking at the ratio of the "rated tractive force" (pounds) to the total heating area of the boiler (square feet). According to the Baldwin Locomotive Company, this ratio is 8-16 for the most common locomotive types, and is 10 for the "4-4-0." The lower the ratio, the easier it is for the locomotive to sustain that tractive force.

The ratio can be calculated for fourteen locomotives in EB11/R, and is 4.2-17.5.

Coaling Up

The nature of the coal available as fuel has an impact on the design of the firebox and, of course, on the overall performance of the boiler. (GW15, Sanderson, Robinson).

There are three basic types of coal. In order of increasing energy content, they are lignite ("brown coal," 9-17,000,000 BTU/ton), bituminous coal ("soft coal," 21-30,000,000 BTU/ton), and anthracite ("hard coal," 22-28,000,000 BTU/ton)(*Wikipedia*, "Coal").

All of the coal in Grantville is bituminous. U.S. railroads generally preferred low water, low ash, low sulphur content bituminous coal; it may be advantageous to test coals from different mines and seams to find the best "steaming coals."

While anthracite burns smokelessly, it combusts slowly and requires a firebox several times larger than for a bituminous coal burner to achieve the same heat production rate.

Coke (25,000,000 BTU/ton) is bituminous coal which has been processed to eliminate the volatiles. It was used on British locomotives because it burns without smoke, but it was too expensive for acceptance by American railroads.

Locomotive Design: Putting It All Together

We have to analyze what we need the USE locomotive to do. What loads must it pull, over what speeds, and in spite of what grades? Freight locomotive designs tend to emphasize tractive force over speed; passenger engines must reverse these priorities. A general purpose locomotive—and that is what we probably want to build first—is a compromise.

We also must consider what limitations on locomotive weight and size are imposed by the quality of the track, the sharpness of the curves, the load capacity of any bridges it crosses, and the clearances of those bridges and other structures.

Of course, since we are starting from scratch, our locomotive design will affect the planning of the line. The first line is likely to be from Grantville to Magdeburg. This is not a mountain region, and the line can follow river valleys to minimize grades. So I think it reasonable to assume a maximum grade in the 1-3% range.

* * *

My recommendation is that the USE first attempt to build a 4-4-0 rod locomotive. This "American" wheel arrangement was extremely successful as a general purpose engine. Even in 1884, 60% of the new engines were 4-4-0's, although that dropped to 14% in 1891 (White)

Alexander's*Iron Horses* has descriptions of a large number of 4-4-0's, starting with the 1837 Hercules (PL8), and ending with the 1893 locomotive used by the CB&Q (PL93). The first 4-4-0's obviously were able to cope with the light rails of the late 1830s.

My one reservation about using 4-4-0's is that our tractive force may be weight-limited if our rails are light. This could be a problem if the track is steeply graded. With forty pound steel rails (allowable wheel weight of 4-6 tons), the maximum weight on the drivers would be 16-24 tons, and maximum tractive force would be one-quarter that (4-6 tons). That in turn limits the maximum total train weight to 533-796 tons on level track or 107-161 tons on a 3% grade.

My suspicion is that the USE will not have great difficulty in achieving "standard" wheel diameters and cylinder dimensions, but that boiler pressure will be more problematic. With sixty inch wheels, and 16X24 cylinders, the rated traction is 87 times the boiler pressure (p.s.i.) So, to achieve six tons of traction at the rail, we need 138 p.s.i.

If that isn't enough pulling power to satisfy USE engineers, we can instead design a 4-6-0 "Ten Wheeler" (Alexander PL30), which, with the same driving wheel load, could have 12,000-18,000 pounds traction, and could handle 800-1,200 tons level or 160-240 on the 3%. We might scale up to 20X30 cylinders, allowing us to make do with only 106 p.s.i. But the larger reciprocating masses will increase hammerblow on the rails, especially at high speed.

* * *

After that we need to think about constructing more specialized locomotives. We will probably be more concerned about moving goods. Hence, the next locomotive might be a 2-8-0, which is the "Consolidation" type, first in 1875 to haul heavy freight. The first engine with this configuration in the Alexander book is the 1879*Uncle Dick* (PL70), and the last one is the 1900*Number 1621* (PL96). An alternative is the 2-8-2 "Mikado," which replaced the "Consolidation" in the 1920s. If an "eight coupled" loco is too heavy for the relatively flimsy tracks we have in service, we could construct a "Decapod" 2-10-0 (the driving weight is spread over five axles instead of four) or a "Santa Fe" 2-10-2 (the trailing axle permits a larger firebox, hence more steaming capacity).

For passenger service, the 4-4-0 was eventually replaced by the more powerful 4-6-0. As a second generation general purpose engine, we might consider a "Northern" 4-8-4 (Sinclair, 681).

For switching purposes, the best choice may be the 0-6-0. An 0-4-0 could be used for light switching at an industrial site. For heavy switching, as in a hump yard, one might step up to a 0-8-0.

* * *

One of the maddening things about locomotive design is how interrelated all the components are. It means that one which works fine in isolation may work poorly when it is in a locomotive which is actually running over track.

It may be tempting to take advantage of late twentieth-century knowledge and technology and design a

"new" steam locomotive. However, if it fails, then you may not be sure whether it is because of the novel features, or because you overlooked something more basic. Hence, it may be prudent to first build a conventional nineteenth-century locomotive. In other words, duplicate, then innovate.

* * *

The final engineering design step is the "detailed design." That is the blueprinting stage, and specifies, e.g., whether the boiler plates are lap welded or riveted.

After design, you build and test a prototype. If it works, you move on to the production phase. If it doesn't, you rethink the design.

Of course, our heroes are starting almost from scratch here. They not only have to do the system-level (locomotive) design, but also designs for virtually all of its components, even such seemingly simple ones as steam pressure gauges.

* * *

I would strongly advise USE engineers to first build a reduced-scale steam locomotive, which would run on a scaled-down experimental track, first. That would allow them to discover some of the inevitable mistakes after only a limited investment in valuable materials. And lives.

What I have in mind for initial prototyping is what model railroaders would call a "garden railroad" with "small-scale live steam." This is most commonly operated on #1 gauge (45 mm) track. These have working boilers and engines. However, they burn either alcohol or butane, not coal. (Miller) It is possible that one of the model railroaders in Grantville already has one of these setups.

The garden railroad will be helpful not only for testing the engine design, but also for showing down-time smiths (and investors!) what we are working toward.

The next step up might be a "ride-aboard," coal-burning locomotive. This still need not be a full-size machine; think amusement park ride. If it is built to two foot gauge, it can use the TacRail track.

Finally, we build the real thing. Expect surprises.

Geared Locomotives

On "rod" locomotives, there is a limit to how much wheel size can be reduced. The stroke length is equal to twice the crank radius, and the latter is necessarily smaller than the diameter of the driving wheel. That implies that at some point, driving wheels cannot be made any smaller without reducing the stroke length, which would defeat the purpose of increasing the tractive force.

The solution to this conundrum is a geared locomotive, which uses the piston to drive a geartrain. If the piston applies a torque to a small gear, whose teeth engage a larger one, then the larger gear experiences a higher torque, but turns more slowly. (This is what is literally meant by "gearing down.") You get even more tractive force, at the expense of speed. A geared locomotive with forty inch diameter wheels, and a 2:1 gear down, will have the tractive force of an equivalent rod locomotive with twenty inch wheels.

But wait. What about the adhesion limit on tractive force? A rod locomotive applies a strongly pulsating torque, and it is its maximum torque which determines the adhesion limit. A geared locomotive applies an almost constant torque, and thus it has a higher effective coefficient of adhesion. Since geared

locomotives are intended to operate at low speeds, they are designed so that all of their wheels are drivers, thus maximizing the adhesion.

Because gears replace most of the rods, there is less mass flying about. This reduces the hammer on the rails, and hence geared locomotives can be used on lighter track. It is safe to assume that the up-timers know something about geared locomotives. Grid character "Monty" Szymanski, Sr. overhauled locomotives of the Cass Valley Scenic Raiload, which operates geared "Shays." There are also photos of Shays in two books in the public library (Ellis, 109;*Rails West* , 12). The documented sources don't explain the differences between the Shay and the other common geared locomotives (Climax, Heisler, etc.)

* * *

Some knowledgeable members of Baen's Bar have strongly urged that the first USE steam locomotive should be geared.

I disagree. It is important to remember that in OTL, geared locomotives occupied an important but small niche (perhaps 3,000 were built). Geared locomotives were developed in the late 1800s to meet the needs of the logging industry for a high traction engine that could ride on temporary tracks (sometimes mere logs) which were curvy, steep and rough. What about the mining industry? Geared locomotives were used if the branch serving the mine had a steep enough grade. However, mining companies typically planned for longer-term operations than loggers. They expected to work the mine for years, and therefore were usually willing to go to some trouble to reduce the grade of the track. In contrast, nineteenth-century loggers expected to "saw and scoot," so they tolerated a steep route.

Now, I just don't see there being a great deal of logging activity in early seventeenth Germany. And, to service mines, I expect that USE railroad entrepreneurs are going to cut-and-fill as needed to provide a reasonably graded roadbed for permanent track, just as was done in OTL. According to a Mannington Public Library book, in Minnesota, the Shays were used on logging railroads, but iron ore was transported on 4-4-0's. (*Rails West*, 12, 14).

So geared locomotives service a niche which probably won't exist. But it is possible that they will be used on a rough-and-ready narrow gauge rail connection into the Thueringerwald hill country, which is a source of both ore and timber.

Geared locomotives are not well suited to hauling passenger and perishable goods trains. They had a top speed of 10-15 mph, which is inferior to even an 1830 0-4-0 rod locomotive (Alexander PL42; 21 mph).

But will the down-timers care? After all, they are accustomed to the pace of draft horses, mules and oxen.

In OTL, without knowing that they were even possible, investors, shippers and passengers clamored almost from the beginning for higher speed trains. In 1831, the B&O held a contest whose entries were required to draw 15 tons at 15 mph over level track—already in excess of what horses could do.

Moreover, in this timeline, people will know what they are missing. They can read in the library that an 1893 4-4-0 supposedly set a speed record of 112.5 mph (Alexander PL85). (Its true speed was probably 82 mph, but steam locomotives*can* exceed 120 mph.) Down-timers can*see* high speed movement on the occasions when a modern automobile barreling down the asphalt roads of Grantville.

So, thanks to popular demand, the main lines, at least, will be dominated by fast-moving rod locomotives.

Second Generation Locomotive Concepts

Compound Expansion. The steam can be expanded in two or more stages. Typically, compound locomotives have two pairs of cylinders, a high pressure pair and a low pressure one. The exhaust steam from the former is directed into the latter, and each pair of cylinders drives one set of driving axles.

Theoretically, compound working increases thermal efficiency (EB11/R). However, in actual practice, "it was discredited for reasons of higher first cost and troublesome maintenance problems." (EA)

* * *

Articulation. The locomotive data table makes reference to "articulated engines." These have essentially two separate but flexibly connected engine-and-wheel sections, each mounted on a bogie. This is essentially a way of having the advantages of a long wheelbase (high tractive effort with low load per axle) without the disadvantage (being "curve-shy"). EA says that articulation "made possible machines of extraordinary size and length." The modern EB is also approving, and mentions the 600 ton articulated "Big Boy" 4-8-8-4 (135,400 pounds traction; over 6,000 hp at 75 mph).

In the original "Mallet" configuration, the boiler was rigidly attached to the rear "power bogie," and the front power bogie pivoted on the rear one. In the "Meyer" configuration, both power bogies were connected by pivots to the overhead boiler. And in the "Garratt" configuration, the boiler was in-between, rather than above, the power bogies. (Self; *Gordon 97).

* * *

Superheating. EB11/R commented that the "application of superheaters to locomotive work" is "exceedingly promising." The steam which is initially generated by the boiler is what is called "wet steam," because it contains water droplets as well as water vapor. If more heat is applied, the temperature remains constant until the water is all evaporated, and then you have dry steam. And if you heat that even more, the temperature rises, and you have superheated steam.

It has two advantages. First, it avoids wasting water by delivering it to the cylinders in liquid form. (It is only the compressed water vapor which, by expanding, moves the pistons.) Secondly, superheated steam occupies a greater volume than wet steam of the same pressure. That means that you can use bigger cylinders, which in turn allows you to either increase power, or reduce the boiler pressure (and fuel consumption). (Netherwood)

EA says that superheating increased horsepower and reduced fuel costs by about 25%. Unfortunately, EB11/R doesn't explain how superheating was carried out, and EA contents itself with a cryptic, "this mechanism returned the steam through the fire tubes of the boiler for reheating."

In a fire tube superheater, the upper rows of fire (hot air) tubes are made large in diameter. The wet steam from the steam dome is fed into narrow tubes which enter the top row of superheater tubes from the smoke box end, make a U-turn at the firebox end, and exit. They may then enter and leave a second or third row of superheater tubes the same way before delivering the now superheated steam to the steam chest. (GW10).

For superheating to be practical, the cylinder and boiler must be able to resist the corrosive effect of

superheated steam, and the cylinder lubricants must remain functional. Heavy mineral oils (in short supply in Grantville) were needed for lubrication (EB11/SE 829). The necessary advances in the iron and oil industries will take some years, which is why I see superheating as a second generation feature.

Other Locomotive Design Features

Headlights, Bells and Whistles. These made travel, especially at night, safer.

* * *

Cowcatcher. Cheaper than fencing the whole line, and helps to clear track of debris or light snow.

* * *

Sanders. These were used to release sand in front of the wheels, to increase adhesion (especially when trying to start a train). EB11/R (p. 646) says that the sand is blown onto the rail by a steam jet. A sand box and sand pipe are shown by Alexander PL79 for a 1887 2-8-0 class R; here, the sand seems to just drop down. Sanding increases adhesion to about one-third (Clarke, 121).

* * *

Water quality. Minerals in the water can deposit on the boiler pipes. This fouling slows heat transfer and can result in tube failure. Impure water may also foam up if the boiler suddenly loses steam, intruding into the cylinders and damaging them (White, GW14). The solution is to purify or treat the water, either before loading it in the tender, or with an on-board system. Or you can "blow down" the boiler regularly, to clean out the scale.

* * *

Tenders. Fuel and water can be carried behind the locomotive in a "tender." A typical one might carry 3,000 to 7,000 gallons of water, and 5 to 10 tons of coal. (Connor, 91).

Water was originally conveyed by leather or canvas hoses; these were replaced by rubber ones in the 1850s. (White 223).

* * *

Water injector. Alexander PL79 shows the use of a steam jet (Giffard, 1859) to force water into the boiler. Previously, axle-driven pumps were used (Nock/RE, 150; Clarke, 116).

* * *

Feedwater heater. Exhaust steam may be used to warm the water before it enters the boiler. (NOCK/RE, 150; EB11/SE," 841).

* * *

Mechanical stokers. A fireman can shovel only 2-2.5 tons an hour; this limited steaming capacity. Mechanical stokers could handle ten times as much coal. (Sinclair, 673; Gordon, 48; EB11/B 150). The EA article shows one type, a screw conveyor for moving coal from the tender to the grate. The fireman could use steam jets to redistribute the coal on the grate.

We will need mechanical stokers only after we are building locomotives which are large enough to overburden a fireman. Even then, since labor is cheap, we might want to first experiment with a two stoker firebox.

* * *

Integral tank. Instead of using a tender, the locomotive may carry its own water and coal. Such a "tank locomotive" is more efficient (the stored water is preheated as a result of proximity to the boiler), able to move in either direction (a tender can't be safely pushed backward, at least at high speed), more compact than the engine-and-tender combination, and capable of exerting a greater tractive force (because the weight of the fuel and water contributes to the weight on the driving wheels).

A "tender locomotive" design is better if the locomotive must go a long distance without refueling, because the storage capacity of a separate tender is greater than that of a "tank locomotive."

* * *

Suspension Systems. In the first locomotives, the driving axles were mounted in a rigid frame. Alexander describes an improvement; in the 1837*Hercules* (PL8), the driving axles were placed in a truck of their own, the center of which was connected to the main frame of the locomotive.

In the bogie holding the leading wheels of the 1842*Mercury* (PL13) the axle boxes hung from springs, which dangled from a bolster, which in turn was attached underneath the front of the engine. Apparently, these axles could move up-and-down if the track was uneven. Alexander says that the driving wheels were also equalized, without providing details.

Ellis (113) also discusses bogie design, and makes the key point that it is desirable to provide a "three point suspension." How is this accomplished? Ellis doesn't say. If there are two driving axles, then the springs on each left side are connected by one equalizing lever, and those on the right side by another. These levers are in turn connected to the bottom of the locomotive frame,*one on each side*. The leading bogie, on the other hand, was*centrally* connected to the bottom of the locomotive. The three connections form a triangle, which makes it easier for the locomotive to "stand" on uneven road. (Clarke, 4, 114).

* * *

Insulated cylinders. Some steam is lost through condensation in the relatively cool cylinders. White (207) says that "the insulation of cylinders might appear to be obvious for reasons of thermal economy, yet, from existing evidence, it was not employed regularly until the 1850's." This is an example of one of the hundreds of fine details of locomotive design which are unlikely to be spelled out in the books available in Grantville.

Conclusion

In Action Comic #1, published in 1938, readers were told that the new hero, Superman, "could run faster than an express train" (i.e., more than 80 mph). Later, he was described as "more powerful than a locomotive" (which by then could muster 3,000 hp). The point of mentioning all this is not, of course, to quantify the superpowers of Superman, but to observe that the locomotive was thought to epitomize both speed and power.

With its ability to haul great loads at high speeds, across vast distances, the USE locomotive will be, in the words of Jessamyn West, "a big iron needle stitching the country together."

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IMAGES

Note from Editor:

There are various images, mostly portraits from the time, which illustrate different aspects of the 1632 universe. In the first issue of the*Grantville Gazette,* I included those with the volume itself. Since that created downloading problems for some people, however, I've separated all the images and they will be maintained and expanded on their own schedule.

If you're interested, you can look at the images and my accompanying commentary at no extra cost. They are set up in the Baen Free Library. You can find them as follows:

1) Go towww.baen.com <http://www.baen.com>

2) Select "Free Library" from the blue menu at the top.

3) Once in the Library, select "The Authors" from the yellow menu on the left.

4) Once in "The Authors," select "Eric Flint."

5) Then select "Images from the Grantville Gazette."

SUBMISSIONS TO THE MAGAZINE

If anyone is interested in submitting stories or articles for future issues of the*Grantville Gazette,* you are welcome to do so. But you must follow a certain procedure:

1) All stories and articles must first be posted in a conference in Baen's Bar set aside for the purpose, called "1632 Slush." Do*not* send them to me directly, because I won't read them. It's good idea to submit a sketch of your story to the conference first, since people there will likely spot any major problems that you overlooked. That can wind up saving you a lot of wasted work.

You can get to that conference by going to Baen Books' web sitewww.baen.com <http://www.baen.com> . Then select "Baen's Bar." If it's your first visit, you will need to register. (That's quick and easy.) Once you're in the Bar, the three conferences devoted to the 1632 universe are "1632 Slush," "1632 Slush Comments," and "1632 Tech Manual." You should post your sketch, outline or story in "1632 Slush." Any discussion of it should take place in "1632 Slush Comments." The "1632 Tech Manual" is for any general discussion not specifically related to a specific story.

2) Your story/article will then be subjected to discussion and commentary by participants in the 1632 discussion. In essence, it will get chewed on by what amounts to a very large, virtual writers' group.

You do*not* need to wait until you've finished the story to start posting it in "1632 Slush." In fact, it's a good idea not to wait, because you will often find that problems can be spotted early in the game, before you've put all the work into completing the piece.

3) While this is happening, the assistant editor of the*Grantville Gazette,* Paula Goodlett, will be keeping an eye on the discussion. She will alert me whenever a story or article seems to be gaining general approval from the participants in the discussion. There's also an editorial board to which Paula and I belong, which does much the same thing. The other members of the board are Karen Bergstralh, Rick Boatright, and Laura Runkle. In addition, authors who publish regularly in the 1632 setting participate on the board as*ex officio* members. My point is that plenty of people will be looking over the various stories being submitted, so you needn't worry that your story will just get lost in the shuffle.

4) At that point—and*only* at that point—do I take a look at a story or article.

I insist that people follow this procedure, for two reasons:

First, as I said, I'm very busy and I just don't have time to read everything submitted until I have some reason to think it's gotten past a certain preliminary screening.

Secondly, and even more importantly, the setting and "established canon" in this series is quite extensive by now. If anyone tries to write a story without first taking the time to become familiar with the setting, they will almost invariably write something which—even if it's otherwise well written—I simply can't accept.

In short, the procedure outlined above will save*you* a lot of wasted time and effort also.

One point in particular: I have gotten extremely hardnosed about the way in which people use American characters in their stories (so-called "up-timers"). That's because I began discovering that my small and realistically portrayed coal mining town of 3500 people was being willy-nilly transformed into a "town" with a population of something like 20,000 people—half of whom were Navy SEALs who just happened to be in town at the Ring of Fire, half of whom were rocket scientists (ibid), half of whom were brain surgeons (ibid), half of whom had a personal library the size of the Library of Congress, half of whom . . .

Not to mention the F-16s which "just happened" to be flying through the area, the Army convoys (ibid),

the trains full of vital industrial supplies (ibid), the FBI agents in hot pursuit of master criminals (ibid), the . . .

NOT A CHANCE. If you want to use an up-time character, you*must* use one of the "authorized" characters. Those are the characters created by Virginia DeMarce using genealogical software and embodied in what is called "the grid."

You can obtain a copy of the grid from the web site which collects and presents the by-now voluminous material concerning the series,www.1632.org <http://www.1632.org> . Look on the right for the link to "Virginia's Up-timer Grid." While you're at it, you should also look further down at the links under the title "Authors' Manual."

You will be paid for any story or factual article which is published. The rates that I can afford for the magazine at the moment fall into the category of "semi-pro." I hope to be able to raise those rates in the future to make them fall clearly within professional rates, but . . . That will obviously depend on whether the magazine starts selling enough copies to generate the needed income. In the meantime, the rates and terms which I can offer are posted below in the standard letter of agreement accepted by all the contributors to this issue.

Standard letter of agreement

Below are the terms for the purchase of a story or factual article (hereafter "the work") to be included in an issue of the online magazine*Grantville Gazette,* edited by Eric Flint and published by Baen Books.

Payment will be sent upon acceptance of the work at the following rates:

1) a rate of 2.5 cents per word for any story or article up to 15,000 words;

2) a rate of 2 cents a word for any story or article after 15,000 words but before 30,000 words;

3) a rate of 1.5 cents a word for any story or article after 30,000 words.

The rates are cumulative, not retroactive to the beginning of the story or article. (E.g., a story 40,000 words long would earn the higher rates for the first 30,000 words.) Word counts will be rounded to the nearest hundred and calculated by Word for Windows XP.

In the event a story has a payment that exceeds $200, the money will be paid in two installments: half on acceptance, and the remaining half two months after publication of the story.

You agree to sell exclusive first world rights for the story, including exclusive first electronic rights for five years following publication, and subsequent nonexclusive world rights. Should Baen Books select your story for a paper edition, you will not receive a second advance but will be paid whatever the differential might be between what you originally received and the advance for different length stories established for the paper edition. You will also be entitled to a proportionate share of any royalties earned by the authors of a paper edition. If the work is reissued in a paper edition, then the standard reversion rights as

stipulated in the Baen contract would supercede the reversion rights contained here.

Eric Flint retains the rights to the 1632 universe setting, as well as the characters in it, so you will need to obtain his permission if you wish to publish the story or use the setting and characters through anyone other than Baen Books even after the rights have reverted to you. You, the author, will retain copyright and all other rights except as listed above. Baen will copyright the story on first publication.

You warrant and represent that you have the right to grant the rights above; that these rights are free and clear; that your story will not violate any copyright or any other right of a third party, nor be contrary to law. You agree to indemnify Baen for any loss, damage, or expense arising out of any claim inconsistent with any of the above warranties and representations.