VOLUME LXXXVI NUMBER FIVE

THE NATIONAL GEOGRAPHIC MAGAZINE

NOVEMBER, 1944

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D.C.

$4.00 A YEAR 50¢ THE COPY

VOL. LXXXVI, No. 5 WASHINGTON NOVEMBER, 1944

THE NATIONAL GEOGRAPHIC MAGAZINE

Infantrymen—The Fighters of War

BY BRIGADIER GENERAL W. H. WILBUR, USA*

IN WORLD WAR I the job of the infantry soldier was tough. The 1918 doughboy had to be virile and rugged. In the present war the doughboy's job is even tougher, for during the past twenty-five years many new devices and improved weapons have been developed.

These new contrivances place in the hands of our troops weapons with which they can concentrate a seemingly annihilating fire on the enemy infantry.

In World War I our principal artillery piece was the 75-mm. gun. The 75 was very accurate, and it poured heavy concentrations on the 1918 edition of German infantry.

In 1944 we are using the 105-mm. howitzer as our principal artillery weapon. It not only has a longer range, much heavier shell, and greater bursting radius, but, because it employs high-angle fire, it can get in behind hills, buildings, and other shelters where the 75 could not reach. The 105 is much more effective against Germans and Japs than was the 75.

Our infantry smothers the Jap or German infantry with mortar fire, delivered by mortars which are very much more accurate and which have a much greater range than the 1918 type.

We roll tanks over the Jap or the German, tanks that are so much more powerful in every way than those used in 1918 that they may almost be classed as a new weapon.

We use rifle and machine-gun fire to seek out the Jap opposing us. The bazooka and the flame thrower, coupled with mortar fire, make bunkers and concrete pillboxes of limited value as shelter for the enemy infantryman. We throw hand grenades into the hole where he seeks shelter. We try to weaken his will, to cow him, to make him give up, or to annihilate him.

And the Germans and Japs do the same to our infantry.

The Doughboy Takes a Beating

No other element of our armed forces takes the beating that we expect our doughboys to stand up under. Every new development—tanks, rocket guns, and dastardly box mines—adds to the burden of the indomitable doughboy.

In this, as in all past wars, soldiers and sailors measure their contribution by four considerations. First, by the degree of their isolation and loneliness; second, by the amount of physical discomfort they endure; third, by the amount of danger they undergo; and last, by the amount of real aggressive fighting that they do.

Measured by any or all of these standards, the infantry soldier, the "doughboy," is in a class by himself and is pre-eminently entitled to the approbation of the people at home and the plaudits of his fellow soldiers.†

War requires the combined and coordinated efforts of the whole Nation. Raw materials must be obtained, weapons and equipment must be fabricated, everything must be transported and finally used against the enemy.

All of these successive steps are essential to the accomplishment of the complete task. Any

* As Assistant Commander of the 36th Infantry Division, General Wilbur fought in North Africa and Italy, on the bloody Salerno beachhead, along the Rapido River, and in other historic engagements. For entering the French lines under fire at Casablanca and attempting to arrange an armistice to prevent further bloodshed on both sides, he was awarded the Nation's highest decoration for gallantry in action, the Medal of Honor. General Wilbur also wears the Silver Star, Legion of Merit, the Moroccan *Ouissam Alaouite*, and campaign ribbons of both World Wars.—*The Editor.*

† See "Around the Clock with Your Soldier Boy," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, July, 1941.

U. S. Army Signal Corps, Official

Wham! A Shell from a 105-mm. Infantry Howitzer Speeds after Retreating Nazis

This gun crew is opening up on the Germans near Carentan, Normandy, as Yank troops burst from the peninsula to drive eastward toward Paris. More effective than the famous 75-mm. of World War I is this mobile artillery piece, important element of an infantry regiment's fire power (pages 513, 527).

man or woman who participates in the great undertaking may feel with satisfaction that he or she is a sharer in our national accomplishment.

As we follow the unbroken chain of effort from farm or mine to the front-line doughboy, the job becomes increasingly uncomfortable, increasingly difficult, increasingly dangerous.

Through the years the infantry has changed and developed remarkably. As new dangers have arisen, the infantry has mastered them.

One could rightly marvel at the fact that the infantry has survived. It has done much more. It has dominated new developments and continued to be the decisive element of war.

In the Civil War whole regiments and sometimes brigades charged bravely, shoulder to shoulder, directly at an enemy position. That was standard procedure. Only the higher commanders used maneuver and envelopment.

General Stonewall Jackson is rightly credited with executing a brilliant maneuver at the Battle of Chancellorsville. He led his entire force around the flank and struck unexpectedly. Today it is normal for a squad or a platoon to do this same thing.

No longer does the squad go forward as a portion of a massed company bravely led by the captain. Now the platoon may be alone in a zone of action formerly considered appropriate for a battalion.

The leader must take advantage of every fold in the ground, must foresee hostile fire and the effect of hostile fire, must set up his own base of fire to support and cover the maneuver of the riflemen around the flank or perhaps even against the enemy's rear.

Infantry Soldier a Person Apart

Just as he gets his maneuver well started, the enemy may strike his maneuvering unit on the flank. It is a struggle of wits, a succession of situations which are always different. It demands calm, rapid thinking. That is why only men of high intelligence can fully shoulder the heavy responsibility of leading a rifle squad or a rifle platoon (page 534).

Many other arms operate by groups and thus have the psychological strength that group effort gives. If infantry is massed or grouped, it commits suicide.

When we consider the mental strain of battle, the effect of the constant pressure of hostile artillery fire, the constant presence of

U. S. Army Signal Corps, Official

On a Wheeled Litter, Medical Corpsmen Evacuate a Wounded Doughboy

This photograph was made during the intense fighting on the Anzio beachhead, Italy, in May, 1944. Never before have wounded soldiers received such prompt and efficient care as the U. S. Army Medical Department has provided in this war. Scores of new techniques, from the use of blood plasma and sulfa drugs to airplane ambulances, have saved thousands of lives which former wars would have claimed (page 522).

danger, and the daily visit of death, without question the infantry soldier is a person apart.

Hundreds of times I have marveled at his spirit. I remember, just before we attempted to cross the Rapido River in Italy, I talked with a fine infantry leader who had repeatedly performed acts of bravery and who had recently been decorated with the Silver Star.*

A few hours before the assault, he told me of his plans and said, "You know, sir, General Walker awarded me the Silver Star the other day. When I think of the number of our men who have given their lives bravely and have received no decoration, I feel how unworthy I am to wear that Silver Star. Today I am going in there and really earn it!"

Twenty-four hours later his body was sprawled on the barbed wire in the very heart of the German position—a grenade still clenched in his hand. He had died at the head of the assault troops.

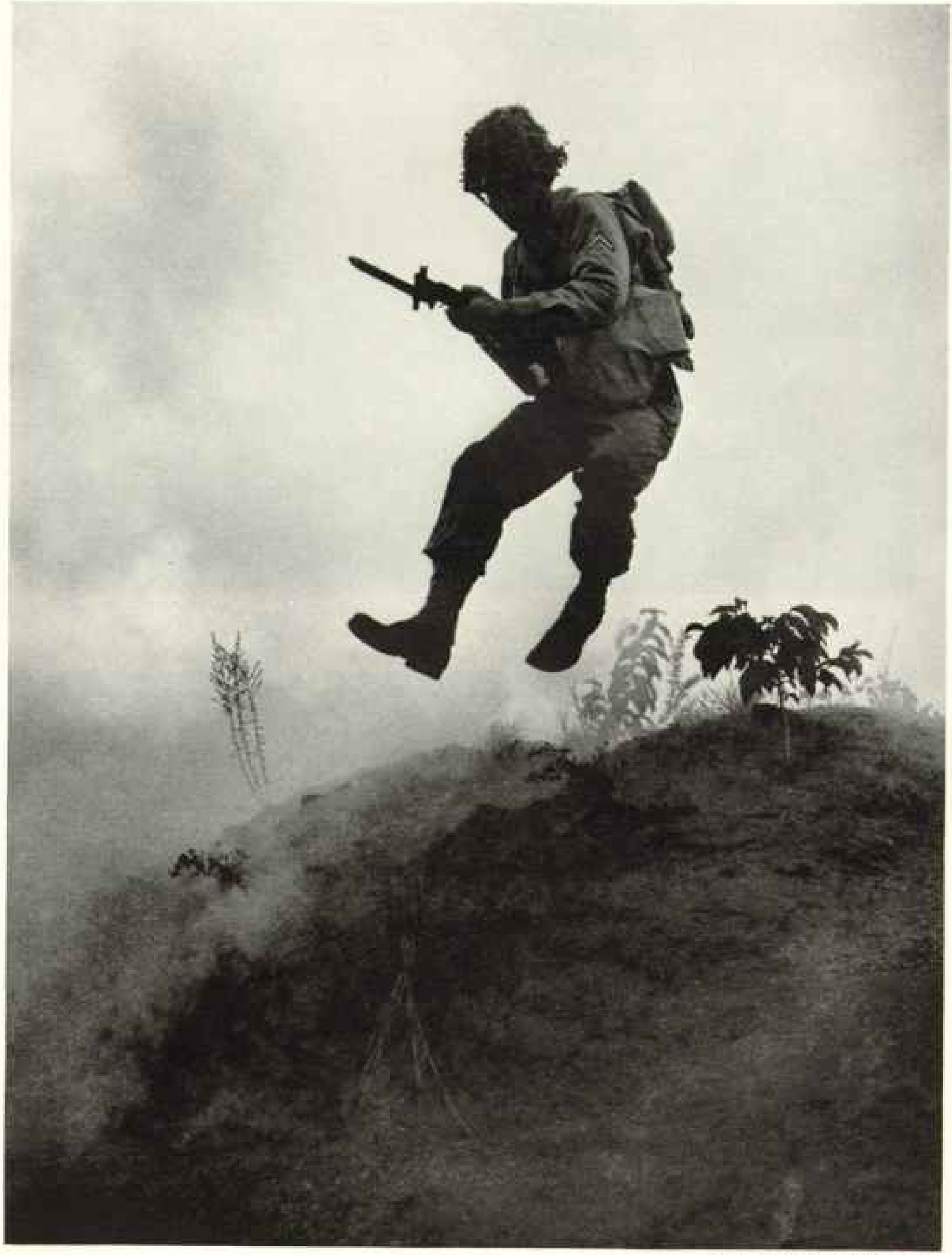
The infantry soldiers who have been in combat will carry something with them for the rest of their lives. Their minds will be seared with memories that will never leave them. I noticed a picture strip the other day in which a little boy was asking his father, "Daddy, why don't you ever tell me about Tarawa?" The answer was that Tarawa brought up too many grim memories, too many thoughts of comrades who had given their all.

Many other boys will be asking their fathers, "Why don't you tell me about the Rapido?" "About Cassino?" "About Anzio?" "About the landing in France?" "About Saipan?" The memories of those and other bloody conflicts will haunt them for years.

When we consider the need for mental keenness, the need for constant alertness, the ability to act with split-second timing, again the infantry soldier must be tops. Members of rear elements can make mistakes of judgment or can fail to be alert, and they will live to tell of it. Too frequently such is not the case with the doughboy.

I remember seeing a rifle soldier going forward across a relatively open stretch of ground. He was crouching forward—the picture of alertness. Suddenly a shell struck within a few feet of his left foot and he was swallowed up in a black cloud. I thought sadly, "Another fine young man gone."

* See "Heraldry of Heroism," by Arthur E. Du Bois, NATIONAL GEOGRAPHIC MAGAZINE, October, 1943.



U. S. Army Infantry School, Official

"Into the Jaws of Death, into the Mouth of Hell"

Tennyson's immortal words referred to the cavalry at Balaklava, but they are just as applicable to the doughboy of 1944 when he charges with his bayonet. This spectacular leap was filmed during bayonet drill at the U. S. Army Infantry School, Fort Benning, Georgia. Fundamental infantry training stresses proficiency with rifle, automatic rifle, bayonet, and hand grenades (page 523).

Suddenly, out of the cloud dashed that same doughboy. He had beaten that first shell to the ground and then was up and away. He wasn't going to be in that spot when the next salvo hit.

Many infantry soldiers are not so lucky. They receive wounds that they will carry through life. The treacherous new German box mine is made to blow off a man's foot. The infantry soldier is much more likely to carry the scars of combat with him to his grave than are the soldiers of any other arm or service.

It is very American to be proud of our sons, our relatives, our friends. The place where they serve in the armed forces is of little importance. We are proud of all of them, and rightly so, for each one is making a contribution to our great national effort.

We know that every man and woman who is in our armed forces, and who is doing his assigned job as well as he can, is doing his share.* But I am sure every one of them will agree that the doughboy does definitely more than his share.

The contribution the men make is shared by their loved ones. Let us not forget that the mothers and fathers, the wives of infantrymen—they too make an outstanding contribution.

From the standpoint of comfort, food, and living conditions, there can be no question that the doughboy and the loyal attached "medics" (page 522) carry a heavy burden. To be wet, muddy, and tired is normal. Not that the infantry soldier is the only soldier who gets muddy. The artillery struggles and works in the mud, and the engineers live in the mud for days at a time.

During the first winter in Africa the airfields at Oran and Algiers were muddy landing strips surrounded by a lake of mud six inches to a foot deep. The difference is that, while others may have to stand, walk, or work in the mud, the doughboy has to stand in it, walk in it, eat in it, lie in it, and frequently die in it.

Make-up of an Infantry Regiment

Infantry units impress an observer with their cumulative power. An infantry regiment has a membership of more than 3,000 men.

Within the infantry regiment itself there are degrees of hazard, ranging from that faced by the supply and maintenance elements through the headquarters and supporting units to that which confronts the heavy-weapons and rifle companies. They all suffer relatively heavy casualties, but the heavy-weapons and rifle companies are the units which suffer by far the heaviest casualties of war.

The most powerful fighting units of the regiment are the three rifle battalions. Each battalion has approximately 800 men, a number which is sometimes increased by the addition of attached tanks or other helpers.

Each battalion has three rifle companies, a heavy-weapons company, and a headquarters company.

What is called a "triangular" type of organization is evident throughout the infantry division. An infantry division is composed of three infantry regiments and supporting artillery, as well as cavalry reconnaissance, combat engineer, quartermaster, medical, signal, and ordnance units.

Each infantry regiment has three rifle battalions plus several supporting fire units. The battalion has three rifle companies plus supporting fire units. The company has three rifle platoons plus a supporting fire unit. A rifle platoon has three rifle squads.

The rifle squad and the rifle platoon are the shock-power elements of battle. They are composed mostly of riflemen—the men who seek out the enemy, the men who are always the first line of battle.

These men must know about cover and concealment, how to handle a multitude of weapons, how to use ground, how to work together.

They are keen men who must be alert to any menace from front, flanks, and rear; men who can never relax completely no matter how tired or sleepy they may be, brave men who do their job always subject to fire. In short, they are fine Americans who give their lives for the rest of us.

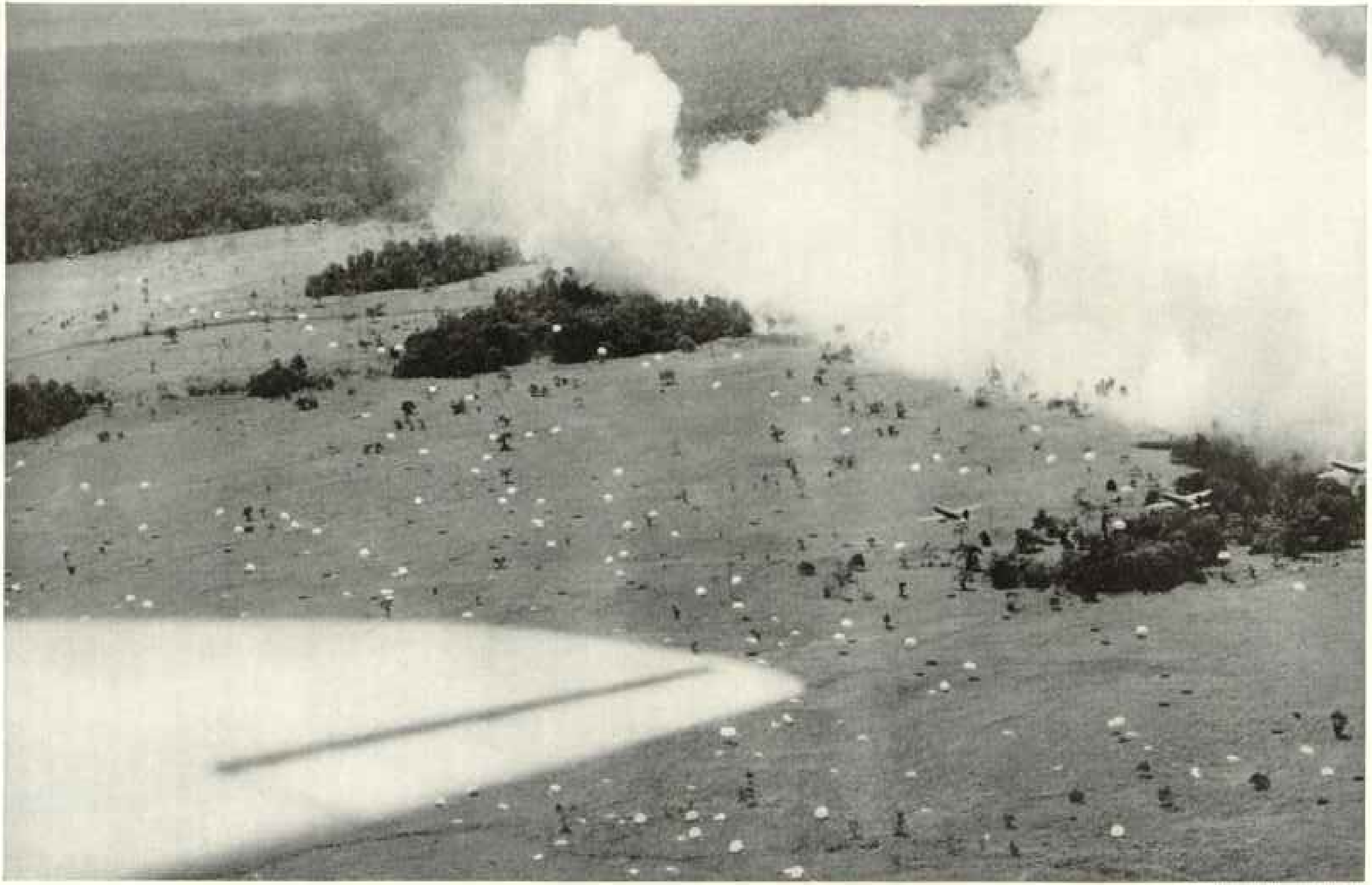
In the rifle company itself, always with the rifle platoons in the toughest part of the battle, is the weapons platoon. It has 60-mm. mortars and light machine guns, and its job is to provide quick fire support when needed (535).

The 60-mm. mortar is a most effective weapon, accurate and dependable. It is pushed well forward right behind the rifle platoons, discovers the enemy most harmful to the riflemen, and neutralizes or liquidates him (page 531).

The weapons platoon gives the rifle company commander fire power to cover the movements of his rifle platoons.

Similarly, in the battalion there is a supporting fire element known as the heavy-weapons company. Its major weapons are the 81-mm. mortar and the .30-caliber water-cooled, heavy machine gun. The machine gun

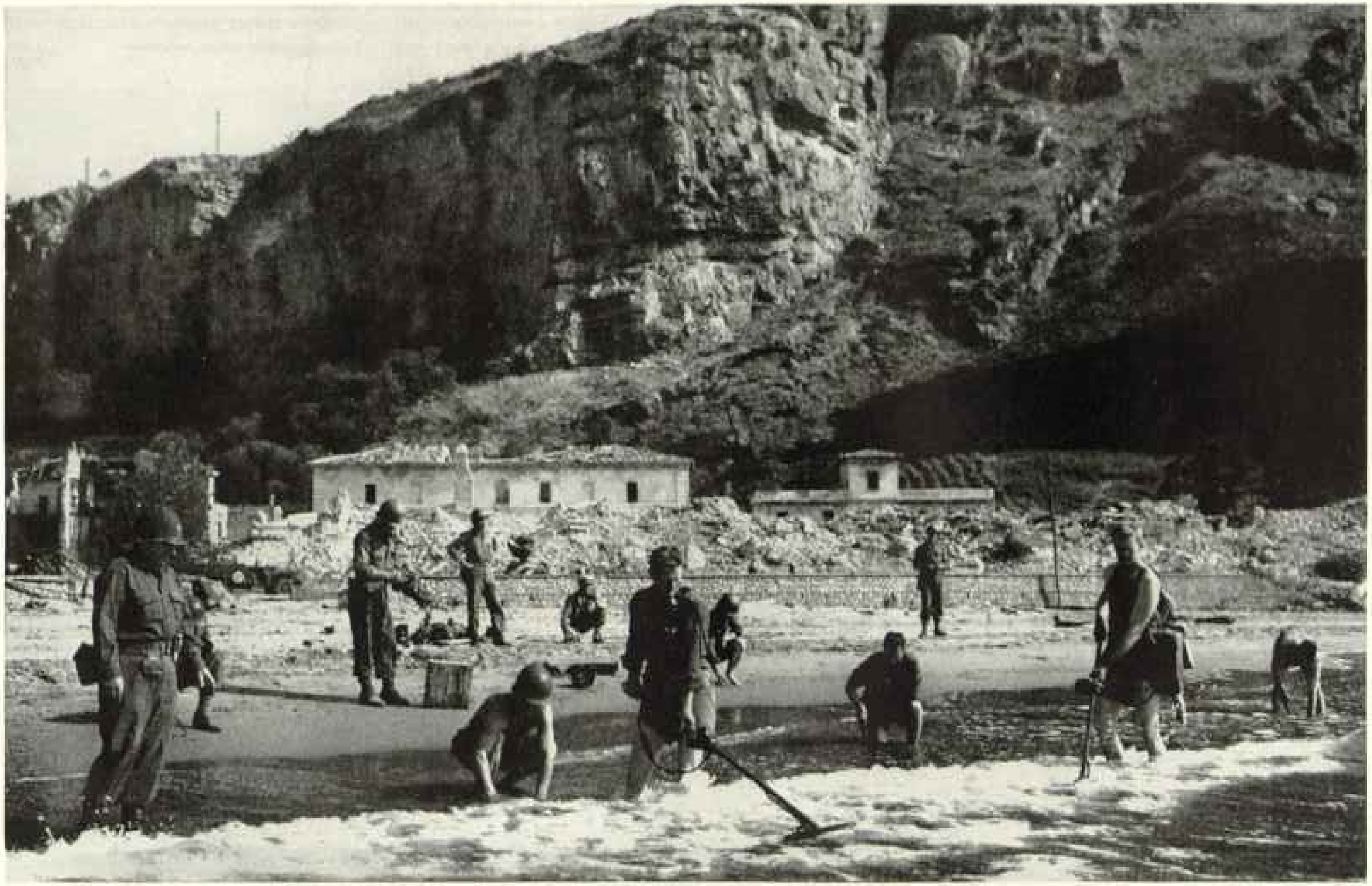
* See "Women in Uniform," by La Verne Bradley, NATIONAL GEOGRAPHIC MAGAZINE, October, 1943.



U. S. Army Air Forces, Official

In This Dramatic Surprise Attack, U. S. Paratroopers Cut Off 20,000 Japs at Lae, New Guinea

The spectacular photograph shows airborne troops dropping along the Markham River. Some of the parachutists are still in the air. Low-flying planes have laid a protective smoke screen. The maneuver completed encirclement of the enemy in the Salamaua-Lae area. Lae fell 11 days later.



U. S. Army Signal Corps, Official

A Mine Platoon of a U. S. Fifth Army Antitank Company Sweeps the Surf of Terracina Beach, Italy

They are looking for German Teller (antitank) and "S" (antipersonnel) mines. Teller mines are disks about a foot in diameter containing high explosives. Considerable pressure is required to explode them. Activated by a slight touch, "S" mines leap upward and spray 320 balls over a radius of some 200 yards (pages 522, 523).

AP from Press Ass'n, Inc.

Reinforcements, Backing Up D Day Invaders, Begin Their March to the Front Lines from a Normandy Beachhead

These infantrymen reached France on June 18, twelve days after the invasion. Until Cherbourg was available to United Nations' shipping, all troops, supplies, and ammunition from across the English Channel came directly onto the beaches from landing barges.

U. S. Army Signal Corps, Official

"Gentlemen, Here They Come—the Queen of Battles, the Infantrymen, the Old Footsloggers"—Lt. Gen. Geo. S. Patton, Jr.

On the way to Avranches after the break-through in Normandy, American doughboys slog through a village in the Department of Manche. The road sign rests on a wrecked German truck. At left, the red cross on helmet identifies a medical corpsman. This scene has been re-enacted in hundreds of liberated French villages.

does its best work on the defensive; the 81-mm. mortar is of outstanding value both in attack and in defense (pages 526, 531).

The 81-mm. mortar sections are placed in gullies and depressions just a few hundred yards in the rear of the rifle companies. Their observers and officers push forward to good vantage points from which they direct fire by telephone so that the best possible support can be given in attack and defense.

The battalion commander is not limited to his own heavy-weapons company to provide fire power to help the rifle soldier. He usually has at his disposal the fire of one or more artillery battalions, proud to perform their important task of supporting the doughboy.

So that the fire of the artillery batteries (which are located several thousand yards to the rear) may be delivered accurately where it will do the most good, the artillery sends up "forward observers," who usually accompany the rifle company commanders.

As a result, the losses among forward observers are the same as those among rifle company officers. They are therefore rightly classed among the top-notch fighters.

Also helping the riflemen are the infantry regimental fire-power units, the cannon company and the antitank company.

The weapons of the infantry cannon company have been both 75-mm. guns and 105-mm. guns, but the principal weapon is now the truck-drawn 105-mm. howitzer, M3.

These howitzers may be considered as forward artillery and are used primarily as weapons of opportunity, ready to step in at relatively short range and crush a particularly strong machine gun nest or antitank gun, or to eliminate hostile tanks (page 514).

The antitank company is usually widely dispersed and assists the doughboy, mostly defensively, by stopping tanks which may strike from the front or flank (page 519).

The new 57-mm. gun, which is the weapon of the regimental antitank company, is accurate and powerful. It is relatively heavy and hence not so mobile as the 37-mm. gun which it replaced.

In addition to the essentially "fighter" units, infantry regiments and battalions also have command, communications, supply, and maintenance units of their own. They work most of the time with or close behind the fighters.*

Gallantry of Medical Corpsmen

Outstanding among them are the medical soldiers, the aid men attached to the infantry rifle units.† Each rifle platoon has one aid man. The courage and spirit of self-sacrifice of these aid men are glorious.

The riflemen have a feeling for them which is something akin to reverence. Going about the battlefield, clinging tenaciously to the rifle groups so that they can minister to them almost instantly, the aid men rise in every way to the heights of the best doughboy soldier (page 515).

Each infantry battalion has a battalion aid station where a doctor and his group of assistants provide emergency treatment. Here blood plasma is frequently given. In the rough, mountainous country of Italy, where it was difficult to bring the wounded back to the aid station, the aid station personnel sometimes went out to the wounded (page 533).

At one time, near the top of a 4,000-foot mountain, enemy fire was so severe and the ground so rough and broken that slow-moving litters could not get back to the aid station in daylight without heavy loss. The regimental dentist was in charge of the aid station, as the doctor had become a casualty. He courageously moved out with limited equipment and cared for the men individually. Each man was dragged to relative shelter in a hollow or depression, made as comfortable as possible, given emergency treatment, and then left there to be evacuated after dark.

When blood plasma was given here in the midst of battle, it sometimes happened that an enemy bullet smashed the bottle held up a bit too high above the depression which sheltered the wounded man and the resourceful medics.

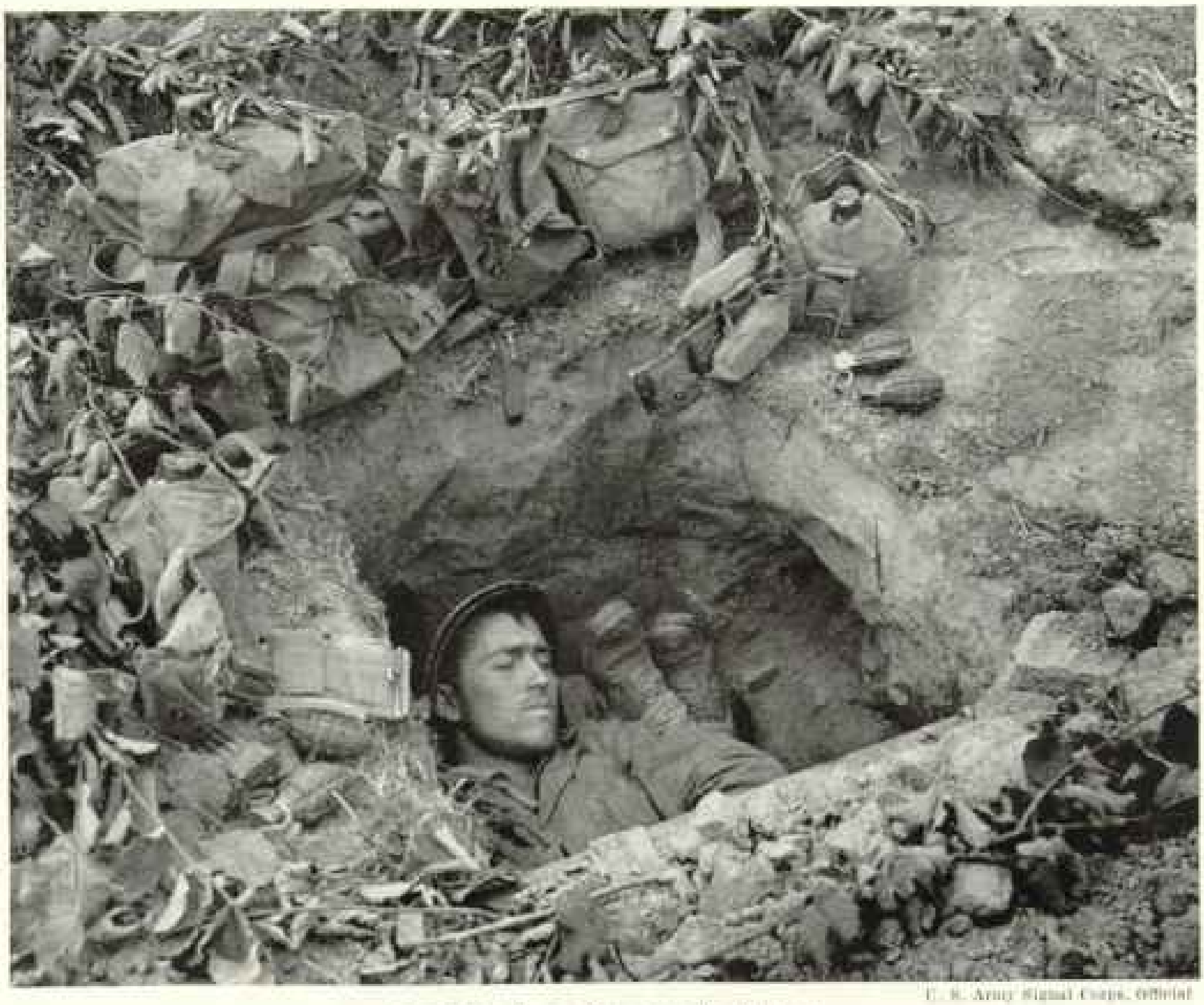
The Miracle of Blood Plasma

The resurrective effect of blood plasma is something one can never forget. When a man has lost considerable blood, the gray, ashen pallor of near-death settles on him. If plasma is available it is like a miracle, a miracle of life flowing back into a corpse.

An infantry regiment has a considerable number of communications men, telephone operators, linemen, radio operators, messengers. They are all infantry soldiers doing their jobs in or near the front line, carrying vital messages regardless of hostile fire, or "running" a telephone line to find and repair a break made by a shell in an exposed place. They are frequently exposed to the fire of enemy snipers, who are on the lookout for them and know the vital job that they do.

* See, in the National Geographic Magazine for November, 1942, "QM, the Fighting Storekeeper," by Frederick Simpich, and "Winged Words—New Weapon of War," by F. Barrows Colton.

† See "Healing Arts in Global War," by Albert W. Atwood, National Geographic Magazine, November, 1943.



U. S. Army Signal Corps, official

Cat Nap in a Normandy Shelter

The infantryman's helmet makes a pillow. Only visible signs of his buddy, stretched alongside in reverse, are his shoes. Grenades, ammunition, canteens, and supplies, lightly camouflaged, are within easy reach. These sleepy doughboys had been at the front continuously since their arrival in France on D Day. Their unit is in reserve; so they are getting a rest.

Men who carry portable radio sets are likewise easy to detect and often get hit.

Infantry regiments and battalions have pioneer units which build small bridges, improve trails, and do similar engineer jobs of a hasty nature. The doughboys are frequently called upon to prod for and remove mines.

Infantry truck drivers, particularly jeep drivers, share the honors of the infantry area. They don't go right up with the rifle companies, but they are often under fire and are frequently the first to pass over a mine-strewn road. It gives you a funny feeling to come back over a road that you traversed going forward and find that the engineers have in the meantime removed a large number of mines from the very stretches over which you hurried forward hours ago.

When a Teller mine blows under a jeep, the jeep is usually reduced to a twisted wreck. If its bottom is covered with sandbags, the occupants may escape with broken legs and minor injuries; or they may not.

Weapons of Incredible Variety

The weapons of a modern infantry regiment are almost unbelievable in variety and fire power. Soldiers in a rifle company must be able to handle the 1903 rifle, the Garand rifle, the Tommy gun, the bazooka, the carbine, the Browning automatic rifle, the light machine gun, the 60-mm. mortar, several kinds of hand grenades, rifle grenades, antitank grenades, and the bayonet (page 516).

One might think that these would be enough, but not so. The need for additional mobile, quickly available fire power has forced the infantry to adopt even more weapons—81-mm. mortars, heavy .30-caliber machine guns, 37-mm. antitank guns, 57-mm. antitank guns, and infantry cannon either of 105-mm. or 75-mm. caliber, or both.

U. S. Army Signal Corps, official

With Tools to Do the Job, a Paratrooper Boards His Plane

Parachute is strapped on back, emergency chute on chest. Over his right hip is a gas mask; beyond it his canteen. Below the breast chute is his field bag loaded with a field kit. His right boot serves as holster for a long knife. On his left side, not visible in photograph, hand grenades and ammunition are fastened (page 537).

Infantry trucks are armed with .50-caliber machine guns, and the infantry cooks are proud of the fact that it is frequently their job to operate them.

The infantry is also using flame throwers and Bangalore torpedoes, developed by the Corps of Engineers and taken over by the doughboy. The flame throwers are weapons of opportunity used to rout Japs out of bunkers and to destroy Germans in pillboxes and concrete emplacements (page 530).

Bangalore torpedoes are carried forward into the teeth of hostile fire and placed under wire entanglements, where they are exploded to make a breach in the wire (page 537).

It makes an imposing total, at least 20 weapons in all, but the end is not yet. The doughboy must know how to detect mines and render them harmless. He must be able to handle captured weapons, such as the German machine pistol, or "diarrhea gun," as the men call it, as well as the German rifle and machine gun.

Many a position has been held because someone was able to use captured weapons against an enemy counterattack. However, the doughboy has been quick to learn that the use of enemy weapons is dangerous. The rate of fire and the sound of German automatic weapons are very distinctive. This is of great value, as it enables the trained infantry soldier to differentiate between friend and foe.

We therefore gave instructions that American soldiers were to use captured weapons only in a grave emergency, for there is always the danger that our own men might mistake the American users for the enemy.

One may rightly ask, "Why does the infantry have to have so many different weapons?"

The answer is, because infantry must perform so many different tasks, must function under such varying conditions of terrain, must do so many different types of fighting, and must have weapons capable of overcoming every type of hostile action.

The "Zone of Greatest Surprise"

The zone where the doughboy fights is the zone of greatest surprise, the zone where anything is possible.

He, and usually he alone, must be able to cope with pillboxes, wire entanglements, guns

of every caliber, mines, rocket guns, tanks, and concrete emplacements. He must be able to fight on the top of mountains and in the valleys, to cross unfordable streams, or to wade ashore and be fully prepared to fight even before he gets ashore. He has learned that he must expect the unexpected, must be armed and equipped to master anything that moves on the land or flies in the air.

To do this he needs an arsenal of weapons, each suited to a particular use in battle.

The rifle is the old stand-by and is still the principal weapon of the infantry. The man with rifle and bayonet is a complete fighting unit, capable of independent, decisive action. He is small enough to take advantage of any available cover, mobile enough to go anywhere, rugged enough to stand any conditions. His courage, brains, body, and weapons make him a one-man army, complete in himself.

This fact is the outstanding difference between the infantry and all other arms. The infantry private is the only private who is entrusted with the complete responsibility for a weapon. He alone has the thrill of imposing his will on the enemy. His individual, personal initiative can influence the tide of battle—can even win a battle. Many, many times he finds himself where he alone must decide what should be done.

The 1903 rifle now is principally used as a sniper's weapon, equipped with a telescopic sight. It has also been used to launch antitank and antipersonnel rifle grenades.

The day after our First Infantry Division stopped a German infantry and tank attack of 50 or more tanks at El Guettar in central Tunisia, the late Brig. Gen. Theodore Roosevelt told me that four of the German tanks were destroyed by antitank grenades fired by doughboys from 1903 rifles. They have destroyed many tanks on other battlefields and also blown up pillboxes.

The M1 (Garand) rifle is a fire-power weapon. It has excellent accuracy and can fire a large number of bullets in a limited time. One of its outstanding qualities is its relatively gentle recoil. The kick of the M1 rifle is much less than that of the Springfield. The M1 rifle has proved to be an unqualified success. It is also used to launch antitank and antipersonnel rifle grenades.

U. S. Army Signal Corps, Official

In Training Maneuvers GI Joes Display Two Kinds of Bazookas

Armed with bazookas, they stand their ground against tank assaults and even go forward to attack tanks (page 526). The bazooka is a form of rocket gun. Pictured here is the old-style, one-piece bazooka (right) and the more easily carried "folding" model, a two-piece unit which can be assembled in a few seconds to form a 61-inch launcher for firing.

U. S. Army Signal Corps, Official

Here's Mail from Home for an 81-mm. Mortar Crew

These mortarmen read the mail during a few minutes' lull within a few hundred yards of the Japs on New Guinea (pages 522, 531). Letters from home renew strength and spirits. Flying the Army mails is more than a service to infantrymen far from home—it's a sure-fire morale builder.

For patrolling, our best men were partial to the Tommy gun. It is an emergency-type weapon, one which will produce a heavy burst of short-range fire in a tight situation. It is short and more convenient to handle than the longer Garand or Springfield. This is an advantage in the jungle or at night (page 533).

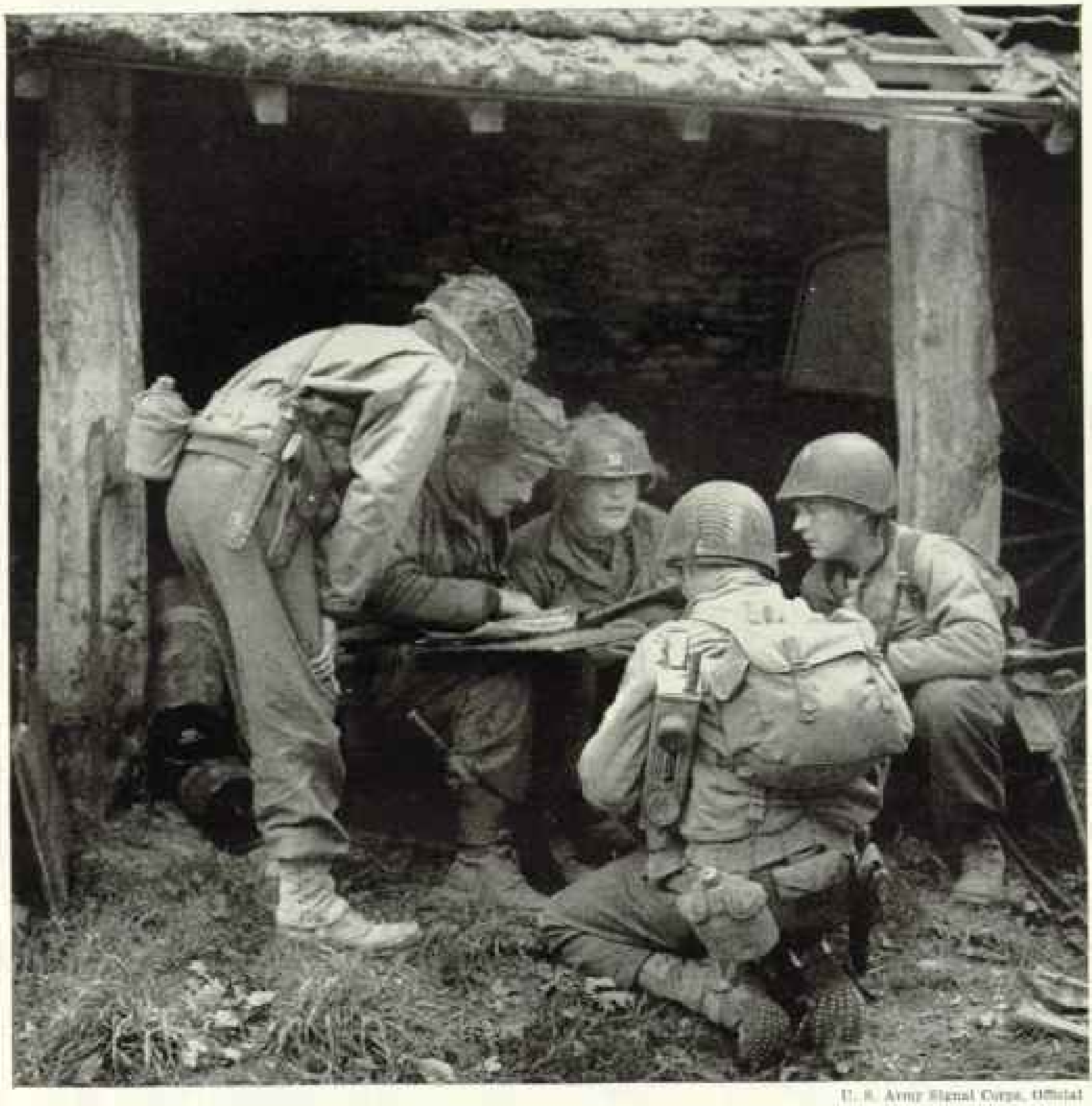
Carbine and Bazooka

The carbine is a light-weight weapon carried by officers and noncommissioned officers who do not fire much but who need a dependable emergency weapon. Both the carbine and its ammunition are light. It has been issued to entire units in situations where mobility, dexterity, and surprise were more important than fire power and long range.

The bazooka has proved itself a valuable infantry weapon. It is a form of rocket gun and, with antitank grenades fired from rifles, has given the infantry an effective means of fighting tanks (page 525). At Salerno, on the first day of our landing in Italy, the German tanks received the surprise of their lives.

All weapons, including 105-mm. artillery pieces, infantry cannon, bazookas, 1903 rifles, and antitank guns, even machine guns and rifles, contributed to this surprise.

However, the bazookas not only destroyed tanks but they gave the infantry the confi-



U. S. Army Signal Corps, Official

A Commander and His Staff Plan for the Offensive Against St. Lô

Armed with aerial photographs, they study platoon objectives before launching a new attack. Doughboys of the U. S. First Army drove the Nazis out of this strategic center in Normandy.

dence so necessary to enable the doughboys to stand their ground against tank attacks. In some cases infantrymen have gone forward and successfully attacked tanks. It has frequently been evident that the German tanks feared the bazooka.

Hand grenades are of three types: fragmentation grenades, offensive (concussion) grenades, and chemical (incendiary and smoke) grenades. They are the doughboy's best weapon on patrols and in night attacks. A man cannot well carry more than five or six, so they are used up all too soon.

The Browning automatic rifle is a popular weapon with rifle soldiers. It delivers a heavy, accurate volume of fire and is very mobile. Since it is operated by one man, it is possible to conceal it much more easily than a machine gun. It is the squad leader's base of fire, the weapon he uses to keep enemy riflemen down while the rest of the squad rushes forward or maneuvers around to the flank (538).

An infantry squad consists of a leader and two teams, the Browning automatic rifle team (or the B.A.R. team, as the soldiers call it) and the rifle team. The B.A.R. team consists of an automatic rifleman, an assistant, and an ammunition carrier. The rifle team consists of a leader and five riflemen. There are also two riflemen scouts who may be used for scouting or may be added to the rifle team.

The squad leader moves his squad forward

U. S. Army Signal Corps, Official

March over Hilly Terrain in North Africa Toughens This Ranger Battalion for Daring Exploits in Italy

Rangers are light infantry, organized into small 60-men companies. They performed in Tunisia, Sicily, and Italy, and are specialists in Commando-type operations.

U. S. Army Signal Corps, Official

A Howitzer Crew of the 82d Airborne Division Artillery Battalion Eats Thanksgiving Day Dinner in Italian Mud

This famous airborne division had distinguished itself in Sicily and Italy before the photograph was made nearly a year ago. Since then it has added new laurels by dropping from the skies on June 6, 1944, to participate in the invasion of Normandy.

U. S. Army Signal Corps, Official

Covered by Riflemen, a Doughboy Attacks a Jap-occupied Pillbox with a Flame Thrower

This 37th Division infantryman is showing how to smoke out the enemy on Bougainville Island, in the Solomons. His weapon, constructed on the general principle of an acetylene torch, sprays a sheet of intense flame for 25 or 30 yards. Advancing so close to the enemy, even under cover, is dangerous business (page 524).

toward its objective by advancing the rifle team and the B.A.R. team alternately. When one team moves forward, the other covers the advance by fire. This fire may wound or kill enemy riflemen, but it usually serves primarily to keep them down in their holes and prevent them from firing at us. If they fire, our covering fire serves to worry them and makes their fire inaccurate and ineffective.

This alternate advance of teams requires a high order of courage and faith in one's comrades. It is the essential principle of a successful infantry attack.

When the doughboy has reached a point 30 to 50 yards from the enemy, he will frequently have to go in and dig the enemy out with the bayonet. Here the danger is not limited to the enemy in his immediate front. The doughboy can almost always count on fire from enemy riflemen or machine guns from the flank or even from his own rear.

Thus the doughboy is not only out in front; he must move forward in the face of enemy fire of all kinds—a supreme example of courage and unselfish devotion. Our young ladies who proudly wear the crossed rifles of the infantry wear the emblem of real champions of liberty and freedom.

The Part of Infantry Squads

The uninitiated cannot appreciate the part the infantry squads play in battle or the value of an infantry squad in terms of winning the war. An infantry division may be compared to a powerful tiger with quick muscles and strong sinews. Alert, aggressive, able to face in any direction and cope with an enemy, it can strike out offensively or crush an unwary aggressor.

The claws and teeth of this strong tiger are the rifle squads, supported by the powerful muscles and body, which are the mortars, the artillery, and the other supporting units.

The total number of these infantry rifle

squads in action is surprisingly small. An infantry division of 15,000 men may have the equivalent of 150 rifle squads in the foremost part of the line.

Backing up the rifle squads are infantrymen handling light and heavy machine guns and 60-mm. and 81-mm. mortars. The light machine gun (air-cooled) is the more mobile of the machine guns, is less visible, and is capable of short bursts of fire (page 535).

The heavy machine gun is less mobile and harder to conceal, but as it is water-cooled it is capable of more sustained rapid fire. It is particularly valuable on the defense when, if properly placed, it can block an extensive area by bringing grazing fire to bear on level fields or along ridges of uniform slope. The bullet fired by both machine guns is the same .30-caliber projectile that is fired by the Garand and the 1903 rifle.

The 60-mm. and 81-mm. mortars are similar in their main characteristics. The 81 is the big brother of the 60. The 60-mm. mortar fires a projectile approximately two and one-third inches in diameter; the 81-mm. fires one roughly three and one-fifth inches in diameter. The larger mortar is heavier and more powerful but less mobile. Both mortars can be fired from deep depressions or gullies. This covers them from direct enemy view, and is an important mortar characteristic.

Mortars are accurate except when the tail fins of the projectile get knocked off. When the tail fins come loose, the shell may land among our own infantry. The 81-mm., because of its power and accuracy, is a favorite infantry weapon. Its only serious limitation is that its ammunition, which is heavy, must be brought up by hand—a hard and dangerous task (pages 517, 526).

Tanks Vital Machines of War

Tanks are a vital mechanism of warfare. In 1939 and 1940 they dominated the battlefield, but the infantryman has since provided himself with the bazooka, the antitank grenade, special-type hand grenades like "Molotov cocktails," and powerful antitank guns of all calibers. These additional weapons in the hands of determined infantrymen and the advent of tank mines on a major scale have greatly restricted tank action.

As a consequence, tanks have taken their place among the powerful elements whose job it is to help the doughboy or to exploit the success the doughboy has won.

Tanks have two general roles: that of assisting and working with the doughboys in the slugging melee of the infantry fight, and that of massed mobile power which makes them particularly adapted to employment as a weapon of opportunity. Tanks are mixed in with the infantry assault units in suitable terrain. This is the ideal team, as it combines the two elements of our fighting forces that possess both fire power and shock power.

The power- and terror-spreading capabilities of the tank are coupled with the finesse of the doughboy—his ability to clear mines in front of the tank or to guide the tank around them, his unimpaired vision, and his ability to fork the enemy out of holes which tank crews may not even see.

If the enemy is well established and has well-concealed antitank guns or pillboxes or emplacements containing antitank guns, the infantry must advance and clean out the antitank weapons before the tanks can go forward.

Thus again we see that when the going is toughest the doughboy and the attached "medic" go forward alone.

The doughboy can fight successfully alone because he is much less visible, can maneuver by taking advantage of every fold of the ground, and can fight in the dark, in smoke, or in dust clouds.

The opportunity to use tanks in masses comes when the infantry has opened a breach through which they may be poured to wreak havoc on a retreating and disorganized enemy or to strike against hostile rear elements. The final phase of the battle for Bizerte and Tunis in North Africa was an excellent example of such massed use of tanks.

Despite much pressure on Lt. Gen. Omar N. Bradley to use his tanks piecemeal, he had retained an armored division intact. When the American infantry had made a hole in the German line, a mass of tanks was hurled through the breach. All German resistance crumpled in a few days.

It is not generally understood that massed tank attacks involve attack by armored divisions which are composed of tanks, infantry, artillery, and other supporting elements.

Two years ago the infantry component of an armored division was only one regiment, while the tank component was two regiments. Experience in Africa showed the need for more doughboys as an integral part of the armored division, and each tank battalion of an armored division is now matched by an infantry battalion as well as by a field artillery battalion.

With this increase of infantry strength there are almost one and a half times as many infantry soldiers in an armored division as there are tank soldiers.

It is likewise of interest to note that the rifle companies of an armored division are larger than those of the standard infantry

U. S. Army Signal Corps, Official

In a Normandy Foxhole an Officer of a Reserve Unit Takes a Facsimile of a Bath

division; so, the next time you read of the fine work of a mass of tanks, remember that there are a lot of doughboys in there too.

When the going is good and advances are rapid, the doughboys may ride on the deck of a tank or aboard a troop carrier; but when the going gets tough, they are right in there slugging on foot, fulfilling their function as the pre-eminent fighters of war.

How Front-line Troops Are Fed

I recently talked to a father whose son was in one of the supply corps. He had the impression that food, ammunition, and other supplies are delivered to infantry rifle soldiers in the front lines by soldiers of the supply corps. This is not the case.

All food that gets to the doughboy is loaded into infantry 2½-ton trucks at Army supply points and moved forward to what are known as regimental dumps, several miles behind the lines. Here it is rehandled by infantry soldiers who work in a relatively sheltered area—that is, an area which, although subject to intermittent shelling and some air action, is otherwise fairly quiet.

Just before nightfall the ammunition, water, and food are loaded into infantry jeeps. At dusk the jeeps rush forward in the half-light of pre-darkness, hurrying to make all the distance they can before complete darkness sets in. The jeeps bring the welcome supplies forward, sometimes to within a thousand yards of the front.

If any kind of trail is available, supplies may be carried over the last lap in a light, two-wheeled, pneumatic-tired cart, but usually it is a man-carry job. In the mountains of Italy this man-carry phase was by far the most difficult part of the task.

It was sometimes necessary to convert infantry rifle companies temporarily into bearer units. Infantry antitank companies, infantry cooks, and infantry truck drivers were pressed into service as bearers. Every infantry soldier who could be spared was used for this tough and dangerous work.

In many places the round trip of the bearer units required 10, 14, even 16 hours over a rough, muddy trail that would have been heavy going in daylight. Horses and mules were used wherever possible, but their use was limited to areas not subject to hostile fire.

In many cases the trail was so steep that we had to use thousands of feet of rope to provide a purchase so that the soldier could pull himself up hand over hand.

Those bearer units went through long hours of heavy mental and physical strain. It was normal for the enemy to shell or mortar the supply routes. When we were on the defensive, or when things were quiet, the bearer units

Willis Arkins from American Red Cross

Up a Rugged Mountain Trail in Italy Comes a Muleload of Blood Plasma

The GI mule skinner takes the plasma (in cans) and other medical supplies to an infantry aid station right at the scene of fighting. Sharing honors with the doughboys for courage and bravery at the front are the medical aid men, who go along, unarmed, into the thick of battle (page 522).

U. S. Army Signal Corps, Official

With Tommy Guns, Infantrymen Fire on Nazi Advance Units Near Anzio, Italy

They are only 400 yards from hostile lines. For such patrol work, in feeling out enemy strength, doughboys like the Tommy gun, which produces a heavy burst of short-range fire in tight situations (page 526).

sometimes took heavier losses than did the rifle units on the front line.

Bearers made it their sacred duty to get at least ammunition and water forward to the battalions doing the fighting. If the shelling or mortar fire was too heavy and they were carrying food or other supplies, the bearers frequently held up for a short spell. But if they were carrying ammunition and water, they kept going.

Using Rocks for Ammunition

Sometimes units ran out of ammunition. One of our forward units once became isolated because of accurate, observed mortar fire.

Completely out of touch, the men of this unit found, about two hours before dark, that they had used up all their ammunition in repelling German attacks during the day. Fortunately there were plenty of rocks weighing several pounds each and our men were located well above the enemy. Using the rocks with a generous mixture of determination and courage, they stood off the Germans and held on until a fresh supply of hand grenades and rifle ammunition arrived just after dark.

On another occasion a large American force succeeded in crossing to the other side of a defended river, where they dug in and then fought all day. As they were located in an open, level area across the river, they were isolated. Re-supply in daylight was tried, but all the bearers were killed or wounded.

About two hours before dark the Germans launched a heavy attack with several reenforcing battalions. The noise of rifle and machine-gun fire told what was happening, for the characteristic sound of the weapons indicated that the fire of German machine pistols, machine guns, and German mortars was being matched by that of our automatic rifles, rifles, and machine guns. The attack was repulsed, and we learned later that many Germans were killed.

However, in repelling this attack our men used up all their ammunition. About half an hour before dark a second heavy German attack was launched against our positions. Except for isolated American fire, the only fire to be heard was that of German weapons.

By eight o'clock in the evening most of the German fire had stopped and the enemy was in undisputed possession of that part of the battlefield. When struggles of that type are fought out with opposing infantry elements in a clinch, it is not possible for the artillery of either side to intervene. Then the doughboys fight it out to a decision.

Many times a day each man, as an individual, makes decisions affecting his own life and that of his comrades. Even when the situation is relatively quiet, the casual decision to smoke a cigarette may stir up hostile mortar fire or a hand grenade and death. In an attack every moment is dangerous and any decision may bring fatal results.

Leaders of squads and platoons likewise make many grave decisions each day. Those decisions may result in success or failure. They may result in the loss of, say, 20 fine young men whom the leader deeply admires and whom he would give anything to protect.

The leaders of those squads, platoons, and companies are the men who make the vital decisions of war. That is why infantry leaders should be intelligent, keen, human, and able to think under stress. The load of responsibility for the lives of their comrades rests on their shoulders all the time, hour after hour, day after day, week after week.

Positive decisions must be made, however, despite the possibility of unfortunate results.

At one place in Italy a battalion went forward to attack a German organized position. The attack faltered. The battalion commander went forward courageously to energize the vital part of the attack. He found a half company of riflemen who had progressed forward to a point where they were under heavy German fire, some of it coming from a distance of only 75 yards. Our doughboys were stopped—"pinned down," as we say—and could not advance.

The battalion commander first radioed back for artillery fire. Down it came, but the terrain was so rough that it could not be brought on the enemy effectively. Then he ordered the artillery to put smoke shells on the enemy. They came down but were ineffective, as the wind was blowing away from our troops.

Knowing full well all the possibilities, the commander ordered a concentration of smoke shells right on the position where he was located. Over the radio came the confirmation: "On the way."

One of our men was killed, one was wounded, but the unit was extricated. It sideslipped to the right and went on toward the accomplishment of its mission.

The Sequence of Infantry Attack

A successful infantry attack frequently follows a general sequence—one, however, which may be changed to fit an infinite variety of tactical patterns. This sequence is usually as follows:

First, an artillery concentration is fired on the positions where the enemy infantry is supposed to be located. For this fire 105-mm., 155-mm., and 8-inch guns are used. During

U. S. Army Signal Corps, Official

A Light Machine Gun Is Placed to Cover a Crossing in New Guinea

In jungle fighting, Japanese are likely to appear at any moment from any direction, particularly at such a critical place as a stream crossing. This light machine gun, which can deliver rapid bursts of fire and comb the thick brush on the side of the stream, is well placed to guard this crossing against unexpected enemy interference (page 531).

this time the doughboys move forward, keeping under cover as much as possible, and advance to within 250 yards of the enemy.

If the artillery ammunition is of unusually high quality and the artillerymen are meticulously careful, the artillery fire will be so accurate that the riflemen may be able to advance to within 150 yards of the enemy.

Second, the artillery fire lifts and is placed on enemy targets in the rear. The 81-mm. mortar sections take up where the artillery left off and shell the enemy infantry, while our men advance by short rushes to within 100 yards of the hostile position. The advancing rifle squads also fire between rushes, so that the enemy is held down by automatic-rifle and standard-rifle fire as well as by mortar fire.

Third, the mortar fire ceases and the rifle squads make the last few hundred yards on their own. Under cover of the fire of their own automatic rifles, the squads continue to rush forward by bounds until they are close enough to throw hand grenades and make the last rush with bayonet fixed.

Fourth, and very important, squad and platoon leaders dispose their men on the captured position so that they will be ready for the expected enemy mortar shelling and counterattack. This reorganization includes the regrouping of units, the assignment of men to take over the duties of men who have fallen, and the redistribution of ammunition.

Sometimes air bombing may start the attack. This is particularly suitable in an attack against an island when the amphibious assault forces are still miles away and the danger of bombing our own troops is slight. Likewise, if air units are available and weather permits, bombing may be used to soften up the enemy rear areas.

In Tunisia the Germans dive-bombed and strafed motor columns and even attacked

International News

"In Front of Him There Is Nothing but the Enemy"

Here Yank infantry furnishes eloquent proof for the assertion of the late Lt. Gen. Lesley J. McNair. These GI's fighting the battle of the hedgerows in Normandy charge across a road under enemy fire. They are advancing on St. Lô.

individual cars on the road. Most of us got stiff necks from trying to maintain forward and rearward observation simultaneously. The Germans did very well until the ground troops began to fight back.

At first the idea was that troops should run and hide when planes appeared. This did not appeal to aggressive leaders, so .50-caliber machine guns mounted on trucks and jeeps were kept in readiness for instant use. Thereafter, planes that dived on motor columns got a hot welcome.

Ground Fire Against Planes

At the same time, more large-caliber antiaircraft guns were attached to infantry divisions, and these weapons were the major element in making the job of the German aviator a tough one. Rifle soldiers joined in the firing, so that, whenever a group of planes tried to bomb ground troops, a very heavy and effective volume of fire rose to meet them.

By early March, 1943, ground fire began to knock down German planes. It was a sight to see a Nazi plane come hurtling to earth, and it wasn't long before the doughboys began to look forward to the next chance to fire at the German flyers.

Just about when the infantry had learned that they had a fair chance of knocking down any plane that tried to dive-bomb them, orders were issued restricting fire of ground troops to that by guns which had been definitely assigned antiaircraft missions.

Though this was hard on the doughboys' enthusiasm, the restriction was necessary because the burst of infantry fire gave away the exact location of our ground forces. However, many of the infantry soldiers had itchy trigger fingers and every so often .30-caliber machine gunners or individual riflemen would fire at passing German planes.

Aggressive fighting back by our ground troops had a prompt effect. The Germans apparently decided that it was not worth while to battle against ground troops that fought back, and they sharply curtailed their efforts to not more than a quarter of their earlier activity.

When we landed at Salerno there was a partial resumption of German dive bombing, particularly against the beaches and the unloading LSTs.* It was ineffective largely be-

* See "Landing Craft for Invasion," by Melville Bell Grosvenor, NATIONAL GEOGRAPHIC MAGAZINE, July, 1944.

U. S. Army Infantry School, official

Another Minute and the Bangalore Torpedo Will Blow This Barbed Wire Sky High

Infantrymen at Fort Benning, Georgia, learn how to breach an entanglement. They have crept up to the barrier, put together the three sections of the torpedo, shoved it under the wire. From a point of safety they will detonate the explosive (page 524).

cause our air units far outnumbered the Nazi planes and soon drove them off.

The difficulty of locating a target from a high altitude in the air, the probability that it will be promptly obscured by dust and smoke, and the possibility that bombs dropped in error on our own troops may be followed by others dropped into the same dust cloud, make the doughboy feel dubious about close air support. Artillery is so much more accurate and so much more effective, regardless of weather, smoke, and dust, that it is the logical support weapon.

American artillery has done a very fine job and the doughboy will testify to that fact with heartfelt appreciation. The artillery has loyally supported the infantry and has proudly stated that it exists to help the infantry.

Close liaison between the infantry and the artillery is essential. This is maintained despite frequent heavy losses among artillery forward-observer parties. Perhaps more thoroughly than any other group, artillerymen realize that the infantry soldier is the one who carries the burden of battle.

Sometimes the artillery concentration fails to shake the enemy. The doughboy goes ahead just the same. This was the case in an attack on a small village not far from Cassino in Italy. Artillery had pounded the German position for days. The fire included that of the division artillery, augmented by additional battalions of all calibers up to 8 inches.

Tanks and tank destroyers had pushed courageously forward so that their guns could be used as close-support artillery; yet, when the attack was made, the German infantry was there in full strength to meet us. The attack failed.

Wars Won, or Lost, by Infantry

We have used several different labels for our infantry, including standard infantry, light infantry, ranger battalions, parachute and glider infantry, motorized infantry, and some horse cavalry which has been transformed into infantry (pages 518, 524, 528).

Marine assault troops are infantry. They are all infantry fighters, regardless of the label or how they get to their work. Whether they creep or walk, wade through water, ride a glider or a parachute to get at the enemy, they all share the glory of being infantry, the essential element of victory.

The infantryman's job is a grim one. In all past wars the infantry has carried the vital

U. S. Army Signal Corps, Official

Batter Up! With a Pitcher's Windup, He Aims a Grenade at a Jap Pillbox

This fighting sergeant is one of the Yanks mopping up on Bougainville in the Solomons in March, 1944. He is a member of the 37th Infantry Division, which played a major role in the Bougainville battles. The soldier at left carries a Browning automatic rifle (page 527). A grenade can be thrown from a sheltered place.

load. We are only now beginning, as a people, to realize that wars are still won or lost by the infantry. We shall win this war when, and only when, we have thoroughly defeated the enemy infantry.

Machines are used wherever possible, and the American machines and mechanical devices are outstanding. There are planes that respond to the lightest touch of the pilot, armored vehicles that move forward impervious to shell fragments, guns that send over massed fire that seemingly should be all-destroying. All of these machines are handled by men who must have alert brains and steady hands.

The private of infantry is himself both a machine and a directing brain. No matter what the danger, he must have the will to maneuver quickly. His body, which is his machine, must be highly trained to respond. His brain and nerves are the complicated controls of the machine. His brave heart is the engine.

Although the infantryman richly deserves a thick coat of steel armor, he has none. Instead, he uses courage—cool courage that covers him, that carries him through the hours and days of grueling, never-ending, smothering hell that is battle for the infantry soldier.

A great soldier, Lt. Gen. Lesley J. McNair, who was recently killed at the front in Normandy, made the following statement in April, 1944:

"The decisive struggle will be fought by the infantry and its supporting arms and services. . . . In no sense does this deprive our naval and air forces of the appreciation and applause they are so richly earning. . . . Yet the infantry is the only arm that can win a decision. And the contribution of the other arms is measured by the aid they give to the infantry."

In view of the fact that the infantry soldier sees more death and pain than others and knows hunger and privation to a degree unknown by others, it is natural that he should have a different state of mind.

After a successful operation, there is no jubilation, no enthusiastic backslapping. He may have captured his objective. His platoon or company may have performed a miracle of clever, aggressive fighting, but always some men have been lost. Even in victory the true infantryman is humble. He knows what victory costs.

Mindanao, on the Road to Tokyo

By Frederick Simpich

LIKE a mammoth steppingstone on a watery path from New Guinea to Tokyo lies big, rich, relatively unexplored Mindanao, southernmost main island of the Philippine group.*

Its gold mines and vast primeval forests, its cattle ranges and as yet unharnessed waterfalls, make it resemble the empty but rich California of ninety-odd years ago.

By last August, General MacArthur's ground forces had pushed their way to the Schouten Islands, 800 miles southeast of this rich Jap-held island, and the American beachhead at Sansapor, at the tip of New Guinea, was about 700 miles from the city of Davao (map, pages 542-3). Aerial bombardment of Jap positions began August 7, 8, and 9, with three successive raids on Davao.

Though still little known, pioneer planters have already proved this tropic region ideal for growing rubber, coconut, and quinine trees, and juicy pineapple crops (pp. 544, 567).

Long ago, from a Moro *proa* offshore, I saw the half-naked tinted hills of Surigao peninsula, now acclaimed by geologists as one of Asia's greatest iron ore deposits (page 563).

Slightly larger than Indiana, Mindanao is second in size only to Luzon.

Moslems under the Stars and Stripes

Among its colorful tribes are some 400,000 Moslem Moros, the only big Mohammedan colony ever under the American flag. With these fanatics the Spaniards had struggled for 300 years, till Admiral Dewey took Manila in 1898. Then American soldiers, with native scouts and constabulary they trained, for years carried on the Moro campaign. Finally, leaving them to their own customs and life under the Koran, we almost pacified the Moros. Emphasize *almost!*

Negritos and other wild tribes still prowl the hills and jungles. Some hunt with spears, eat bats, and take fish by throwing intoxicating weeds into the pools. Here, too, are man-eating crocodiles, eagles that kill monkeys, lizards that fly. Battles occur between vicious wild boars and big pythons.†

Drama and tragedy swept Mindanao in the early summer of 1942 as Japs sought to mop up the last of the Americans. Gen. William F. Sharp had surrendered on May 11.

For General MacArthur, the late President Manuel Quezón, President Sergio Osmeña, and other dignitaries, Mindanao was the last jumping-off place for Australia.

From Borneo came a few of our surviving bombers, to rain ruin and death on enemy ships and docks at Davao. Daringly, Lt. John D. Bulkeley's MTB's (Motor Torpedo Boats) harassed Jap warcraft off Mindanao's coast or sneaked into Mindanao ports by dark of night, bringing fugitives for rendezvous with Australia-bound planes or submarines.

One MTB was actually dismantled, hauled up to Lake Lanao, and rebuilt for use in a last desperate stab at the Japs.

Cruelty to American captives was unspeakable, as told in *The Dyess Story*. In Davao prison camp the Japs concentrated a large number of Americans, and it was from here that the late Lt. Col. William E. Dyess, Lt. Comdr. Melvyn H. McCoy, and others escaped.

Pirates, Pearls, and Slave Girls

Most vivid South Sea fiction tales are no more exciting than the bald history of Mindanao. Its Moro lands include the musically named islands of Basilan, Jolo, and Tawitawi, which string out toward Borneo.

Pirates and pearls, slave girls and smugglers, tribal raids and war canoes loaded with spearmen carrying shields, and mortal hand-to-hand battles had made Mindanao known from Arabia to South China even before Columbus sailed west (page 560).

Magellan got to the Philippines in 1521 and anchored at Limasawa, a small island northwest of Surigao. Here two kings of the north coast of Mindanao came out to visit him. This was before the great navigator went on to Cebu, and later to Mactan, where he was killed.

After his death, his ships continued the voyage and touched at western Mindanao. They also sighted Jolo Island, but contrary winds prevented them from visiting it.

Jolo is the old home of the Sultan of Sulu. Since the death of Sultan Jamalul Kiram II, in June, 1936, without an heir, the sultanate has been in dispute, and the title may

* See, in the National Geographic Magazine, "Facts about the Philippines," February, 1942, and "Return to Manila," October, 1940, both by Frederick Simpich; "Unexplored Philippines from the Air," by Lt. George W. Goddard, September, 1930; "Philippines," August, 1905, "Ten Years in the Philippines," February, 1908, and "Some Impressions of 150,000 Miles of Travel," May, 1930, all by William Howard Taft.

† See "What the Fighting Yanks See," by Wanda Burnett, in the National Geographic Magazine for October, 1944.

Olive R. T. Jones

Long Fingernail Guards Are Badges of the Idle Rich

As a Moro chieftain's daughter, she has harem serfs and does not have to work. Rich in bracelets, she could afford shoes; she goes barefoot for comfort. Just above her head are two pet monkeys.

eventually be surrendered to the Philippine Commonwealth (page 557).*

This Moro ruler's name was spread all over the United States when George Ade's comic opera, *The Sultan of Sulu*, was being sung. One of Kiram's nieces attended the University of Illinois, but "went native" later.

The Sultan of Sulu Goes Shopping

As a newspaper reporter in Manila, I covered one of the Sultan's trips to that city. Often he went window-shopping, a silk-clad flunky holding a green umbrella over the royal head. Patent-leather shoes enticed him, but toy stores were his favorite haunt, and he loaded up his baggage with harmonicas, dolls, and mechanical trains.

Gen. John J. Pershing won fame in the campaign against the Moros on Mindanao and especially in Jolo's bloody battle of Bud (Mount) Bagsak (1913). Generals Hugh Scott, Leonard Wood, and Tasker Bliss also helped subdue these Moslems.

Near the north coast of Mindanao is big fresh-water Lake Lanao, heart of the Moro country. When the Spaniards surrendered, they told our officers where, in that lake, they had sunk small gunboats, first smearing them with grease to guard against rust. We raised these gunboats, and I made trips on them when later our Army used them.

Today the Lake Lanao country is one of the island's beauty spots. Amid its high, salubrious hills a prosperous foreign colony had developed, which boasted a fine country club—occupied now by the Japanese!

Richest American stake in Mindanao was the rapidly developing gold mines (pages 556, 561). Richest stake for the Japs was their hemp land holdings (Plate VIII).

Japs Destroyed American Property

"By 1941 our islands had become one of the world's greatest gold-producing regions," said J. M. Elizalde, former High Commissioner of the Philippines at Washington. "On Mindanao my family owned the Davao Gold Mines. First we flew all machinery in, then built an aerial tramway. The Japs destroyed our tramway and mills.

"We also operated sawmills. We had 50 miles of standard-gauge American railways, with logging engines and trains. All that the Japanese despoiled. I imagine they also took our locomotives. They stole all the logs and cut lumber in sight, but for some reason did not keep the sawmills going, despite their

*See "'As the Tuan Had Said,'" by George M. Hanson, in the National Geographic Magazine, November, 1935.

Customers Loiter at a "Chineleria," or Slipper Shop, on Davao's Main Street

In Davao's "Little Tokyo" many signs were in Japanese even before the war (page 544). After the conquest all were "Japanned." In 1944 Navy airmen returned to Davao, bombing waterfront and airdromes.

Willard Price

A Moro Chief Seals a Blood Compact between Men of Rival Tribes

The *Datu*, wearing a fez, slits the forefingers of a Moro (left) and a Bagobo with a razor-edge knife. When each sips at the other's wound, they become blood brothers.

Piedra Blanca

PANAY

GUIMARAS

La Carlota

Fontevedra

Hinigaran

Binalbagan

Panay Gulf

Isabela

Himamaylan

Cauayan

Sojoton Point

Mt. Malaglantan

Cartagena

Kabankalan

Sipalay

NEGROS

Tablas

Plateau

Nabulao Bay

Jinobaan

Asia

Kalipapa

Basay

Canlaan Point

Tolong

Tolong Viejo

Dumaguete

Giligaon

Slat

Bald Point

Verde Islands

PALAWAN

Malcampo

Green Island Bay

Ilian

Davisan Reef

Cagayan Islands

Calusa Island

Cagayancillo

Boombong Island

Manucan Island

Dondonay Island

Baran Island

Cavili Island

Arena Island

Jessie Beazley Reef

North Islet

Tubbataha Reefs

Black Rock

South Islet

S U L U S E A

Lanboyan Point

Sindangan Bay

Sindangan Point

Labason

Peñaplata

Mt. Dansalan

Coronado Bay

Baligulan

Puerto Santa Maria

Siocon

Balatacan Point

Panabutan Bay

Kauit Bay

Amungan

Batotindoc Point

Fangian

Limasun

Alimpaya Point

Patalon

San Ramon

Teinga Island

Sangboy Islands

Kaludlud Island

Lakit Islands

Dasalan Island

Pilas Island

Port Holland

Tamuk Island

Tapiantana I.

Linawan Island

Tatalan Island

Bulan Island

Tanggul I.

Samales Group

Olutanga Island

Siboguey Bay

Kabasalan

Tuntac Peak

Bulnan

Tuba Bay

Lumaraos

Bangaan

Port Banga

Vitali Island

Port Simulon

Sibuco

Malayal

Curuan

Diap

Sacol Island

Landang

Malanipa Island

Tictauan I.

Lanhil Island

Sibago Island

Isabela

Lamitan

Takut Tungug Bay

Bojelebung

Kauluan Island

Amoylot

Saluping Island

Zamboanga

BASILAN

Pangutaran Group

Kulassein Island

Tubigan Island

Pangutaran I.

Pangutaran

Teomabal Island

Pangutaran Passage

North Ubian Island

Panducan I.

Bubuan I.

Cabucan I.

Minis I.

Pangasinan I.

Bolod Islands

Malicut Island

Cunilan I.

Usada I.

Basbas I.

Jolo

Patikul

Bud Bagsak

Talipao

Indanan

Tulisan Island

Parang

Maimbung

Sulade I.

Dammai I.

Walan I.

Tapul I.

Talul I.

Lugus I.

Mamanuc Island

Bambannan Island

Cap Island

Laparan Island

Doc Can Island

Taja Island

Zau I.

Deatobato Island

Datubaco Islands

Tubaluhac Island

Tatalan

Parol I.

Bangalao Island

Simisa Island

Tumbagaan I.

Tandubatu Island

Tandubas I.

Secubun Island

Latuan Island

Manta Buan Island

Banaran Island

Tilayo Islands

Bilatan Island

Tawitawi

Tataan Is.

Duncan

Balimbing

Bongao I.

Sanga Sanga I.

Simunul

Manuk Manka I.

Omapoy I.

Sibutu

Sibutu Island

Tumindao Island

Ligayan

Hog Pt.

Siasi

Siasi Island

Pata Island

Cabingaan Island

Lapac Island

Tapul Group

Tapaan Island

Tapaan Passage

Sugbut Passage

Kinapusan Island

Tabawan Island

South Ubian Island

Jessie Beazley Reef

Tubbataha Reefs

BORNEO

TAWITAWI

SULU ARCHIPELAGO

SULU SEA

Sibutu Passage

Highways —— Trails —— Railroads ——

STATUTE MILES


Toledo
Liloan
Hilongos
Sogod
LEYTE
Hinundayan
Loreto
DINAGAT
Pinamungajan
Tabuelan
Opon
Camotes
Mactan I.
Sea
Matalom
Malitbog
Cebu
Cebu
Guihulngan
Naga
Jetafe
Talibon
Canigao Chan.
Maasin
Carcar
Inabanga
Ubay
Bohol
Str.
Tabigue
BOHOL
Mabini
Candijay
Anda
Limasawa I.
Panaon I.
Cabalian
Liloan Bay
Surigao
Str.
Melgar
Pintuyan
Dinagat
Malinao Inlet
Gaus Bay
Valencia
Boa
Dinagat Sound
Sugbuhan Pt.
Rizal
SIARGAO
Numancia
Port Pilar
General Luna
Dapa
Port Sibungan
Bucas Grande
Mindanao Deep
8400 +
Hinatuan Passage
Pamilacan I.
Dalaguete
Argao
Loon
Moalboal
Alegria
Moribojoc
Calape
Balilihan
Carmen
Leboc
Tagbilaran
Dauis
Loay
Panglao
Dimiao
Garcia Hernandez
Jagna
Guindulman
Anda
Surigao
Tuguman River
Gold Area
Nonoc I.
Badas
Bacuag
Malimit
Cagniguit
Lake Mainit
Mt. Kalutuan
Jabonga
Lake Pagusan
Carrascal
Cantilan
Court Point
Hinatuan Bay
Oslob
Santander
Dumaguete
Siquijor
Maria
San Juan
Zamboanguita
Lazi
Apo Island
Bonbonan Point
Tanjay
Sibulan
Ayuho
Bonbon
Catarman
Sagay
Mambajao
CAMIGUIN
Diusta Point
Gingoog Bay
Butuan Bay
Cabadbaran
Mt. Hilanghilang
Lamiza
Tandag
Tago
Caguait Harbor
Umanum Point
Antipolo
Bilenavista
Butuan
Nueva Sibagat
Maygaraan
Esperanza
Azpitia
Prosperidad
Las Nieves
Bunagait
Talisayan
Medina
Salay
Anakan
Cingoog
Balingasag
Mt. Balatucan
Macajalar Bay
Claveria
Tagoloan
Bugo
Mt. Amalai
Talacogon
Lake Lanao
Rosario
Bahi
Borbon
Llanga
Bakulin
Lamon Point
Himatuan
Himatuan Bay
Nowele
Sanco Point
Valencia
Bunawan
Davao
Mt. Apo
Mt. Ampaoid
Malaybalay
Managoc
Katanglad Mts.
Kalatungan Mts.
Maramag
Valencia
Tankulang
Mt. Agtungenon
Compostela
Cateel
Boston
Carmen
Moncayo
Catarman Anchorage
Catarman Point
Cateel Bay
Bangai Point
Dapnan
Baganga
Caraga
Pusan Point
Mt. Kampalili
Mt. Tagubud
Bucas Grande Bay
Manay
Holy Cross
Tarragona
Tagubun Point
Mayo Bay
Bobon
Lamigan Point
Linda Bay
Mt. Hamiguitan
Nagas Point
Kabuaya
Luban
Boso-boso
Cape San Agustin
Surup
Mati
Pantukan
Libuak
Santa Ana
Pindasan
Tagum
Tuganay
Panabo
Ragano
Davao
Pikit
Pagaluñgan
Guiahga
Kidapawan
Mt. Apo
National Park
Dalliao
Talikod Island
Lupon
Paet Pt.
Santa Cruz
Digos
Davao
Gulf
Sigaboy
Cuabo
Mt. Hamiguitan
Nagas Point
Kabuaya
Luban
Boso-boso
Cape San Agustin
Siuman
Pisa
Relcie
Malita
Lala
Talagutong
Caliran Point
Kalian
Linadasan
Mangili
Caburan
Maybio
Tabayon
Tamonian
Saddle Peak
Noing
Sarangani Strait
Tinaca Point
Tomanao
Sarangani Island
Balut Island
Sarangani Islands
Tubay
Mt. Matutum
Kabalen
Tacalina
Koronadal
Sebu
Dadiangas
Binayan
Lun
Lago
Glan
Sigul
Tupi
Kabacawa
Tubo
Basiawan
Tubalan Head
Lacaron
Mt. Latian
Lawa
Malapatan
Pulangi
Mindanao
Allah
Kabacan
Carmen
Midsayap
Nuling
Cotabato
Dinaig
Awang
Tumbao
Dulawan
Nalkan
Mt. Binaca
Upi
Mt. Bita
Kinimi
Reta Bay
Reta
Nuro
Talayan
Meti
Linao Bay
Tran
Mao
Lake Buluan
Buluan
Tukunahago
Mamali
Malalan
Bulol
Pagalungan
Salaman
Port Labak
Labak
Penas
Donasuang Island
Dagutila
Tuna
Borong
Palimbang
Sapuka
Mt. Matutum
Sapu
Mt. Busa
Milbuk
Kragan
Luan
Saub
Kiamba
Tugues
Kling
Lumuyon
Panangag
Dalao
Kamanga
Sarangani
Canalosan Cove
Pangyan
Batulaki
Malabang
Buldan
Ramitan
Bacungan
Kabakan
Pikit
Midsayap
Paidu
Bagan
Bagan Peninsula
Bay
Illana
Moro
Gulf
Celebes
Sea
Mindanao
Sulu Sea
Philippine Sea
Mindanao: Where Liberators and Lightnings Strike
As American planes hit Davao, General MacArthur found the Japanese air force "driven from southern Mindanao," and Tokyo predicted his troops in New Guinea would try an invasion. Rich, but little developed, Mindanao is second largest of the Philippines' 7,083 islands. Manila, on Luzon, is 600 miles northwest of Davao.
Miangas [Palmas] ☆
(Netherlands)

declared policy of cooperating with native peoples in all occupied areas.

"My family was the largest manufacturer of Manila rope in the islands. We used to buy a lot of Mindanao hemp from the Jap planters. That crop must be much reduced now, because thousands of Japs who worked in those fields went into the ranks when the Jap Army came, and a lot of pagans who worked for the Japs fled to the hills when shooting began."

Into Jap hands also fell the Goodyear Tire and Rubber Company's "Pathfinder" plantation near Zamboanga, with its machinery for processing latex, with its smokehouses and coagulator sheds, and company buildings. Its American officials were interned (page 562).

From its Dolok Merangir plantations in Sumatra the Goodyear Company had brought high-yielding, bud-grafted Hevea trees to this Mindanao plantation, some 600,000 of which were producing when the Japs invaded.

From Brazil rubber plants first moved to the Orient, via Kew Gardens in London, then on to Ceylon, and finally on to Malaya and the Netherlands Indies. Now, from the Orient by way of Mindanao, rubber growing is coming back to the Western Hemisphere.

From Mindanao, in 1934, the Goodyear Company removed about 40,000 young trees and sent them to newly acquired plantations in Panama, beside Gatún Lake. Thus, in this final overseas jump, the rubber plant has moved around the world.*

Japs also halted work on the California Packing Corporation's big pineapple plantations near Cagayan, on north Mindanao. Crops worth millions were left to rot in the fields and buildings were wrecked.

Our Army used this pineapple company's airfield and offices as military headquarters in this region of the Philippines when the Pacific war started. From here bombers took off in our last slaps at the Japs before we quit the islands.

This was probably one reason, together with lack of shipping, why the enemy chose to damage the plantation, instead of trying to operate it. This is the same Del Monte plantation mentioned in *They Were Expendable* and *Queens Die Proudly* (page 569).

Americans had brought pineapple planting here from Hawaii and were producing the Smooth Cayenne variety of fruit on a big scale. From the fields ripe fruit was hauled to a modern cannery at the port of Bugo, 22 road miles away. From here steamers took the product to San Francisco, or to New York through the Panama Canal. This plantation had become an agricultural show place.

Hemp is Mindanao's most valuable crop. Japanese grow most of it, in Davao Province, which is a "Little Tokyo" of Jap speech and ways of life. Davao hemp growing was first begun on a big scale by American ex-soldiers, who remained in the islands after the Insurrection of 1899 was quelled.

After 1918, when Jap migration set in, most Americans sold their lands to the Nipponese or hired the Japs as farm managers; so, when the invaders came, they found 20,000 of their countrymen already settled, familiar with Mindanao roads, resources, and whereabouts of Americans then on the island. Long-range planning by the crafty Japs!

Davao Resembles a Jap City

Davao city, in the southern Province of that name, is an island metropolis, with more than 100,000 people. It looks, sounds, and smells like what it is—a Japanese place (p. 541).

The Imperial Japanese Consulate General at Davao is the island's most sumptuous edifice. When war came, 90 percent of all goods being sold here were of Jap origin; even the registered mail clerk in the Philippine Government's post office was a Japanese subject.

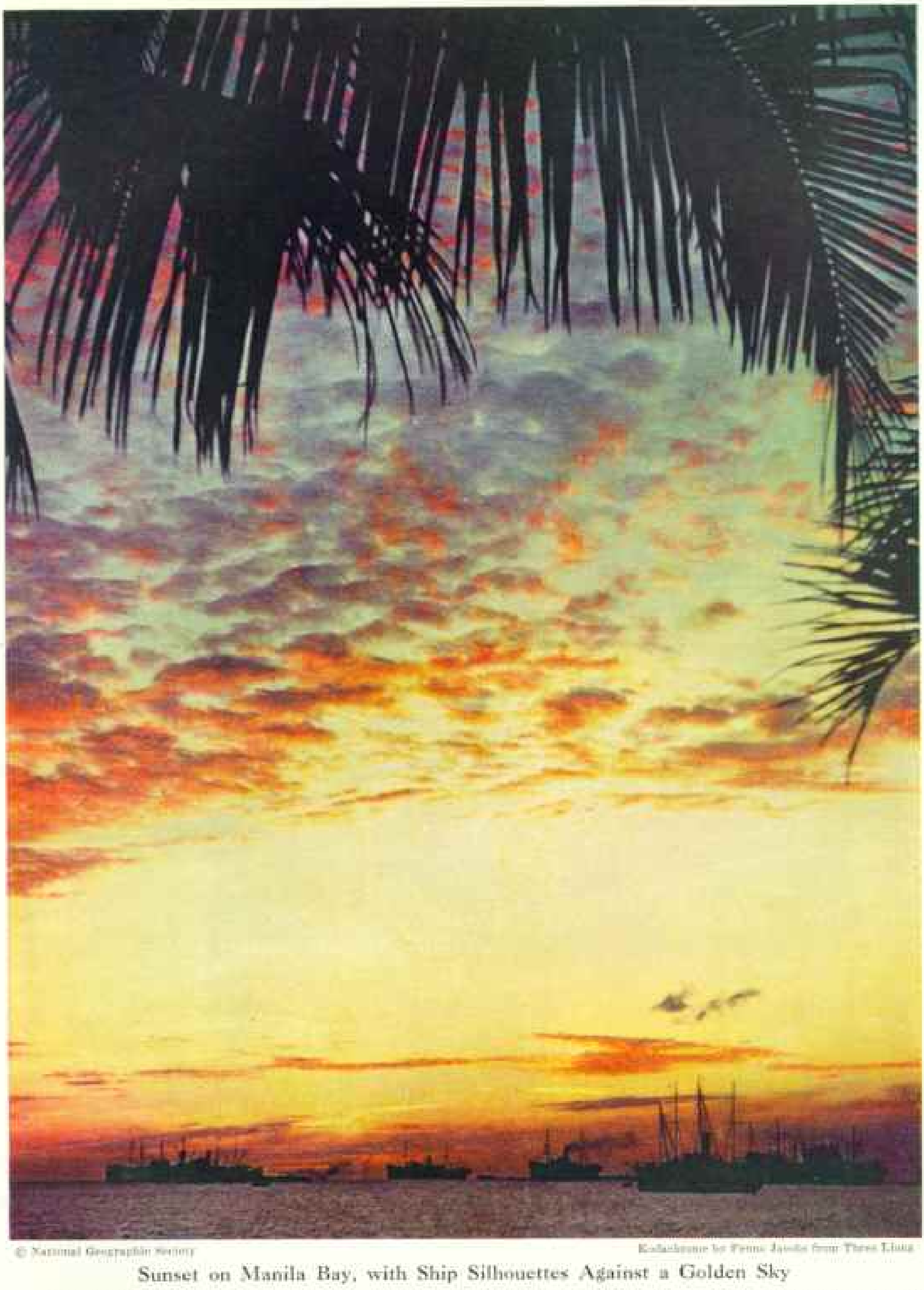
Mr. Atsuhiko (once a teacher of English at the Davao High School) owns and edits the daily Davao Mainichi News and the weekly Davao Koron, both printed in Japanese. They take the place of the Mindanao Herald, an English-language paper published here in the old days of American supremacy.

Signboards along San Pedro Street show how completely "Japanned" Davao is. So do the names appearing in advertisements in the Filipino-owned Mindanao Recorder: Asati, Shinsato, Furukawa, Matsibuchi, Nakano, Mitsui, Watanabi, Wakamatsu, Ohta, Ogawa, Ishida—they're all in business here.

But more important are Japanese big names you *don't* see. They are silent partners in many a mine, lumber camp, plantation, and fishing fleet or cannery. Though manned by Filipino dummy officers, these industries are in reality financed by money from Tokyo, Osaka, Yokohama, Kobe. That's why Davao has far more Filipino lawyers than any city its size anywhere in the islands. They incorporate these companies and help them circumvent antiforeign land laws.

From a purely economic standpoint, this was good for the islands; Japanese not only grew hemp but built roads, bridges, sawmills, and fish canneries. They brought in heavy capital, scientific skill, and managerial talent.

* See "Our Most Versatile Vegetable Product (Rubber)," by J. R. Hildebrand, NATIONAL GEOGRAPHIC MAGAZINE, February, 1940.



Kodachrome by Penn Jacobs from Three Lions

Sunset on Manila Bay, with Ship Silhouettes Against a Golden Sky

What homesickness this picture arouses, not only in exiled Filipinos but in the memories of many Americans! Since Dewey sank the Spanish fleet in these waters in 1898, this polyglot capital has echoed to the tramp of endless American soldiers and sailors. Visitors in hordes have seen and enjoyed its old churches and walled city.

Kodachrome by Penn Jacobs from Three Lions

Nipa Shacks Spring Up along Narrow-gauge Railroads Whose Log Trains Run between Forest and Sawmills

This log train on Negros Island belongs to the pioneer American-owned Insular Lumber Company, whose mills sawed 55,000,000 board feet a year. Trained Filipinos filled all but a few key jobs. A count based on number of people employed made lumbering the islands' second industry.

Kodachrome by Paul Zouda from Three Lions

Through Centuries Tireless Mountain Tribes Toiled to Build and Irrigate These Terraced Rice Fields of Northern Luzon

In Straw Trays Rice Grain Is Winnowed from Its Chaff

Philippine rice culture antedates written history. Rice grows now on almost every inhabited island in the archipelago and is the staple food of Filipinos. Up to 60 years ago, there was a surplus.

Reproduction by Frank Lerch from Three Lions

"Guess Who We Are, with Our Blouses on Backwards!"

To show their odd hair-do, the cameraman had these Igorot girls on Luzon turn their backs. In their hair they wear bright twists of cord and beads.

Kodachrome by Nazel and Miller

Designers of Rugs, Calico, or Wallpaper Can See New Patterns in Moro Sails

From the southern Philippines to Borneo and Celebes these speedy outrigger Moro craft have been linked for centuries not only with commerce, but with piracy, slave trade, and tribal wars.

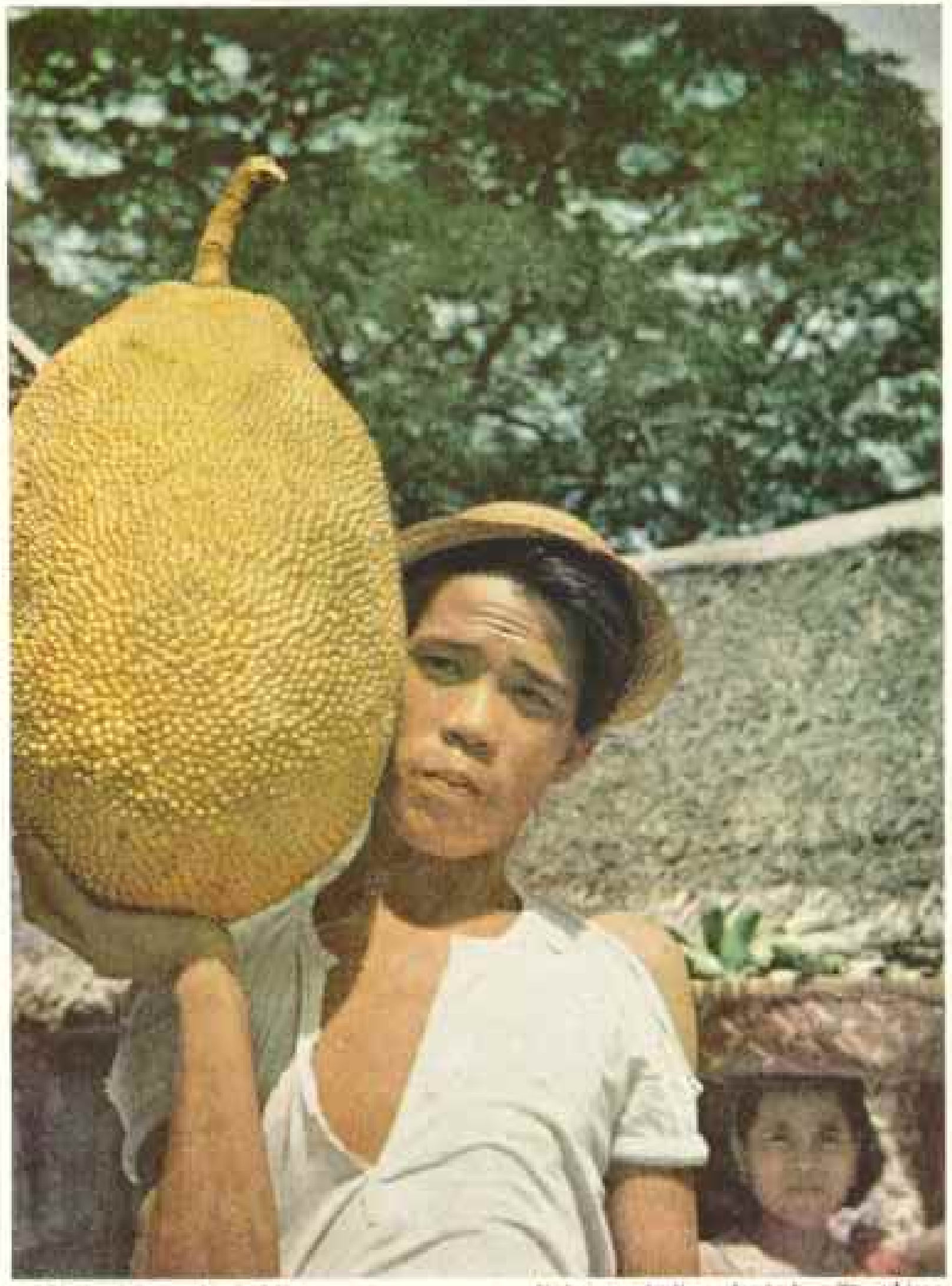
Kodachrome by J. Baylor Roberts

Zamboanga Penal Farm Sells Model Boats Made by Prisoners

With its typical striped sail, a toy *vinta*, or Moro outrigger, is shown to a customer. Sea shells, walking sticks, carvings, and coconuts cut and painted to resemble human faces also were on sale in Mindanao shops.

From Philippine Iron Mines Ore Was Going to Japan at the Rate of Nearly 1,192,000 Tons a Year in Prewar Times

On Surigao peninsula, Mindanao, lies one of Asia's largest-known iron deposits, estimated at one billion tons. This is yet undeveloped. This open-pit mine is in southeastern Luzon.



Kodachrome by Frenn Jacobs from Three Lions

Watermelon-size, Breadfruit Comes from Trees

Baked in embers, it may be served, like potatoes, with gravy, or it may be made into pudding. The bark yields clothing; the wood, canoes; the sap, glue.

Kodachrome by Karl J. Pfizer

All Fezzes Look Alike, But Which Shall It Be?

Moros favor this cap, which good Mohammedans wear even indoors. The open-air shop is at Dansalan, Mindanao.

Kodachrome by J. Baylor Roberts

His Polygamous Family Around Him, a *Datu*, or Chief, Examines His New Gun

Moro families like their houses ornately decorated. Though it is not convenient to any freight route, this Mindanao jungle home near Lake Lanao has a tin roof.

Kodachrome by Fenno Jacobs from Three Lions

Stripped from Its Bananalike Stalk, Hemp Dries on a Japanese Plantation near Davao

Known to trade as Manila hemp, abacá is native to the Philippines. Even in pre-Spanish times Filipinos used it to make rope and fish nets. Magellan in 1521 saw natives wearing hemp clothing.

and returned many millions in taxes to the island government. All this, of course, is one reason why some Filipino quislings are friendly to Nipponese operations here.

Sound, practical farm lessons of much value to agriculture in Mindanao have also been taught by these enterprising Japs. They spent years on costly scientific trial and error at the huge Ohta Experimental Farm, near Davao, learning what plants could be successfully introduced into this island, and how best to till and develop them. Flying over this school was a Japanese flag, at the top of the pole. On a crossbar beneath, hanging down instead of being flown in the proper position, were the American and Filipino flags!

Davao beauty parlors were crowded when the Japs came. Movies and dance halls were jammed, taxis whizzed over paved streets, and busloads of people rode between Davao and the hemp farms and pueblos out the new highways towards Cotabato, Zamboanga, Lake Lanao, and Surigao. Daily planes tied Davao to Manila, and there was good steamer service.

In early hemp-boom days Davao claimed the highest standard of living in the Philippines. Native hemp strippers often earned $1 gold an hour, and wild Bagobo tribesmen, venturing down to earn some cash from the Jap overlords, buttoned their garments with 10- and 20-centavo silver pieces.

Davao Province, especially the fields east of Mount Apo volcano, highest peak in the Philippines, boasts vast fertile and largely level lands ideal for hemp (abacá), corn, coconuts, rice, and ramie, the latter a plant whose fiber is used in making stout textiles.

Abacá, known to world trade as Manila hemp, is a green plant and looks like a banana stalk. Magellan found Philippine natives wearing clothing of hemp fiber. Now this fiber is mostly used in cordage. It is light, durable, and has great tensile strength. Indispensable to naval and merchant fleets for hawsers, it is also much used in fishermen's and firemen's nets, and by builders for swinging their scaffolds (Plate VIII).

Our imports of Manila hemp grew after 1820, when Lt. John White, USN, brought some sample fiber back to Salem, Massachusetts. Before the war we took, usually, about 32 percent of the total crop.

"Christian Filipino" Migration

But Japs didn't stop with hemp. They built roads, sawmills, canneries, and rice mills. They took over most fishing. They made dynamite—not that crude explosive the Moros make from bat dung, sulphur, and match heads—for their bombs.

In Manila, in 1939, I found loyal Filipinos alarmed at this Japanese menace. To counteract it, a Government colonizing plan was under way, and some 1,000 "Christian Filipino" immigrants a month were landing at Cotabato and Davao. (This phrase, "Christian Filipinos," is an island term used to distinguish between such civilized peoples as Tagalogs and Visayans, on the one hand, and the Mohammedan Moros and pagan tribes on the other.)

The "New Promised Land"

Manila editors, urging colonization, named Mindanao the "New Promised Land." They said it was to the other islands what our then half-empty West was to the United States 75 years ago.

This doesn't mean that till then only a few Americans, and the thousands of Japs, were the only civilized people on Mindanao. For decades some rich coastal lands had been worked by upper-class Filipinos and Spaniards. Yet fear of Moros and lack of roads had left much of the interior unexplored.

Like homesteaders everywhere, these later migrant Filipinos met with hardship and danger. Insect pests ate up their gardens. Wild hogs in one night often destroyed the settlers' whole corn and sweet potato crops, or rooted up gardens from sheer devilment, to keep their snouts in form.

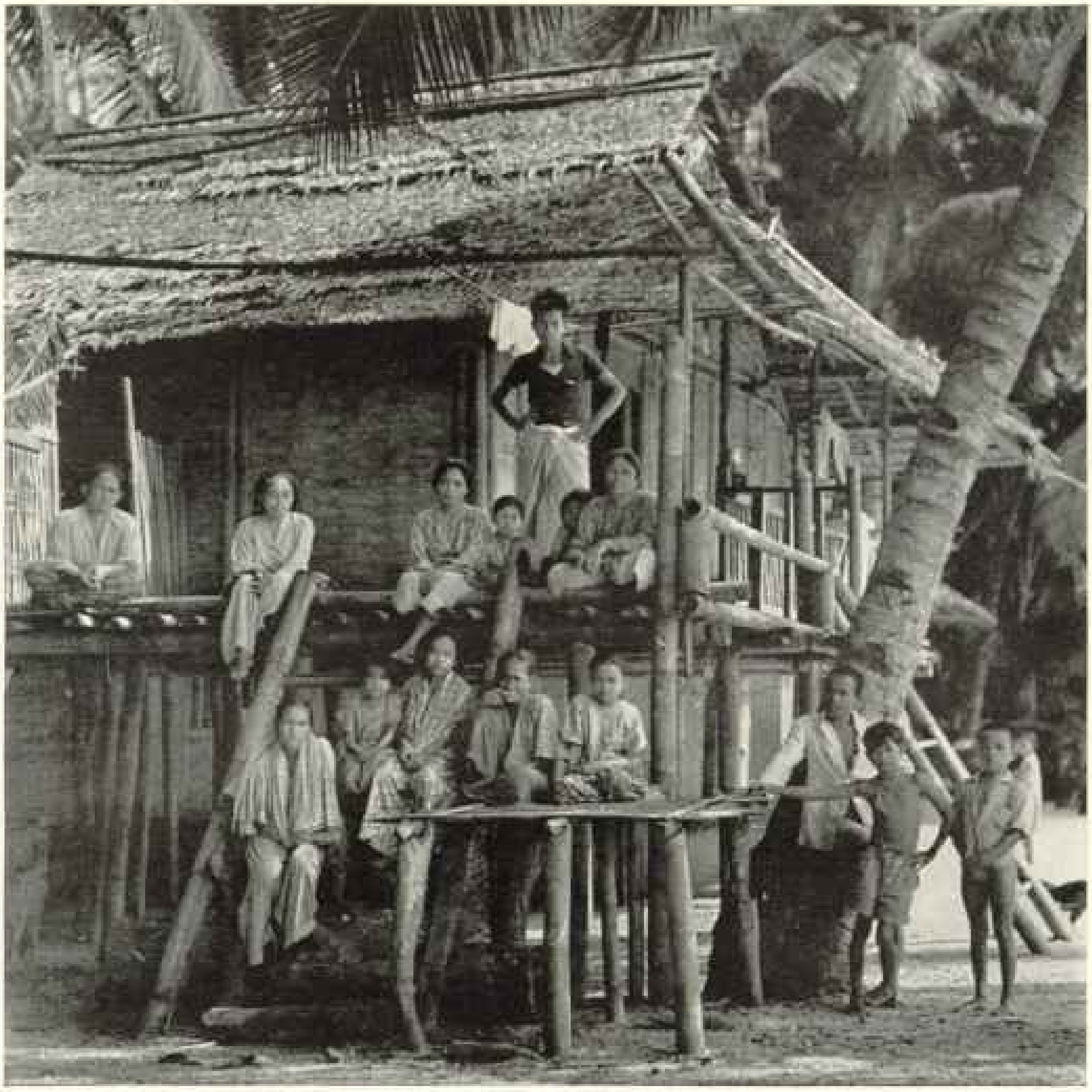
Wild fruits are a prize dish for these hogs. When they hear a mango fall, they rush to grab it. Hunters trick them by climbing a fruit tree with a bag of stones and dropping them one at a time. Hearing the thud, the hogs rush out to grab the supposed fruit and get shot.

Once I shot a big boar, which ran under some brush and lay down. It lay so motionless I thought it was dead. Clad only in pants and boots, I laid down my gun and started crawling under the brush to get my porker. Eyes on the pig, I didn't notice a hill of giant red ants till I was right on them. They swarmed over me and bit. Then the boar jumped up and rushed me. Only a quick shot from my companion saved me.

I felt as if I might die anyway, first from the pain and then from the fever of the ant bites. My whole body was covered with big hard welts. I waded into a swamp, sat down in the water, and poulticed my bites with mud, the Filipino's treatment for stings.

Though a few highways have been built, settlers who took up land very far from such roads can't get their crops to market.

Since the war, says President Osmeña, Jap seizure of all trucks, gas, and bull carts has disrupted transportation. Imports of food



Staff Photographer J. Baylor Roberts

Save for the Boy (Right) Who Lost His Pants, This Family Shows No Worries

All are members of a Jolo fisherman's household. Set high on stilts, their home of latticed walls and split-bamboo floor is air-cooled. Ripening coconuts drop in their laps. Life was easy on Jolo.

have almost ceased. Now famine threatens.

Children in the United States have it so easy, they can't even imagine the adventures of getting an education in Mindanao.

Of course, in big towns like Zamboanga and Davao the schools are, or were, fairly modern. But contrast these with the one-room country schools of Cotabato Province, often built only of poles and palm leaves hacked from the jungle with a bolo.

Much of Cotabato, Mindanao's largest Province, is a Congolike jungle of marshes and fields of cogón grass crossed only by sluggish streams. Here are only three smallish towns, Cotabato, Midsayap, and Dulawan.

Outside these towns are a few lonely, scattered one-room schoolhouses, built to take care of "wild" children and those of scattered "Christian" settlers.

To reach school many pupils walk, ride ponies, or paddle in dugouts. Always they must watch for snakes, leeches, and man-eating crocodiles. By 1941 some pagan chiefs had come to realize the importance of schools. In other cases, if a schoolhouse was built near a tribal village the whole town would pack up and move!

At the town of Upi is an agricultural high school, first built by missionaries for use of children of the timid Tirurai tribe. But so

Staff Photographer J. Baylor Roberts

Blacksmith and Helper Forge a Kris Blade; an Apprentice Pumps the Bellows

The kris, which often has a wavy "flaming-sword" blade, is the Moro's universal weapon. Without one, no man is really dressed. With one, fanatics have run amok, killing nonbelievers (page 563).

eager were all other Cotabato people for education that, when the Japanese came, pupils in the Episcopal school at Upi included Ilocanos, Visayans, Moros, Manobos, Bilaans, Subanos, Tagabilis, and others.

Though their parents, members of rival tribes, may have hated and fought each other, their children in school worked peaceably together.

The Manobos, in particular, though a half-wild tribe, wanted their children educated. Some built their own schoolhouse, on condition that teachers be sent. Parent Manobos, dressed in their best tribal finery, came on Child Health Day and listened closely when the English program was translated to them.

An odd fact about this Upi school is that the American teacher was once captured by the Moros. They were about to kill him when they learned, somehow, that he could cook. They tried his cooking, enjoyed it, and that saved his neck!

The lonely jungle teacher's job is hard enough, says D. R. Famador, a Filipino writing in the Mindanao Recorder of Davao, "but life of a school inspector is even worse."

Schools may lie three or four days' jungle travel apart. No roads, no boats; so some inspectors ride on pack bulls, carrying gun, bolo, mosquito net, blankets, and cooking utensils.

An Estimated 30 Million Tons of High-grade Iron Ore Surround a Harbor Created by Nature as if for Its Export

Before the war, Japanese took extensive samples from Dahikan Bay area. Nickel, too, exists here. Chromite is associated with much Mindanao iron (page 563).

George Kennan

A Tugunan River Gold Bed Slowly Panned since Ancient Times Is Swiftly Washed Away by American Hydraulic Equipment

As water piped from a higher level bites into the hill, gravel flows into a flume, where it is washed for nuggets and dust (page 561).

Otis B. T. Jann

All One Happy Family, 14 Ladies of the Sultan's Harem Pose for Their Portrait

Some of these women wear Chinese-style hats and American-fashion shoes. Others are barefoot. All dress in silks. Plural wives did not insure an heir; so the Sultanate at Jolo has been in dispute since the death of Jamalul Kiram II (page 539).

Ruth Allen

A Graceful Bridge on Lake Lanao's Shore Attests Moro Engineers' Skill with Bamboo and Rope

Moro custom says strangers should not look upon their women. When outsiders pass, therefore, the women peep at them through the split-bamboo walls of the houses. Through cracks in bamboo floors, crumbs fall to poultry on the ground. Moros, following the Koran, keep no pigs.

Staff Photographer J. Baylor Roberts

A Symphony in Brass—Gongs and Trays Are Hammered in a Vise of Moro Feet

In their dreams, American veterans of our Moro campaign still hear the jungle drums of these people. The Moros are mostly of Malayan descent, but their Mohammedan faith sets them apart from other Filipinos. This house was built without nails; joints were lashed with rattan.

Photo Jacobs from Three Lions

As Pirates, Slavers, and Smugglers, Their Forebears Ravaged the Sulu Sea for Centuries

Moros cruise off Zamboanga, old Spanish stronghold on Mindanao. American soldiers loved Zamboanga, where you could "kick your breakfast off a tree." Filipino soldiers training in California for their homecoming sang an old folk song, "Don't you go, oh, don't you go to Zamboanga, where you may forget your darling far away."

Along wild-pig trails the only sound the inspector hears is the clank-clank of his coffee-pot and skillet knocking together on the pack-saddle, or the cries of birds and snorts of wild hogs. When it rains he must build a shelter of banana leaves and keep a smoky fire going under this shelter to scare away pythons and crocodiles.

Primitive and scattered as they are, says President Osmeña, these schools have been a prime force in tempering the hostility and taming the wild ways of the pagan tribes.

The Way Japs Treat the Filipinos

Except that their supplies are shut off, these interior homesteaders feel Jap oppression but slightly. As for the pagans, when the Japs got too rough on them they simply withdrew farther into the hills.

But in towns and coastal regions the heel of the Nip is hard.

By giving them so-called "Independence," Japan seeks to prove to Filipinos that her aims are purely altruistic.

"We are doing our utmost to drive out American thought," said one Jap military man, on the air from Manila. In other intercepted broadcasts frequent reference is made to "the need to stamp out evil concepts of Americanism" and to replace them with the "spiritual" values of Japan.

Streets, signboards, ships, etc., have been rechristened with Japanese names. All American tunes are forbidden; people are not even allowed to play records of American music.

To arouse hostility against us, the Japs harp on our past "ruthless exploitation," or insist we have a racial prejudice against all orientals. In one broadcast from Manila a speaker said, "Filipinos must learn the Jap language and gain more knowledge of Japanese art, science, and social breeding."

In Mindanao native dialects are permitted, but looked on as secondary tongues.

From Japan came a set of 22 textbooks, published for use in southern occupied areas. Jap teachers are sent to spread the Nipponese tongue, as well as the history and literature of Japan.

Filipino youth organizations are being shaped to Japanese pattern. Filipino lads have been sent to Japan for training. Among these were sons of puppet leaders such as Jorge B. Vargas and José P. Laurel. The latter is the puppet president.

These words from the islands have also been picked out of the air: "Priests and ministers of all religious orders must help in Jap pacification." Later the puppet government directed all priests to explain to their flocks, in every sermon and by every means in their power, the merits of Japan's plan for the "Greater East Asia Co-Prosperity Sphere."

On Mindanao in 1939, more than 1,000 Okinawas, mostly hemp-field workers from Japan's Nansei Islands (Ryukyu Retto), were killed with knives by Christian and pagan Filipinos. Some heads were carried off! These Okinawas had been brought in by the Japanese Government and encouraged to marry Mindanao women in order to extend Japanese holdings.

In gaining these ends, as the Japanese consul at Davao well knew, many of the coolie-class Okinawas would inevitably be killed. But the rulers of Japan and its diplomats are aristocrats; to them the death of a few hundred lowly coolies meant nothing. It was a trivial sacrifice, to gain additional hemp lands on Mindanao.

A Geologist's Happy Hunting Ground

In the geographic past this island was tied on the north to Luzon, Samar, and Leyte, and on the southwest with Borneo. Emergence, geologically, was quite recent. Even yet Mindanao is really a series of separate blocks, like a jigsaw puzzle. Some of its blocks are still sinking and others are rising.

Earthquakes occur. Only 50 miles off the east coast of Mindanao lies the world's greatest known ocean deep. It is nearly 7 miles to the bottom. It's the deepest known spot in that whole long, narrow ocean trough which borders the east shore of the Philippine group.

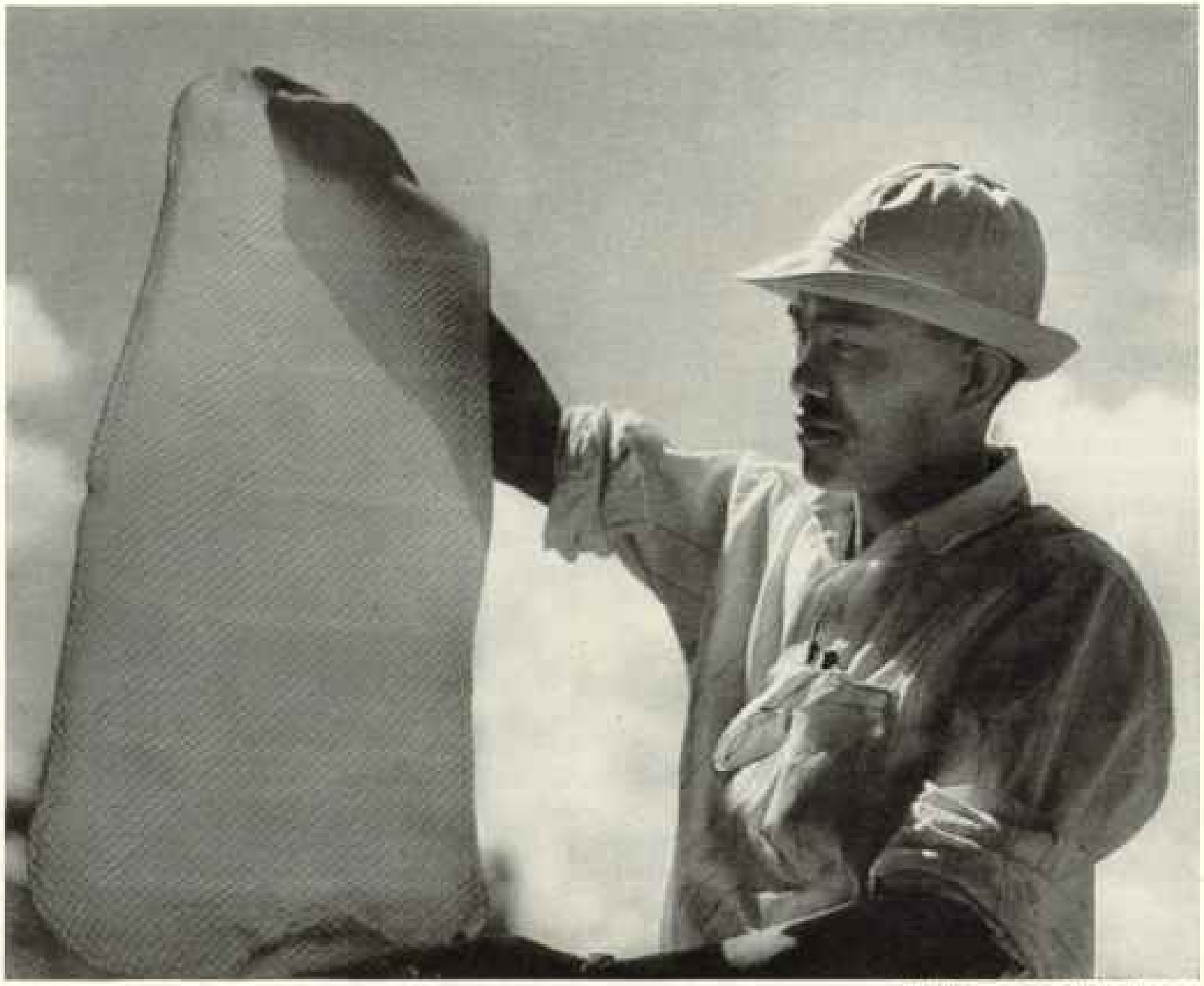
In northeast Mindanao, geologists say, you may hear an earthquake before you feel it. It may sound like the rumble of a mountain thunderstorm. Severe shocks, felt on the surface, are seldom noticed by miners working underground.

Dr. George Kemmer, long with the U. S. Bureau of Mines, walked, climbed, and paddled through hundreds of Mindanao jungle miles; both as prospector and as operator of coal mines for the Philippine Government, he came to know much of this island's geology.

"We know now," says Dr. Kemmer, "that Mindanao has enormous iron and gold resources. When the great Philippine gold boom started in 1935 and these islands became one of the world's leading producers, prospectors flocked to Mindanao.

"Gold seekers came from the United States, from Canada, Japan, and Australia. Some are now dead, interned, or in hiding.

"By 1941 excitement was intense. It was like Klondike days. When the Japs came, the gold district in northeast Surigao was producing around $700,000 a month, though



Staff Photographer J. Baylor Roberts

Boa Constrictor Skin? No! A Sheet of Newly Made Mindanao Rubber

The Goodyear Tire and Rubber Company lost 600,000 trees when Japan took Zamboanga. Its American officials were interned (page 544).

the island as a whole had not been even superficially prospected.

"A gold mine map of the western Pacific would show producing mines working here and there from Luzon south to New Guinea and Australia.

"My own work, and that of others, showed that gold lode and placer mining here dates back centuries. In fact, most of the modern mines are simply old or 'relic' mines, first worked long ago.

Chinese Once Dug Mindanao's Gold

"Some abandoned underground workings we found show that the early Chinese miners used methods, such as stope and fill, which we occidentals today regard as being fairly modern!

"To get drinking water, the pioneer Chinese planted rattans about their mines; these they simply cut, and sucked good water out of the vines. It's a curious fact that modern prospectors, looking in the hills for old mine workings, often find them by first locating such patches of transplanted rattans."

Early pottery has been found in these old mines. Some of it dates from the Sung dynasty. Most prized pieces to collectors are the celadon, a delicate green variety.

Placer gold from the Tugunan River was prized by Chinese because of its peculiar yellow shade and easy workability. When Americans had to flee, these placer mines were being worked again. Clean-up time was always full of surprises.

In one batch of stream material washed out there was obtained, besides the gold, ancient native earrings, old Spanish jewelry, musket balls, nails, mercury globules, and even metal links from a miner's modern zipper shirt—proving that gold seekers have worked along the Tugunan for many years.

"After a flood in the Agusan River," adds Dr. Kemmer, "a golden Bodhisattva of Javanese workmanship was found near the hamlet of Esperanza; it dates from the 15th or 16th

Willard Price

With Ax and Crosscut Saw, Lumberjacks Fell a Forest Giant in Davao Province

Apitong is one of the native names for this tree, which may reach 140 feet in height. A resinous oil, useful for illuminating, varnishing, and calking, is collected by chopping a dripping cavity into the trunk. Lest decay enter the wound, timbering should follow tapping. Yellowish heartwood is used for construction.

century. This golden figure is now on exhibit in the Gem Room of the Chicago Natural History Museum."

Besides gold, careful surveys show 1,000,000,000 tons of iron ore in sight, in the Surigao Province deposits. In places this ore reaches about 90 feet in depth and when dry it assays around 50 percent iron (Plate VI).

When viewed from out at sea, this reddish deposit, covering the landscape from lowlands to mountain slopes, presents a striking appearance (page 556). The scant vegetation seen here is peculiar to iron-ore regions.

Much of this ore contains one percent nickel and two percent chrome. Just before the war some Surigao chrome deposits were being worked. For use at their Yawata steel mills the Japs, before the war, were taking iron ore from some of the other Philippine islands at the rate of nearly 1,192,000 tons a year.

This Mindanao iron ore can be cheaply mined with power shovels, and good harbors are near. To the west, on the Agus River which flows out of Lake Lanao, is a water-power site of enormous possibilities. In about 24 miles the water falls some 2,200 feet. Engineering surveys show a minimum of 330,000 horsepower can be developed here.

Before the Pacific war the Philippine Government had plans for building a dam and powerhouse here and using the current to work the Surigao iron deposits, to operate smelters, and to make nitrates from the air for needed fertilizers.

Scorpions in Your Shoes

White men who dig gold, saw lumber, or farm in Mindanao face some strange and unexpected odds.

American exiles I've talked with say they never yet have got used to crocodiles killing their workers, or to crazed Moros who shave their heads and run amok with a wavy-bladed kris, swearing to die killing Christians and thus

George Kemmer

A Garden Hoe Reveals a 12-foot Coal Seam

This is the Lumbog open pit in Zamboanga district. Mindanao's coal is largely undeveloped.

get a ride up to heaven on a white horse, to dwell with Allah.

"You get used to snakes," one old-timer said, "even to deadly little green tree vipers. You calmly smack any big centipede that scoots about your shower, and you habitually shake your shoes, before you dress, to stampede any lurking scorpion.

"If lizards want to fly, or if wild men want to eat bats and pythons, that's O.K., and you soon learn to sleep in camp despite red deer that bark all night, like dogs.

"But as for these mimetic insects, as science calls them, they're always a surprise. We've got a walking stick on Mindanao that may grow to 18 inches, including its legs, and it looks exactly like an old stick of wood. Others are shaped and colored so much like leaves of the tree they live on that you can't tell 'em from those leaves until they start crawling. But the crocs—they're man-eating devils!"

Plentiful Crocodiles Are a Menace

In the streams about Cotabato crocodiles are so dangerous that women and children, to wash clothes and bathe, must do so behind paling fences built on the water's edge; so plentiful are they here that a Cotabato dealer, in 1939, shipped 3,000 salted hides to New York.

Known scientifically as *Crocodylus porosus*, this reptile lives in sluggish streams; it crawls along the coast from one river mouth to another, and often appears to lie in ambush at some point frequented by human beings.

Crocs lurk near river villages in Mindanao and kill people, just as tigers at night devour natives who venture outside their villages in parts of India. During 1941 three Mindanao employees of the National Development Company were killed or badly wounded by crocodiles.

"One of my men, helping build a ferry," says the geologist Dr. George Kemmer (page 561), "was told to take a canoe and cross the river to get a certain tool. He disobeyed and started to swim. Halfway across, a croc grabbed him. I heard him yell, saw the commotion, but the reptile dragged him under.

"Another night my paymaster, walking from the house down to the beach, was seized. Though a stout, heavy-set man, the croc had him by one thigh and started dragging him out to sea. We heard his yells, grabbed guns and flashlights, and, accompanied by his wife, ran down to the water's edge. We could see

Staff Photographer J. Baylor Roberts

On a Plank Road a Hardwood Titan Started Its Long Journey to the U. S. A.

Some of Mindanao's woods are so hard they are used for bearings, others so light they serve as fish-net floats. Striving for light, some trees stretch 250 feet from canyon floors (page 566).

Ruth Allen

Moro Schoolgirls Learn to Read, as Well as to Sing and Dance

Daughters of wealthy Lake Lanao families wear gold coins as blouse buttons. As Moslems, they must dress modestly. As an alternate to the topknot, hair style permits a long loop over one ear.

Willard Price

First He Narcotizes Fish, Then He Spears Them

His left hand holds a plant whose crushed, dried roots spread a stupefying juice in the pond. As fish float to the surface, they are transfixed. If taken by hand, they revive.

the man and big reptile floundering in the water, but were afraid to shoot, lest we hit our paymaster.

"'Stick your thumbs in his eyes! Gouge out his eyes!' It was the victim's plucky wife who yelled this wise advice. The paymaster was able to squirm about and do just that, and the croc dropped him. But he was badly chewed up when we fished him out and he spent three months in a hospital.

"One 10-year-old Moro boy, son of a chief, walking beside our stream with two elderly guardians, was grabbed from ambush by a young crocodile. The reptile first struck him with its curled tail. This is the way they strike on land, forming a C with their tails at the instant of impact. This stuns the victim and knocks him into the croc's open jaws. In this case the boy got a glancing blow, so only one of his arms went into the reptile's mouth.

"Instantly the two old Moro guardians grabbed the boy's feet and struggled to pull him loose. Failing, one Moro took his thin-edged *barong* and chopped at the crocodile's eyes, forcing him to release the lad's arm, which was by now only a bare, dangling bone.

"They brought the boy into my office and laid him on my desk. He was conscious. I sent him to our first-aid place, called the doctor and the boy's father.

"Amputation was imperative, but the father wouldn't consent unless the mother did, and she was in a village eight miles away. We had to fan flies and wait for her! When she came she said, 'No, I'd rather my son should die than live a one-armed man.'

"I argued. I told her that in the future people would point out her one-armed son as the brave boy who fought a crocodile; and so she consented. Her son got well."

Wonders of the Island Forests

"About 82 percent of Mindanao is covered with forests, including some of the finest our flag ever flew over," says Col. Arthur F. Fischer, once director of the Philippine Bureau of Forestry and for years a crusader in the protection and wiser use of the trees of these islands.

"Biggest predominating Mindanao trees are of the dipterocarps family," he told me. "They frequently stand from 180 to 200 feet high; those in canyon floors, reaching up for

sunlight, may attain 250 feet in height.

"To this same family belong the lauan and tanguile, both commonly known as 'Philippine mahogany' and popular in the United States for use in bar and store fixtures and in planking for boats and pleasure craft.

"Some narras (*Pterocarpus*) and other trees here bear purple and yellow flowers."

Woods of rare beauty are prized by Moros for making fancy kris and barong handles. The wood of the kamüning tree, akin to citrus, takes a finish like mottled old ivory. The gnarled roots of ebony and camagón have patterns streaked with pink, purple, and black.

Other woods are so hard they are used for cogwheels, bearings, and wedges (pages 563, 565).

Fish traps are made from forest vines; rattan goes into furniture; cutch, or extract, from mangrove bark goes into tanning fluids. From these rich forests come also gums, wild rubber, cinnamon barks, dyewoods, etc.

Willard Price

Bells Tinkle as Wrinkled Fingers Caress a Curved Knife

A Bagobo, a pagan tribesman, is the swordsman. His blade was obtained from the Moros or made in imitation of theirs. Bells were fashioned by the cire-perdue (lost wax) process. The tribe makes a wax model, covers it with a clay mold, melts the wax, and fills the vacant space with molten metal.

Glorious orchids paint brilliant patterns against solid forest greens. Hunting them has been a profitable business.

Colonel Fischer was especially interested in the Mindanao quinine plantation. It stands in the Bukidnon Province hills, west of Malaybalay town, on slopes from 4,000 to 6,000 feet above sea level. Cinchona bark for making quinine was being cut when the Japs came.

From this plantation in 1937 Colonel Fischer brought 1,500,000 seeds to the United States. Young trees from these seeds now grow in parts of Latin America.

In 1942, under Japanese fire, courageous Colonel Fischer got away with yet another lot of these important seeds. They at last reached the Government's farm laboratory at Beltsville, Maryland (page 574).

Thus quinine, like Hevea rubber, also used Mindanao as a steppingstone to get from the Netherlands Indies back to the Western Hemisphere, its original home.

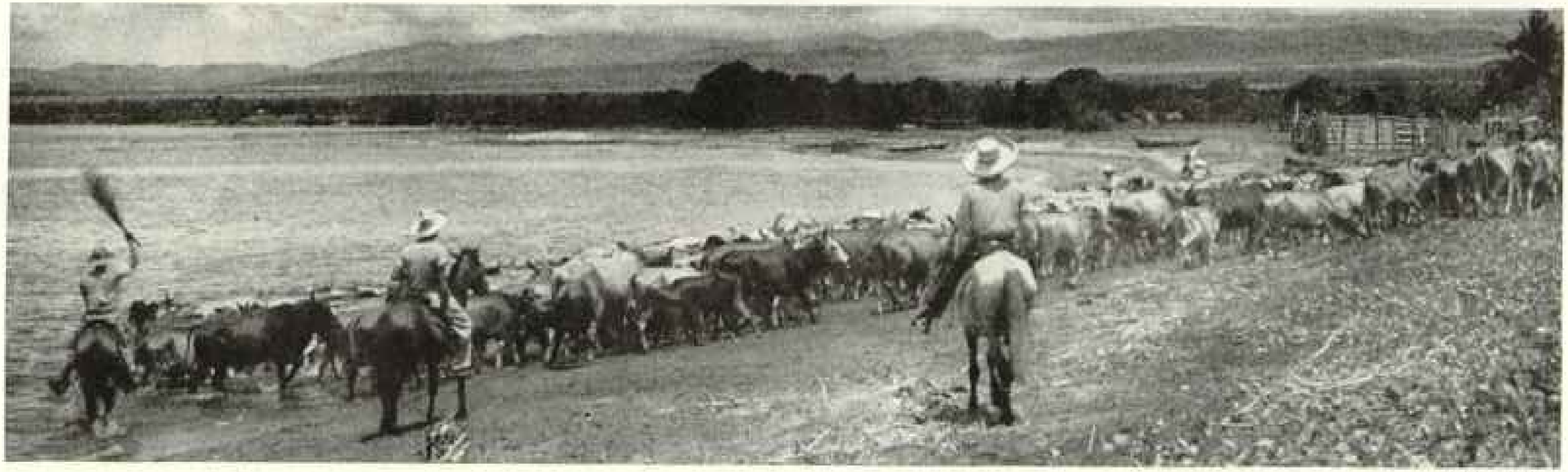
Some Wild People Lived in Trees

Pagans here look with superstition on certain trees. If a tree has a strangler fig vine growing up it, the wild people will not sleep under it, perhaps because poisonous snakes frequent these vines. Rotting wood of a tree choked to death by the fig vines may emit a phosphorescent glow (p. 571), and some natives look on such a tree as the abode of spirits.

Ofjer B. T. Jones

Zamboanga's Spacious Harbor Welcomed Western Steamers and Moro Sailboats

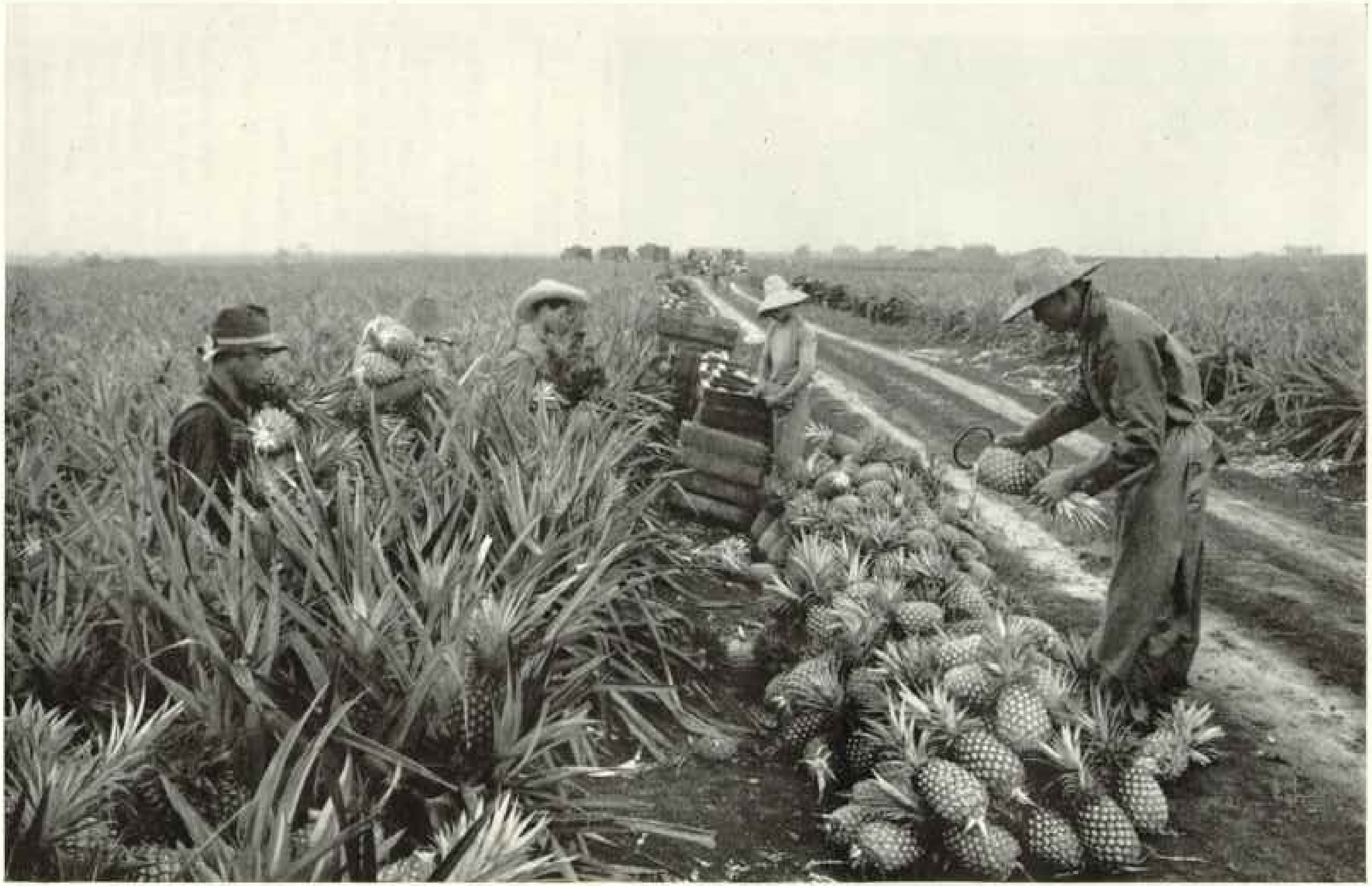
Three centuries ago Spaniards established the town as a fortified outpost against the Moros. Americans liked the pleasant climate.



Karl J. Pelzer

As Mindanao Cowboys Herd Cattle along Sarangani Bay, One Uses a Palm Frond as a Whip (left)

Crossing humped Brahman stock from India with the native Spanish strain has resulted in a heavier, disease-resisting animal.



Staff Photographer J. Baxter Roberts

This Rich Plantation, Where Field Hands Picked, Measured, Trimmed, and Boxed Fat Pineapples, Lies in Wanton Ruins Today

Crops were allowed to rot and buildings were wrecked when Japan captured Del Monte plantation, a Mindanao show place. American bombers used its flat fields for a last-ditch stand (page 544). Hawaii introduced its fruit; the States were its best customer. Trucks on the road hauled the crop to a cannery at Bugo.

U. S. Army Air Corps, Official

Shaky Bridges Connect Nipa Huts; Outriggers Tie Up at Kitchen Doors

Fish traps are dropped from the shacks. The pilot-photographer could detect the odor of fish 100 feet above the village. His air view shows a section of Jolo, capital of Jolo Island, Sulu Archipelago. Some of its old-timers never venture beyond it. Bigger houses "uptown" have tin roofs.

Once the Mandaya tribe lived in tree houses. Some took their dogs and chickens up there at night. Then they would pull up their ladder so no enemies could reach them. Enemies used to shoot flaming arrows up on the thatched roofs to set them afire; then, as the family scrambled down, they were killed.

The spread of law and order under American rule had about ended these tribal raids. In recent years most of the Mandaya had moved down to the ground, built little huts there, and gone to farming.

Native farmers burn off scars in the forests to make cleared fields for crops.

Known there as *caiñgins*, these scars are plainly seen as you fly over. In this "caiñginning" the people first ring the trees, let them dry, then fire the brush, and thus clear land for rice, corn, sweet potatoes, and other crops. Having no plows or work animals, they till with only a sharp stick.

Soon the tenacious cogón grass so encroaches on the cleared patch that the people abandon it and move on to another site. Cattle owners fire the cogón grass, too, as our people do in parts of Florida and Alabama, to improve grazing. Cogón grass is the Mindanao farmer's enemy; in it also breeds the horde of locusts that now and then swarm over the country, eating up gardens and field crops.

More Monkeys Than People

More monkeys than people live in parts of Mindanao.

Monkeys often raid the fruit trees and gardens. While hunting, I came to a village where more than 500 monkeys were digging and eating in the sweet-potato patches. The little town was empty of all human beings. I learned later that the men and boys had gone early that morning to work in distant tobacco fields, and the women, left alone, had fled in panic before this army of chattering monkeys.

The nimble, tricky mongoose always amused

Photo Ingrid from Three Lions

Like Freshly Laid Eggs of Giant Birds, Shelled Coconuts Drop on a Moving Belt

These Filipinos do piecework on a Japanese plantation near Davao. A pair of Japanese feet treads the overseer's platform in the upper left. After drying and packing, the nuts usually went into American pies, cakes, and soaps.

me. He kills snakes and is as crazy about papaya as your cat is about catnip. He's easy to catch, with papaya bait, and easily tamed.

Most curious little beast here to me is a lemur, *Tarsius carbonarius*, kin to monkeys. One of the most ancient of living primates, he has relatives in other parts of the Far East. He is arboreal and nocturnal.

With a long, furry tail and bulbous eyes, he is hideously ugly. Living mostly in hollow trees and rotten stumps, he eats grubs and forest cockroaches. Tips of his fingers and toes are pads, which work like suction cups when he climbs.

"My work as a geologist took me into nooks and high peaks of the island where few other foreigners have to go," Dr. Kemmer told me. "After you leave the rain forest, climbing up you hit the mossy forest, and on top of the ridges, at highest elevations, you enter the elfin forest. This is indeed often a fairyland, where sunshine filters down through the lacy net of dwarfed and stunted hardwood trees. No human beings live up here."

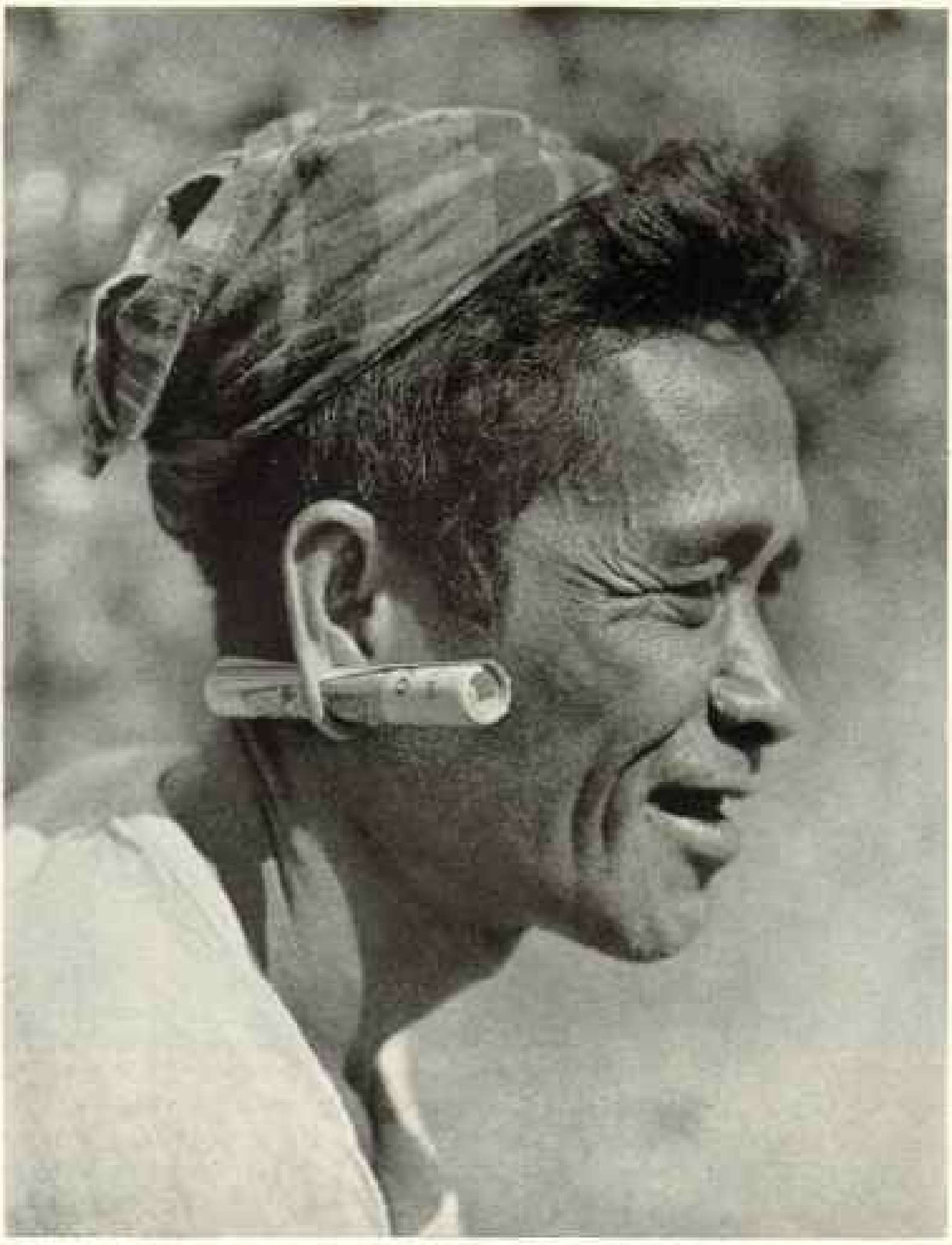
Despite their dense appearance, the floors of the rain and moss forests are often surprisingly clean and open. And they can be fascinating at night.

Aglow with Luminous Rattans

Some sections are luminous after nightfall. The rattans and lianas which hang from the canopy of treetops may actually glow, not unlike neon tubes. At times even the tree trunks, leaves, orchids, and the ground itself are aglow, probably from some fungus growth.

Prospectors have cut these luminous rattans and used them as forest trail markers. As long as the surface of the plants is kept moist, they will glow.

"To keep out of trouble," said Dr. Kemmer, "and to get guides and labor when working through wilder parts of Mindanao, geological



William E. Paton

Here Ear, Not Eye, Absorbs the Day's News

Bagobo men and boys do carry small objects in the split and distended lobes of their ears. However, this delivery was the cameraman's idea.

parties must make friends with the pagans, of whom there must be 200,000.

"Though written years ago, I think Dean C. Worcester's studies of these people are still the best ever printed.*

"To us, the Manobos were particularly useful; they're good blacksmiths. They make excellent bolos and spears.

"They also make a stringed instrument, with guitarlike frets, often shaped like a crocodile, which takes a lot of skill in playing. Their legends say they came from China, long ago, to work in gold mines; maybe so. They're still good miners.

"In the northern Diuata Mountain region I saw much of the Mamanuas, a well-developed people of Negrito stock. They live on *camotes* (a mealy type of sweet potato), deer, and wild pig meat. Some of their huts I saw were lined with boar skulls. Because of tribal fights, the Mamanuas are fast diminishing: men are already so scarce that some husbands have eight wives."

About Davao Gulf live the simple pagan Bagobos. Many of them have worked on the American plantations in recent years. But they don't like Japs, and therefore many quit the hemp country for the hills. In the last few years they're credited with having removed hundreds of Japanese heads!

For work on American plantations, in sawmills and mines, labor supply comes chiefly, however, from the 400,000 Mohammedan Moros and from the 1,240,000 Christian Filipinos, many of whom are descendants of Luzon and Visayan immigrants who came here in Spanish times.

On his bus rides across Mindanao, guarded by the Constabulary, our photographer Joe Roberts says that in places monkeys were as thick as jack rabbits at sundown along an Arizona ranch road.

Cooked with a "New England boiled dinner," Moro style, Joe got a big green banana in place of carrots.

As Our Cameraman Saw It

A Moro boy who toted Joe's camera cases was named Pershing. Joe was astonished when a Jolo youth walked up and said, "I'm Abdurahaman Ali, champion swimmer. I was in the Olympic Games in Los Angeles."

* See, by Dean C. Worcester, in the National Geographic Magazine, "Non-Christian Peoples of the Philippine Islands," November, 1913; "Head-hunters of Northern Luzon," September, 1912; and "Field Sports Among the Wild Men of Northern Luzon," March, 1911.

"On the long bus ride from Cotabato across to Davao," says Roberts, "we saw few houses, except near the streams, where often we had to use a cable ferry. Through some swampy stretches we drove over corduroy road. In spite of all the wild, uninhabited country, at one ferry crossing was a signboard reading 'Expert Clock and Watch Repairing.'

"When the bus was too crowded, it wouldn't stop for Moros who stood waiting beside the road. To get even, Moros at one village, after they'd been left to walk, hid a board with nails in it under some leaves on the road and punctured the tires of the next bus that tried to run past them!"

This Moro spirit is unbroken. New graves, shown to Roberts, marked the spot where the Constabulary had just had a brush with the Moslems.

To own a gun is the Moro's big ambition. To get one, he even digs up the small water pipes on American premises, steals the pipe, and uses it for making gun barrels!

Willard Price

Bagobo Women Strum This Instrument in Guitar Fashion

A joint of fat bamboo forms its sounding box. It has seven strings, a bridge and frets, and requires no little skill. Bagobos have few tunes. This woman's make-up shows foreign influence.

In the bamboo palace of the Sultan of Sulu, near Jolo, Roberts had his camera all set for a color shot. Suddenly a leg of his tripod slid through a crack in the bamboo floor, and the Sultan and all the courtiers leaped up to help grab it! At first the old Sultan refused to pose, but when he was told Roberts had come 9,000 miles from Washington, D. C., he agreed. Meanwhile, he and his priests smoked all of Roberts' cigarettes!

Natives Pray for Americans' Return

At one village on Lake Lanao, Roberts watched the Moros making brass gongs and platters (page 559).

At Dansalan, chief lake town, the party halted at Camp Keithley, named for an American Army hero slain forty years ago. Big trees shade its lakeside parade ground. Here what was once an officers' club is now a rest-house. Today it houses Japs.

It rained all night when Roberts was there, and the Moros beat their gongs all night. About Lake Lanao Moros have improved farms and substantial houses, decorated with carved and painted wood (Plate VIII).

"When the Japs first invaded Mindanao," I was told by President Osmeña, "they treated our people with great cruelty. Then local commanders were changed and a somewhat softer policy resulted.

"The enemy's aim here, as all over Asia, is to

U. S. Army, official.

Mindanao Cinchona Seedlings Tell a Tale of Malaria Battle on Two Continents

Col. Arthur F. Fischer (left), long chief of the Philippine Bureau of Forestry, risked his life to insure our future quinine needs. Flown from Bataan to Mindanao, he gathered cinchona seeds during the last days of the Philippines' defense. Though malaria-stricken, he flew out again. The seeds he took with him started a quinine industry in Costa Rica (page 567). Brig. Gen. James S. Simmons, Chief, Preventive Medicine Division, Office of the Surgeon General, wraps the plants at a Maryland station where the seeds were propagated.

impose their culture on us; they soon learned they could not do this by cruelty.

"From all reports we get, most Mindanao people heroically stick to their own way of life. They are *not* trying to learn Japanese. To talk with them, Japs have to use English, because that is the tongue of at least 30 percent of all Mindanao. Native dialects of course remain in use. This is still true all through the Philippines.

"More Americans than ever, counting prisoners of war and internees, are now in Mindanao, because so many fled there or were brought there from northern islands.

Japs Armed the Moros

"To help keep order, the Japs reorganized the Philippine Constabulary. One report says that Moros, armed by the Japs, went over in large numbers to guerrilla bands still in the hills. We know, too, that the enemy destroyed all the American-owned property they could and sent shiploads of metal, lumber, machinery, and goods to Japan.

"More and more Japs continue to arrive in the islands. Press reports say some fresh divisions were brought from Manchuria. But since the Japs seized all trucks, boats, and gasoline, transportation has so broken down that food movements are checked, and a condition bordering on famine is imminent.

"All regular coastwise shipping is destroyed; only occasional sailboats move between Mindanao and other islands. Fishermen are afraid to put to sea. Cowboys used to herd many thousands of fine meat-bearing animals over the grasslands of central and eastern Mindanao; this industry, likewise, has undoubtedly been much reduced. There is particular suffering among the 100,000 Christian immigrants who had in late years moved here from northern islands (page 553).

"My last sight of Mindanao was from the rescue plane that picked up my party at the American-owned Del Monte pineapple plantation. So many pineapples were rotting there in the fields that the air was filled with the smell. We found it easier to get pineapple juice than to get a drink of water.

"We all pray for the early return of American soldiers. That will be a big day in Philippine history."

Coffee Is King in El Salvador

By Luis Marden

With Illustrations from Photographs by the Author

COFFEE, their "grain of gold," looms large in the daily life of the people of El Salvador. A rise or fall in the market price of the fragrant bean makes front-page news in the Republic; the humble bootblack in San Salvador talks coffee "shop" with the knowing air of a planter.

Salvadorans do not quibble about their most famous national product; postage stamps of the Republic bear the legend, "The coffee of El Salvador is the best in the world."

Though the tiny country has the densest population of mainland North and South America, 65 coffee trees grow for every inhabitant. And El Salvador, like Manhattan, is cramped for space. Lack of horizontal growing room has forced plantations to expand vertically, and the flanks of dead and quiescent volcanoes are planted to the limit of cultivation. The best coffee thrives in the altitude and acid ash soil of the mountainsides.

"Farming of one kind or another is our chief occupation," a Salvadoran told me. "Our lands are fertile, but we have about 1,830,000 people—139 to the square mile. So many of us live in such little room that we have to scramble to make a living.

This partly explains why Salvadorans have so much energy and industry.

Their enterprise manifests itself in many ways. Notable in a country with mountainous terrain is the network of first-class paved roads that virtually covers the country. *Vialidad*, meaning the public roads system, is a word you see and hear often in El Salvador.

The Salvadoran portion of the Pan American Highway, except for a short stretch from the city of San Miguel to the Honduras frontier, is paved from one end of the country to the other (Plates VIII and XXII).

El Salvador is the only Central American republic without an Atlantic coastline. The west side of the Central American isthmus swings east at this point, and El Salvador runs approximately east and west, with the Pacific to the south (map, page 580).

Like Nicaragua,* El Salvador straddles the chain of Central American volcanoes that ends in Panama, only to reappear on the South American Continent as the mighty Andes. But in El Salvador the cordillera runs close to the Pacific.

In the mountains near the coast lies San Salvador, the capital, at 2,250 feet. Its many-storied buildings, cool climate, and pine-planted parks give it more an air of a northern city than one of the Tropics (page 578).

Laboratories for Coffee Study

The coffee planters of the Republic have an association, the *Asociación Cafetalera de El Salvador*, that maintains experimental plantations and laboratories in Santa Tecla, 7 miles from the capital (page 582).

High on a hill overlooking the drowsy colonial town, a magnificent building houses laboratories where coffee is studied in all its aspects. In adjacent plantations experts experiment with soils, fertilizers, and cross-breeding.

White-smocked chemists who showed me through a shining laboratory offered me a beaker of dry white wine.

"Like it?" they asked.

"Yes," I said. "Local grape?"

The chemist smiled. "Very much so. We make it from the pulp of the coffee bean."

That same day I tasted a liqueur made from coffee beans, saw sheets of plastic made by pressing vellumlike sheaths of the coffee bean with binders, and even sniffed perfume extracted from sweet-scented coffee blossoms.

"Of course," my guide went on to say, "these are merely experiments. Our real work here lies in the improvement of the strain and increase of yield, among other things.

"We try to guide the planters in scientific methods. In fact, so well have we instilled the progressive spirit that even a small country planter will solemnly pick up a handful of his soil and ask, 'What pH has this?' "

The pH stands for acid-alkalinity content; technicians test soil with litmus paper to determine its suitability for coffee planting, then measure its pH degree. Soil rather on the acid side (pH 6) gives best results.

Planters here seem not to have the traditional conservative attitude of farmers. Rather, they come to the experts seeking advice, anxious to keep their methods abreast of the latest discoveries.

This is one reason why Salvadoran coffee occupies such a high place in the world market. Yet, as sometimes with oranges in California, the best of the national product is hard to

* See, in the National Geographic Magazine, "A Land of Lakes and Volcanoes," by Luis Marden, August, 1944, and "Army Engineer Explores Nicaragua," by Lt. Col. Dan I. Sultan, May, 1932.

Tortillas Are Produced in Mass to Feed Hungry Coffee Pickers

Three women on a plantation near Santa Ana work to keep the hands of pickers supplied with corn cakes. Most pickers are migratory, visiting plantations in turn. On this modern ranch the quantity gathered by each picker is measured by a copper rule thrust into the sack.

obtain locally. Rumor has it that in public places, such as hotels, ersatz substitutes—roasted avocado seeds, for instance—are occasionally served in lieu of coffee.

Shade, Altitude, and Soil Factors in Coffee Culture

The technician briefly summarized the ideal conditions for coffee culture.

"First," he said, "coffee needs shade, which is furnished by trees. Second, altitude, from 2,500 to 4,500 feet. Again, as we have seen, slightly acid, moist soil; finally, well-distributed rains and protection from high wind."

So well have El Salvador planters succeeded in meeting these conditions that their coffee trees look like exhibition plants. At harvesttime, near Christmas, I saw several trees that had literally broken under the weight of fruit. One tree had an estimated 14,000 berries on it.

The well-groomed trees looked more like ornamental plants than a food crop. A full-laden tree, with its dark-green, glossy leaves and shining red berries glistens in the mottled light beneath the shade trees.

Planters love their coffee. They talk it, live it, and drink it.

"Those fellows have interest in nothing but growing coffee," the secretary of the Association said. "They don't care about politics or anything else. All they want is to be left alone to grow and pamper their beloved coffee in peace."

On one plantation I saw some old coffee trees that had trunks nearly eight inches in diameter. To my surprise I learned that the wood, heavy, white, and fine-grained, takes

Defective Beans Are Culled from the Good on an Endless Belt at El Molino

This mill in Santa Ana is one of the world's finest. Here women pick out inferior beans and foreign matter before the coffee is bagged for export. The endless belt stops periodically, then moves on, bringing a new lot into position. El Salvador's best coffee, called *Malacara,* comes from this mill.

a high polish and is used to make ash trays, book ends, and other small articles that adorn many growers' homes.

A Mammoth Coffee Mill

On the Pan American Highway, 48 miles by road northwest of San Salvador, is Santa Ana, second city of the Republic. It has narrower streets, older houses, and a quieter atmosphere than the capital. The city is the center of a large coffee-growing area, and here I visited El Molino, a tremendous coffee mill that processes millions of pounds of coffee each season.

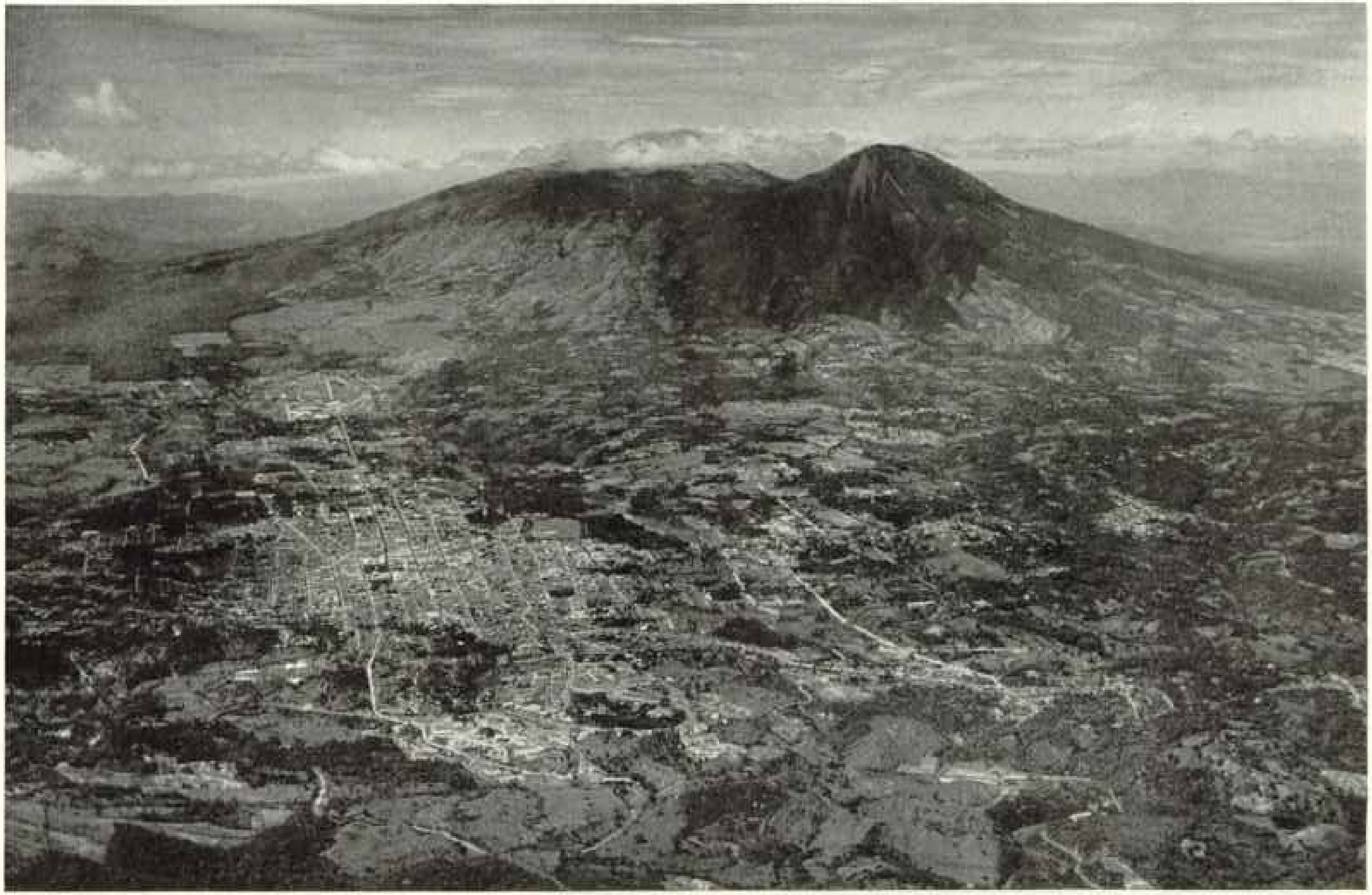
We still had coffee rationing in the United States when I visited El Molino, but here on an enormous concrete drying floor I saw 1,200,000 pounds of the gray-green beans spread in the sun—enough to make nearly five million cups of coffee! (Plate III).

Barefooted workmen with wooden rakes pushed and pulled the coffee into furrows parallel with the rays of the sun, so that little remained in shadow.

Coffee arrived at El Molino by train, auto truck, and oxcart (Plate II). Night and day during the harvest season, which is at its height about Christmastime, streams of the red berries pour into the big receiving bins.

Mr. Alfonso Álvarez explained the process to me. (The Álvarez family, proprietors of El Molino, includes seven members of the National Geographic Society.)

"It takes five pounds of the berries, as you see them here, to make one pound of processed coffee, coffee 'in gold,' as we say," said Don Alfonso. "On leaving these bins, the

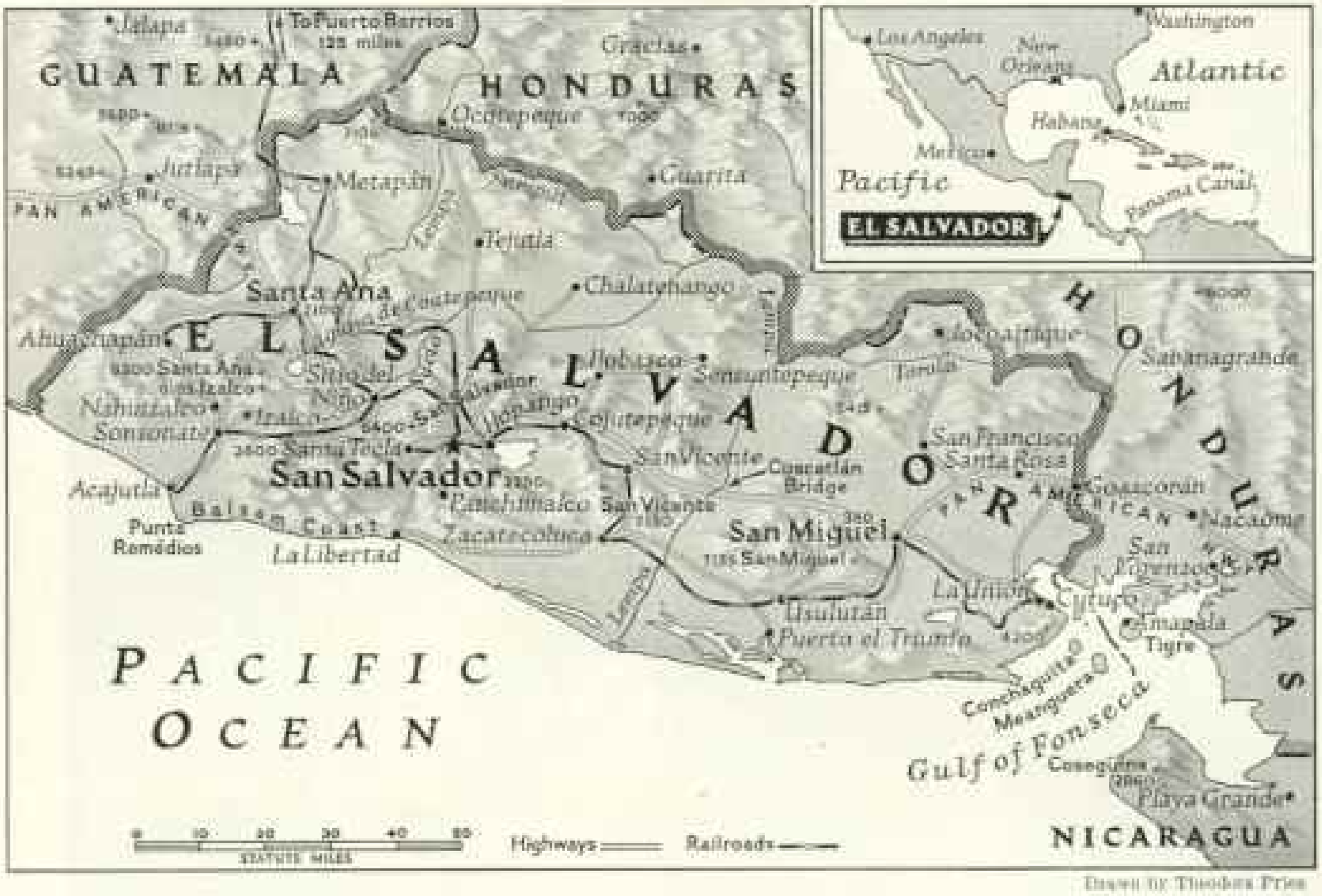


At the Foot of a Volcano, San Salvador Lies Cradled in the Valley of the Hammocks

Frequent earth temblors gave the valley its name. The crater of San Salvador Volcano is hidden by cloud; what looks like the top of the mountain is actually another peak far beyond it. An altitude of 2,250 feet gives the Salvadoran capital a cool climate.

Every Few Minutes Izalco Volcano Takes a 1,000-foot Puff on Its Concealed Pipe

The vent of the crater may be concealed under lava debris. Approximately every eight minutes, a column of gas, dust, and small fragments explodes. Lava issues almost continually from a small side crater (at head of black streak in upper pictures). These air views of a single eruption were made about three seconds apart (601).



Drawn by Theodore Price

Lacking an Atlantic Coastline, Tiny El Salvador Looks South to the Pacific

Because of the eastward curve of the Central American isthmus, El Salvador's 160-mile Pacific coastline runs almost due east and west. Eastbound exports go by rail to the Guatemala port of Puerto Barrios on the Caribbean Sea.

berries are screened for size, then run through depulpers where the covering surrounding the beans is taken off."

Don Alfonso picked up a coffee berry—"cherry" in Spanish—and broke it open, revealing the beans nested in pulp. "When we put these into the fermenting vats," he said, "the last of the pulp sloughs away. We use the aged, fermented pulp to fertilize coffee trees" (Plate I).

Running water moves the coffee about most of the mill. It floats into the pulpers and fermenters, then a fast-flowing stream in concrete flumes takes it to the drying floor.

To bring the beans back after 48 hours' sunning, a flexible vacuum tube is snaked across the patio floor. The nozzle sucks up the dry coffee with a rush and deposits it wherever the outlet is directed.

After three weeks in a storage tank, the parchmentlike skin of the bean is removed. Finally the coffee passes over moving belts under the sharp eyes of women inspectors, who pick out foreign matter and bad beans, before it is packed in sacks made of Salvadoran sisal (page 577).

The drying shed, with the inverted cones of the hoppers soaring up into dim-lighted rafters, looked like the inside of a dirigible. One of the finest coffee mills in the world, El Molino cost nearly two million dollars to build.

Migratory Workers Pick Coffee

In coffee harvesttime at the end of the year, big bands of migratory pickers walk the roads from plantation to plantation. Mostly they are women, who carry their shallow picking baskets. Often the children go along, too.

Pickers are paid at piece rates, usually in coin. The demand for small change increases heavily at the time of the coffee harvest.

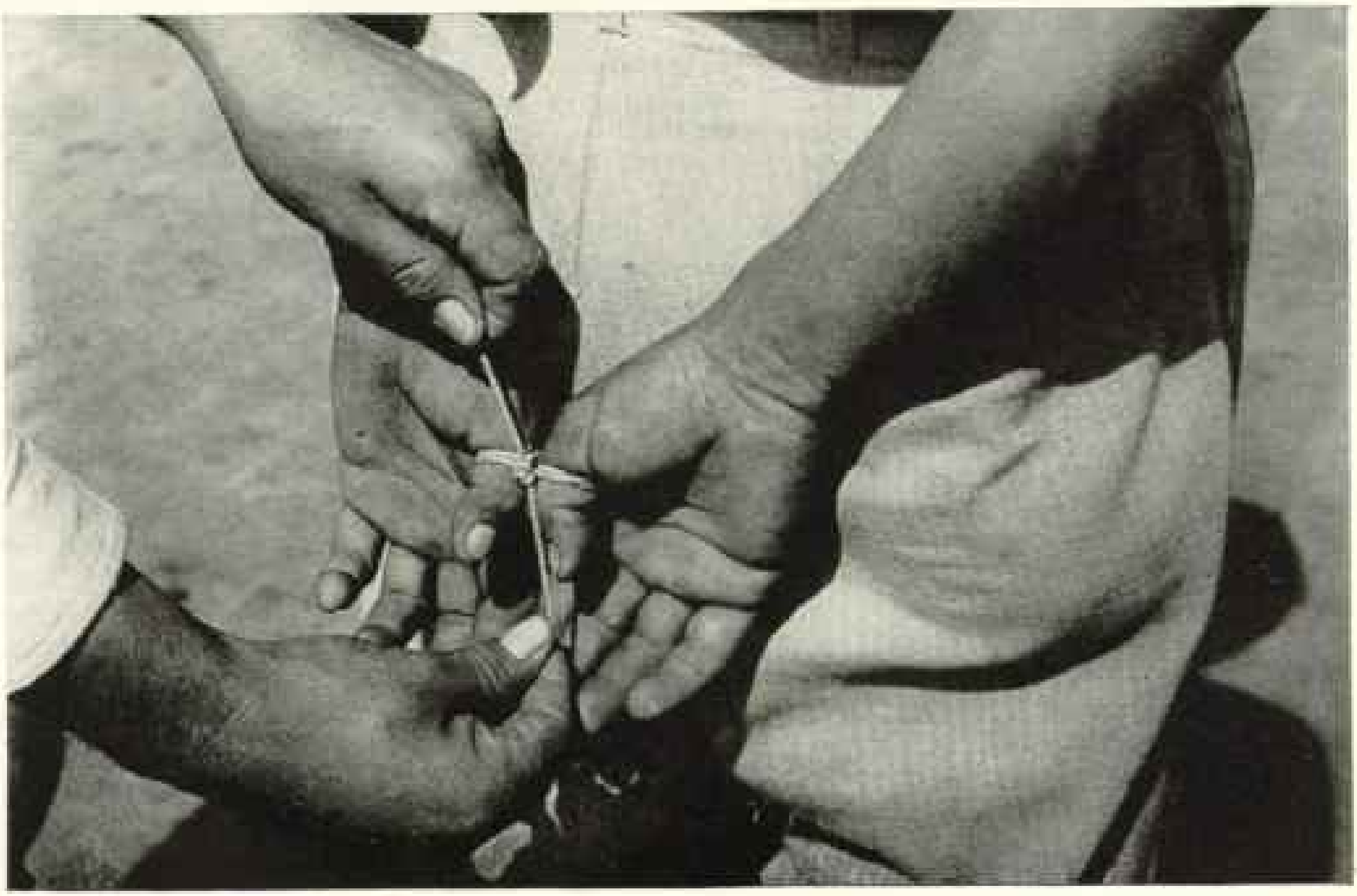
Each part of Latin America knows best certain sections of the United States. Brazilians and Argentines, and South Americans in general, know New York; Mexicans know Los Angeles, the Texas cities, and Chicago; in El Salvador I found that most of the people who had gone to the United States had visited San Francisco.

"We send much of our coffee to San Francisco," I was told. "Many of our planters have business connections there. Before the war steamships ran directly from our ports of La Libertad and Cutuco to San Francisco."

Lacking an Atlantic coast, El Salvador's

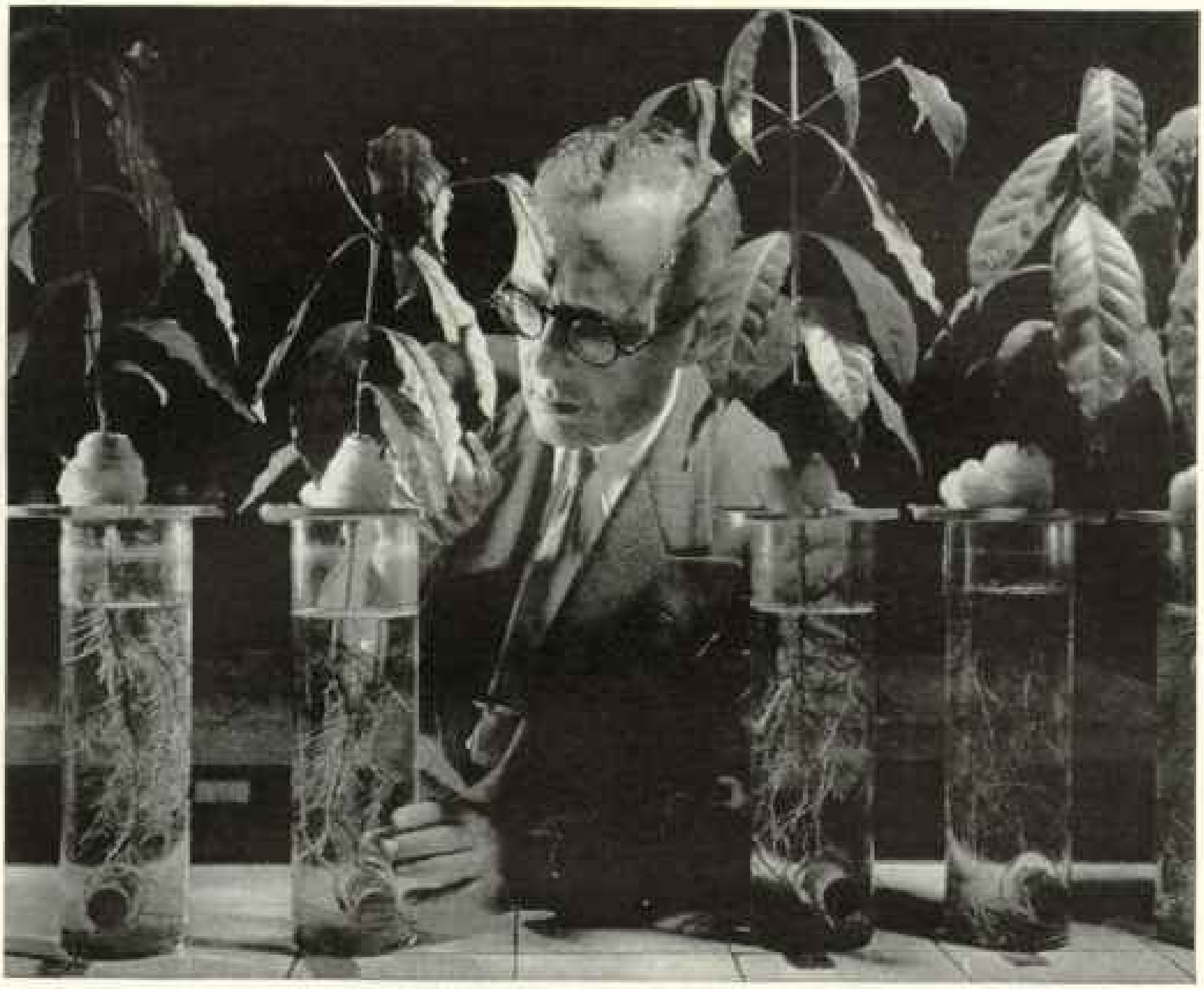
Her Deft Fingers Fashion Miniature Figures of Clay

Dominga of Ilobasco is famed in El Salvador for her clay figurines. Groups representing the Nativity (center) are in demand at Christmas. Lid of container at left—called a "surprise"—is lifted to reveal a woman making tortillas. Some contain a pair of kissing lovers.



Looks Easy, But Try to Get Out of This Simple "Handcuff"

Police of the National Guard tie prisoners' thumbs together when conducting them along the road.



Coffee Seedlings Grow in Water to Test El Salvador Soil

In the Santa Tecla laboratory of the Coffee Association, extracts of the nutrient elements in soil samples from all over the Republic are made. In these hydroponic solutions seedlings grow under controlled conditions. Type and rate of growth are studied to determine suitability of each area for coffee culture (page 575).

only outlet for trade and passengers through the east is the Guatemala port of Puerto Barrios, which is connected by the International Railways of Central America with San Salvador (map, page 580).

Santa Tecla straddles the highest point on the El Salvador section of the Pan American Highway (Plate XII). The town was for a while the capital of El Salvador. Many of the leading families built large homes there, only to return to San Salvador when the seat of government moved back to the present capital. And so Santa Tecla has, with its cobbled streets and sleepy air, the flavor of a small town and the mansions of a big city.

The social club here, the *Casino Tecleño*, has Spanish colonial architecture in keeping with most of the old houses of the town. The inner doors, carved locally from Spanish cedar, look like brown lace in the delicate tracery of their latticework.

At one corner of the building the designer placed a circular roofed porch or veranda. Here club members sit and survey the passers-by while they sip drinks. No event of street life misses the hawk eyes of the sitters, and many an ear would burn could it hear the apt and witty remarks. Since here are sharpened the scissors of criticism, members call the porch the *Mollejón*—the Grindstone.

I was sitting on the Grindstone with acquaintances one day when a dark-skinned man with snow-white hair passed. "That fellow's nickname ought to interest you as a photographer," one of the men said. "We call him the Negative."

Termites Eat a Homemade Calendar

Many of the old houses of Santa Tecla are of the thick-walled barred-window style that dates from colonial times. A lady of Santa Tecla showed me through one such ancient house which she planned to restore. A withered crone lived there as caretaker.

In This Olympic Stadium El Salvador Plays Soccer Football

At the close of 1943, soccer games of the Central American Olympics were played off in this magnificent stadium in San Salvador. The Republic won more games than Nicaragua, Guatemala, and Costa Rica. Stadium facilities include officially correct Olympic swimming pool (lower left).

When I asked her age, she said, "Sir, I used to put a grain of corn into a jar for every year of my life. Not long ago I wanted to count them and broke open the jar, but termites had eaten all the corn. I'm pretty old, though."

Spanish customs, such as that of the serenade, persist in Santa Tecla, but to serenade one's lady in Santa Tecla a permit has to be obtained. It costs two dollars.

In the quiet side streets of Santa Tecla are nuns' schools for girls, and boys' schools operated by monastic orders. One of the latter, that of the Salesians, excells in teaching crafts, as the school's tannery and cabinet shop attest.

The first duty of a Latin-American girl is to be a good wife and housekeeper. Most of them are both, and they run a house with the efficiency of a modern factory.

One of the most popular courses in the Instituto Bethania (page 603) is the household-management course. Girls taking it operate a model household, supervise the kitchen, cook, market, and sew.

Girls in the nuns' schools may be day students or live in. Though the curriculum is modernized—even commercial studies, such as shorthand and typewriting are included—the gentler arts, hallmark of the lady in the Old World and in early America, are still stressed.

I saw paintings and skilled repoussé work done by students, and particularly exquisite needlework.

One girl had done the family coat of arms in thread of gold on red velvet with such fine stitches that I had to use a magnifying glass to see the threads.

When I think of Santa Tecla, I think of those quiet side streets, with long queues of demure girl students, in their neat uniforms and off-the-face hats, filing down the street, accompanied by black-clad nuns with folded hands and downcast eyes.

I think, too, of its brisk climate (it is 2,600

feet above sea level) and its Araucarian pines, looking like Christmas trees with stiff upturned brushes for branches.

It is hard to think of hilly Santa Tecla as a seagoing town, and its quiet does not connote industry. Nevertheless, it is both: head of a department with an important seaport, La Libertad, just 45 minutes away by road, and a place of many factories, where soap, candles, and tanned hides are produced.

Flowers Grow on the Volcano

From the laboratories of the Coffee Association behind Santa Tecla, a winding road leads to the top of San Salvador Volcano. Driving up one day, I met women descending on foot and on donkey-back. These women wear loose blouses and voluminous colored skirts, which form one of three typical Salvadoran costumes. The other two types come from the Izalco region and the town of Panchimalco, near the capital (Plate IX).

These women came from the flower and vegetable gardens high up on the mountain. Carnations, lilies, daisies, and geraniums flourish in terraced gardens, and every morning women carry basketloads on their heads down to the markets of San Salvador (Plate XV).

At the end of the auto road there a white stone-bordered path climbs among flower terraces to a little kiosk and lookout. From here I looked down into the dizzy depths of the enormous mouth of San Salvador Volcano. The mountain is squat, with a deep, straight-sided crater; trees and shrubs now clothe the walls of the tremendous cavity. From the crater floor, 1,640 feet below, rises a small, perfectly formed, gray cinder cone.

Until 1917 there was a lake in the main crater. For 258 years the volcano had shown no signs of activity. Trees grew on the walls; hardy excursionists climbed down into the volcano and sailed rafts on the big lake.

On the night of June 7, 1917, earth temblors shook San Salvador. These increased in violence until they assumed the proportion of a major earthquake. The earth heaved up and down, and even moved with a nauseating rotary motion; buildings were thrown down, fires started, and people were killed and injured.

Next morning several flank craters were seen to have opened on the far side of San Salvador Volcano. From them lava flowed and spread a gigantic black tongue down the mountainside, cutting a railway line in its creeping progression.

Three days later the lake in the crater began to boil. For days clouds of steam hid it, and by the end of June the lake had entirely *boiled away*, as a saucepan of water does when it has been left on the fire too long. From the now-dry floor of the crater incandescent lava, bombs, and other ejecta burst forth, and red-hot columns of material shot high into the air, almost to the rim of the main crater.

The awesome spectacle continued with decreasing violence until November. People got used to it and little refreshment stands opened on the rim of the volcano. Here spectators sat and sipped beer while they watched the fireworks.

Earthquakes that accompanied this eruption laid waste a great part of the capital.

Precious Wood in Volcanoes' Mouths

Only the symmetrical cinder cone remains in San Salvador Volcano, a goal for energetic sight-seers. The mighty mouth is silent now, save for the dull blows of woodsmen's axes that echo out of the green cavity, for El Salvador has a problem unique in Central America: deforestation. Its many people and much farming have so denuded the country of timber that wood must be sought even in the mouths of quiescent volcanoes.

So much timber has been cut for fuel and building that virtually no first-growth trees of any size are left. Big trees grow on the coffee plantations, of course, but they are left standing to give shade to the coffee.

There is still one area of the country that has a good stand of trees, however. These are too valuable to cut wholesale. They are the balsams growing along the strip called the Balsam Coast, between the ports of Acajutla and La Libertad.

These trees produce the medicinal "balsam of Peru." The misnomer annoys the Salvadorans; it probably started when almost everything from the Spanish colonies was shipped to Spain via Peru.

Known to every pharmacopoeia, balsam of Peru is used in many localities as a cicatrizer, antiseptic, ingredient of cough syrups and throat lozenges, and in soaps.

The true balsam originally grew here. When transplanted, the tree does not yield the amount and quality of balsam extracted in its original home.

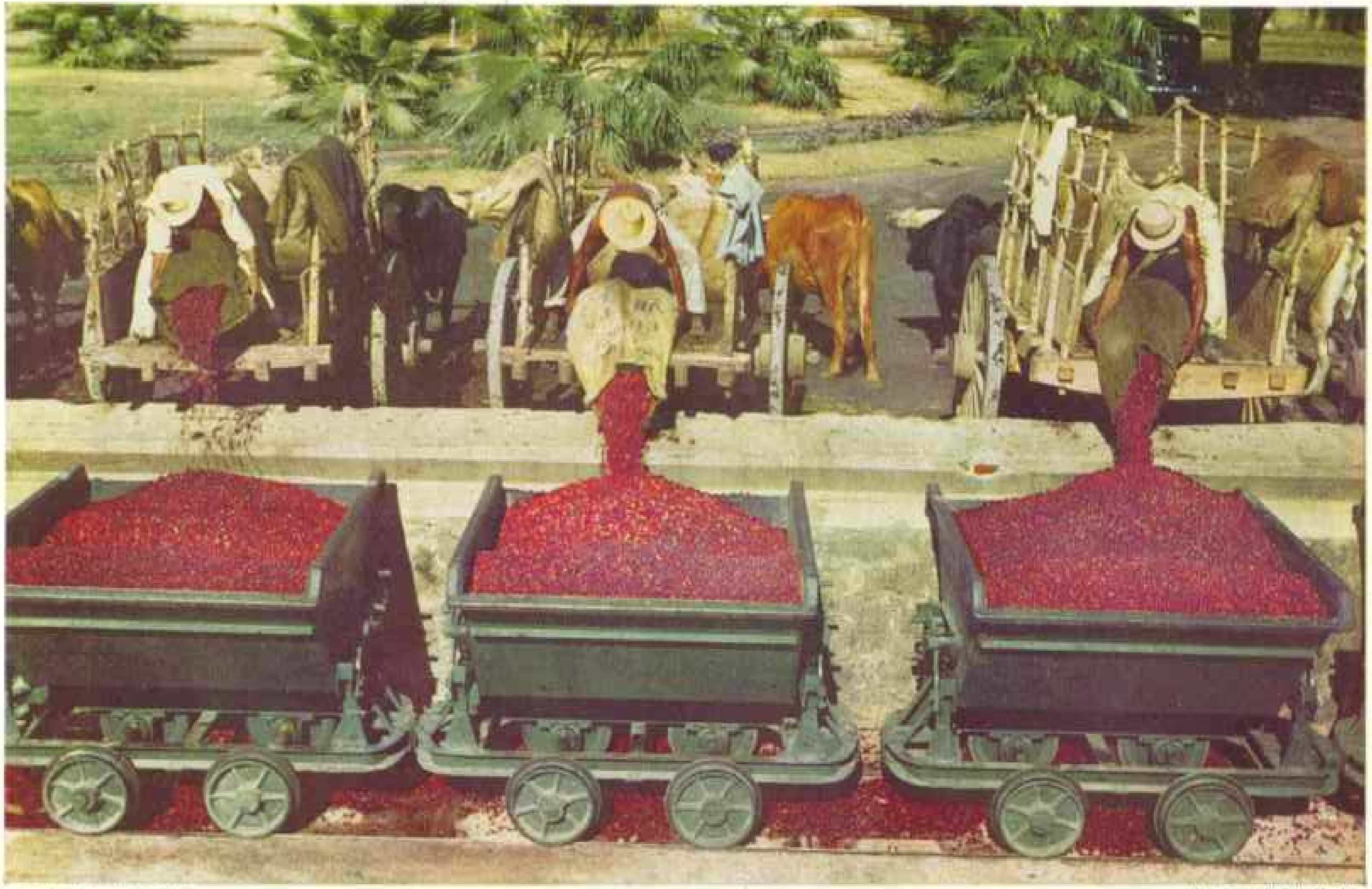
Unlike our balsams of Canada and Maine, the Salvador balsam (*Myroxylon pereirae*) is not a conifer. It reaches a height of 50 feet or more and grows in hilly country up to 1,000 feet in altitude.

The tonic air in a balsam grove has a delicate vanilla odor, overlaid with a pungent sweetness.

Kodachrome by Luis Marden

Aromatic Highland Coffee Is Literally El Salvador's "Grain of Gold"

Salvadorans call the bean by this name because it has brought prosperity to their little nation. Coffee accounts for 90 percent—about $14,000,000 annually—of the Republic's exports. Here a picker near Santa Tecla selects ripe red berries, called "cherries" in Spanish. Green ones will ripen and be picked in a few days.



Kodachrome by Luis Marden

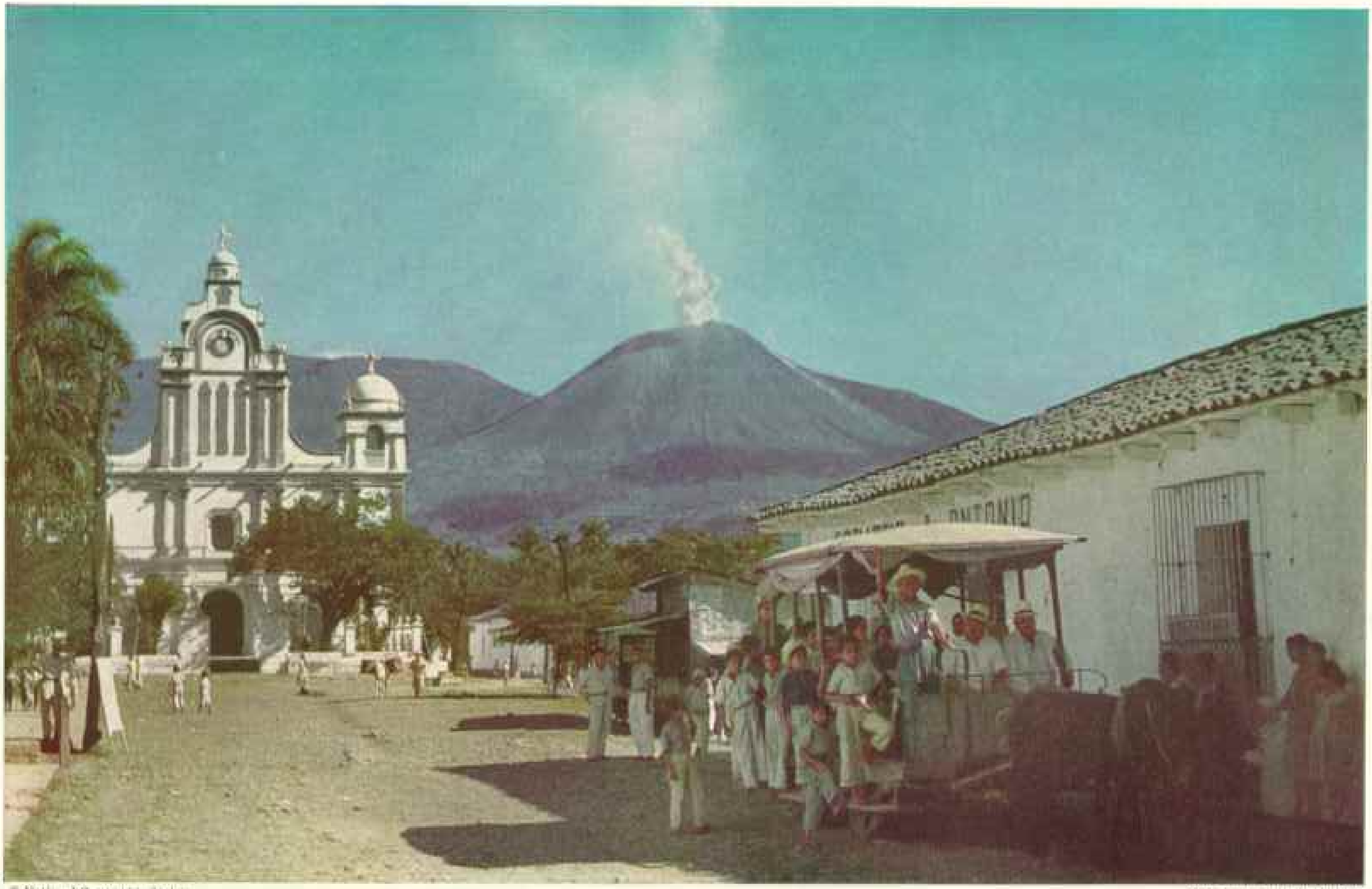
Glossy Coffee Berries Arriving at the Mill Look Like Cranberries from New England Bogs

Ripe coffee is brought by oxcart, truck, and train to El Molino, one of the world's most up-to-date coffee mills. Near Santa Ana, El Molino processes more than 100,000 bags each season. Berries go to depulpers, where outer covering is removed. Beans are then fermented, washed, and dried by sun and artificial heat.

Kodachrome by Luis Marden

Five Million Cups of Coffee Are Spread in the Sun to Dry at El Molino

Furrows are frequently changed to parallel the sun's rays, so that heat may reach all beans evenly. After two to three days in the sun, coffee is picked up by vacuum hose. Further drying by artificial heat, hulling, and culling complete the process. Coffee is harvested at Christmastime in El Salvador.



Kodachrome by Luis Marden

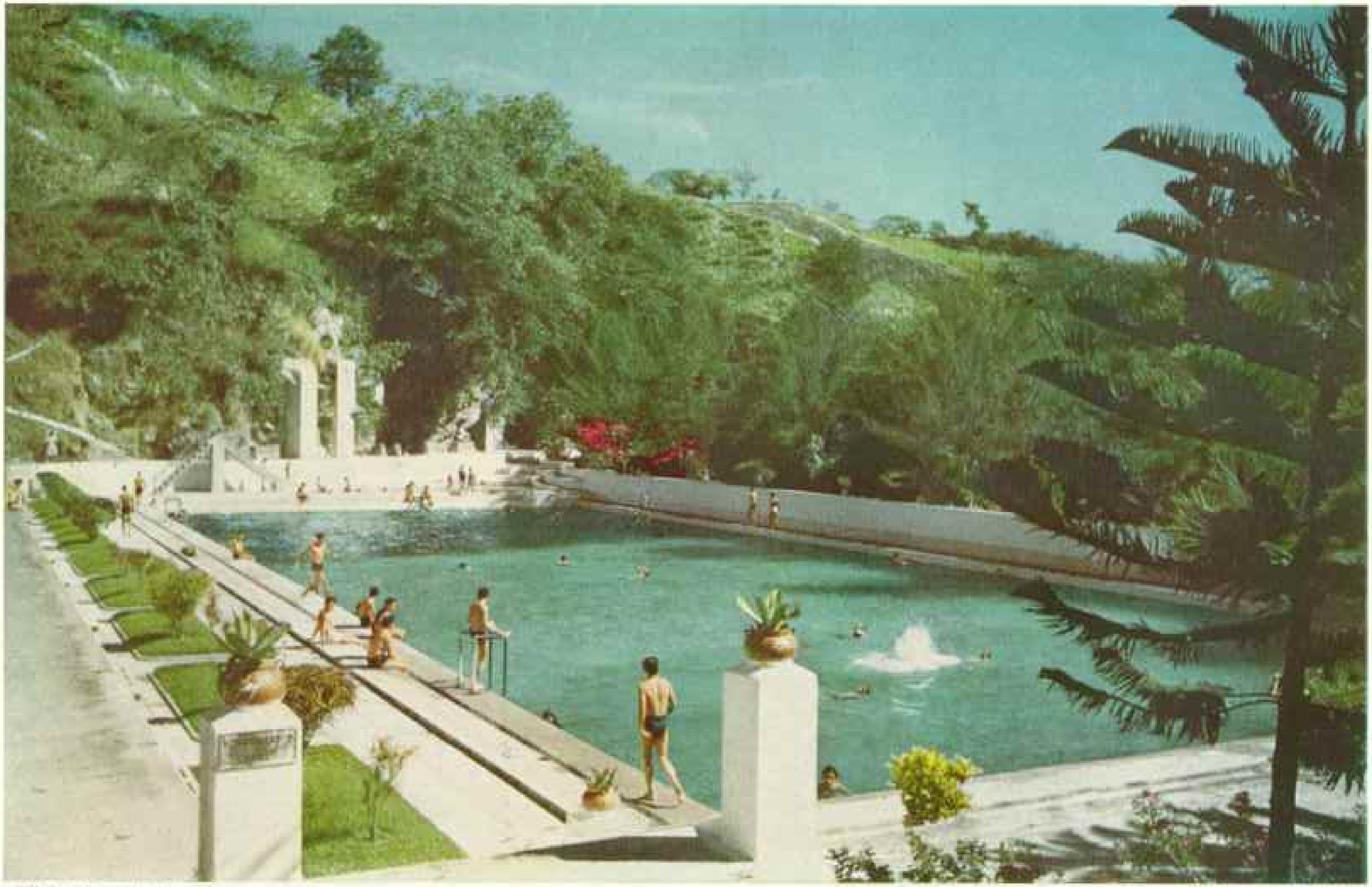
"A Pillar of Fire by Night," Izalco's Volcano Spouts Steam and Ash by Day

For nearly two hundred years the "Lighthouse of Central America" has erupted so regularly that ships sailing along the Pacific coast can tell their positions by it. Residents of Izalco are unconcerned at the accustomed spectacle (Plate XVI). The mule-drawn tramcar runs between Izalco and Sonsonate.

Kodachrome by Luis Marden

Instead of a Cake with Candles, This Salvadoran Child Celebrates Her Birthday with a Candy-filled *Piñata*

Traditional in Spanish-speaking countries is the earthen jar decorated with colored paper and filled with sweets. The blindfolded youngster tries to break the thin-walled jar with a blow of a stick, while the man at right works the piñata up and down with rope and pulley. When jar bursts, children scramble for sweets.



Kodachrome by Luis Marden

Public Swimming Pool of La Chacra in San Salvador Is Fed by Warm Springs

Volcanic El Salvador possesses many warm, hot, and cold springs. This pool, on the outskirts of the capital, is a popular week-end spot. Anyone may swim by paying ten centavos. There are dressing rooms, showers, and a dance terrace. Springs well directly up from the floor of the basin.

Kodachrome by Luis Marden

Red-leafed Poinsettias Are Christmas Flowers in El Salvador, Too—El Modelo Park

The inconspicuous true flower is green and yellow, the red "petals" are really leaves. Called *flor de Pascua*—Christmas flower—in El Salvador, the poinsettia was named in this country for Joel R. Poinsett, of South Carolina, appointed in 1825 first United States Minister to Mexico.

Below Cuscatlán Bridge a Fisherman Casts His Net for Four-eyed Fish

Eyes of these queer fish, which swim in schools near the surface, are split into two pairs. Upper pairs stick out of the water like twin periscopes and look for floating food; lower pairs watch for underwater enemies. The suspension bridge carries the Pan American Highway across El Salvador's largest river, the Lempa.

Kodachromes by Luis Marden

Oxcarts Look Incongruous on the Macadamized Pan American Highway in El Salvador

Near San Miguel the road runs straight for 9 miles and passes through henequen (sisal) fields (Plate XVII).

Kodachrome by Luis Marden

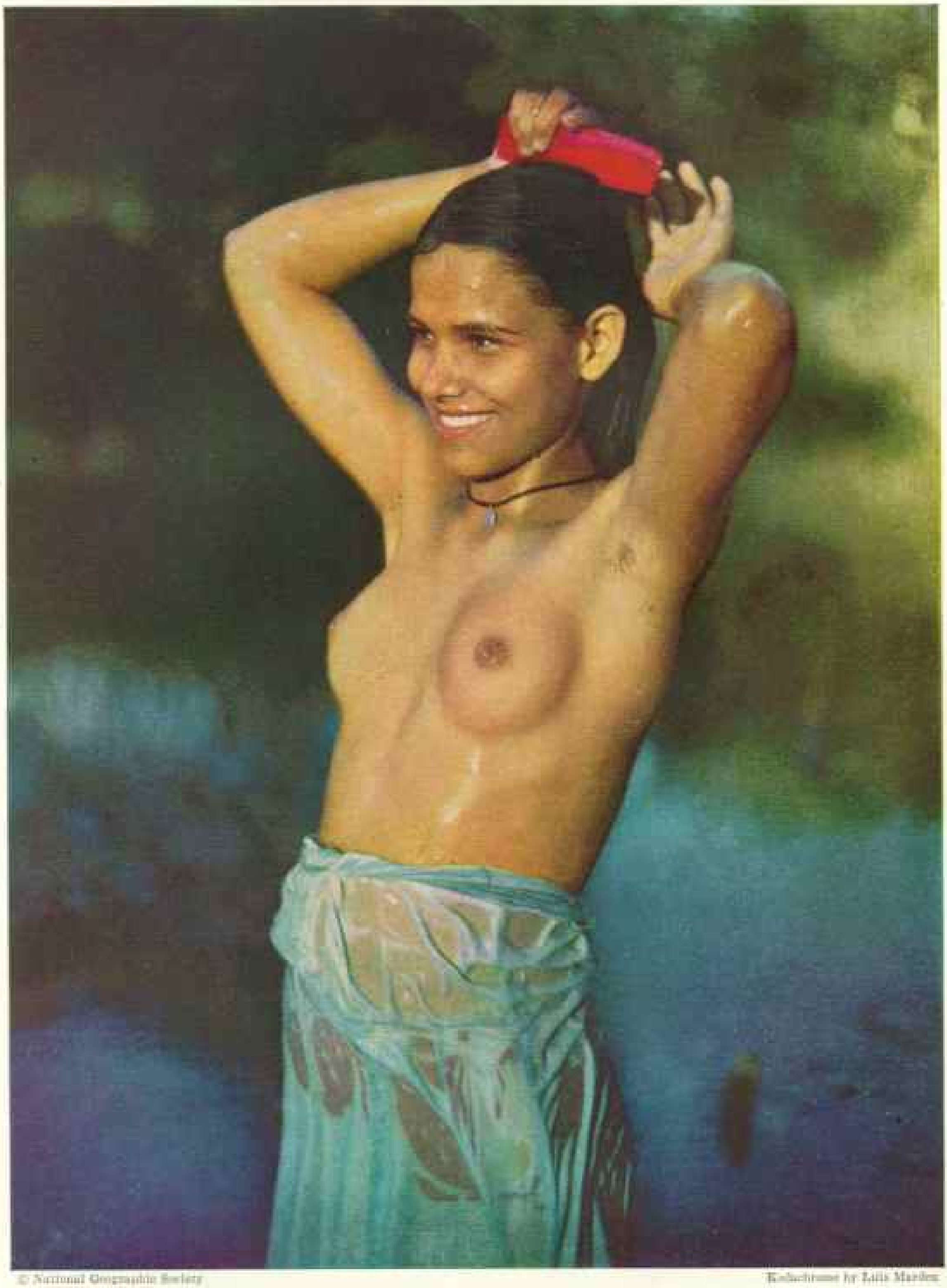
Panchimalco's Costumes and Colonial Church Are Monuments to El Salvador's Past

Only in this town near San Salvador and in two other regions of the Republic do original costumes persist as everyday dress. These women leaving church wear heavy necklaces of Spanish coins some two centuries old. People of Panchimalco speak a Nahuatl dialect as well as Spanish.

 Kodachrome by Luis Marden

Balsam of Peru, a Healing Medicament, Comes Principally from El Salvador

The misnomer was acquired in colonial times, when balsam was shipped to Spain via Peru. The broad-leafed tree, *Myroxylon pereirae*, is not a conifer. Balsam is used to dress wounds and to treat skin and throat ailments. Here a gatherer beats bark with burning fagots to stimulate flow of balsam from tree.



 Kodachrome by Luis Marden

Her Work Finished, a Country Lass Bathes in the Sucio River

Near Sitio del Niño the author happened upon a group of laundresses, unconcernedly bathing and doing the family wash. Though this pretty laundress of 15 lived not far from San Salvador, she had never been to the capital. At night, river dwellers capture four-eyed fish in the stream with cast net and torch (Plate VIII).

Kodachrome by Luis Marden

Youth and Beauty Parade through Santa Tecla Streets on Christmas Morning

Floats, fairs, and general merrymaking mark the holiday season. Prizes are given for the best floats and most original costumes. Santa Tecla, higher and colder than San Salvador, was for a time the capital of the Republic, and many prominent families built large homes there.

Kodachrome by Luis Marden

Salvadoran Children Dress Up for a Procession on the Day of the Indian

On December 12, feast day of the Virgin of Guadalupe, her image is carried in procession from San Salvador to a chapel at La Ceiba, on the outskirts of the city. On this day costumes of the Indians of El Salvador and neighboring countries are worn; youngsters wear them in the street, and their parents at balls.

Song and Dance Are Part of the Curriculum in Salvadoran Schools

Grade schools have children's theaters in which plays, dances, and allegorical pageants are performed. This one represents a rural wedding, in which each guest, as well as the bridegroom, dances with the girl of his choice.

Kodachromes by Luis Marden

Famed for Their Sleeping Mats Are the Women of Nahuizalco

The *petate*, or sleeping mat, is made of tule, a rush that is dried, split, and woven into mats that are also used as floor coverings. Woman at left splits stalks from bundles of whole rushes in background.

 Kodachrome by Luis Marden

City Girls Dress as Volcano Dwellers on the Day of the Indian

Flowers for the San Salvador markets are cultivated high up on the San Salvador Volcano. *Volcanēas*, or volcano-ites, dressed like these two holiday makers, bring the cut blossoms down to the city in the early morning. Carnations, lilies, geraniums, daisies, and a dwarf poinsettia are grown on the highlands.

 Kodachrome by Luis Marden

Izalco Thrusts a Half-clenched Fist into the Salvadoran Sky

The dust-laden gas cloud of the volcano assumes fantastic shapes when seen from an El Salvador Air Force aircraft. Constant activity for nearly two hundred years has kept the sides of the volcano bare of vegetation. Black V on cone's flank is congealed lava (Plate IV).

I watched the trees being tapped in much the same manner that they have been worked from pre-Conquest times. First, the bark was beaten all around the trunk except for a narrow strip left intact. After several days, if the bark does not break open of itself, it is cut and stripped away. Cloths are laid over the wound and the edges tucked under the bark surrounding the opening with an implement like a putty knife.

Several days later the cloths, now stiff with dried exuded gum, are stripped away and placed in a kettle of boiling water. Foreign matter and water rise to the top of the vat; the balsam remains at the bottom.

To hasten the flow from the tree, the tapper heats the bark above the wound with a bundle of burning balsam-wood sticks bound together like fasces (Plate X).

The finished product, a thick syrup of a reddish-brown to black color, smells like vanilla and has a bitter taste.

Chemically, El Salvador balsam is a complex mixture. It contains chiefly cinnamein, (50 to 60 percent), a substance that is the principal agent in its curative properties. In addition to its antiseptic and healing qualities, balsam also finds use in perfumery. Builders and cabinetmakers highly prize the heavy beef-colored wood of the balsam tree.

Izalco, "Lighthouse of the Pacific"

The principal volcanoes of El Salvador, part of the Central American chain, lie in a line so straight that a ruler laid on the map passes through most of them. So many firespouters, active and quiescent, dot the Republic that Salvadoreños have nicknamed their country "Daughter of Fire."

Most famous of the active ones is legendary Izalco, long known to mariners as the "Lighthouse of the Pacific." This mountain regularly erupts every few minutes. It has been doing so, with occasional lapses, since 1770, when the volcano first broke through the side of the parent cone, Santa Ana (Plates IV and XVI, and page 579).

Izalco has been likened to a lighthouse because the regular flare of its eruptions can be seen from the Pacific. Only 20 miles inland from the port of Acajutla, Izalco has been used as a beacon by mariners making for that port.

I first saw Izalco from the San Salvador-Santa Ana road. Descending a steep grade, we came into a flat plain across which the road ran straight as a bowstring. Far to the left bulked squat Santa Ana, 8,300 feet high and highest peak of the Republic. From its left flank rose a dun-colored cone dwarfed by the parent mountain. The cone looked like a big sandhill at that distance, entirely devoid of vapor or any sign of activity. I was disappointed.

"Are you sure that is Izalco?" I asked my traveling companion who had pointed it out to me. He smiled and said, "Have patience," with utmost confidence in a show of Nature that has scarcely failed to perform on schedule for nearly two centuries.

The sun had just set. As we watched, suddenly an inky pall shot with astonishing speed from the top of Izalco, billowing upward and spreading into a mushroom-shaped blob of black against the lemon-yellow sky. It was as if some monster squid had shot a cloud of sepia into a limpid sea.

For perhaps half a minute the eruption persisted, and the cloud continued to rise and spread. As the force spent itself, however, the prevailing wind blew the cloud of dust and gas to one side and dissipated it. Finally only a thin vapor remained to one side as evidence of the mountain's sudden awakening.

During the several subsequent times I saw the volcano, the eruptions were spaced almost exactly eight minutes apart. A friend who once watched it with me remarked, "Looks as if the devil was lying on his back under there and puffing on his pipe."

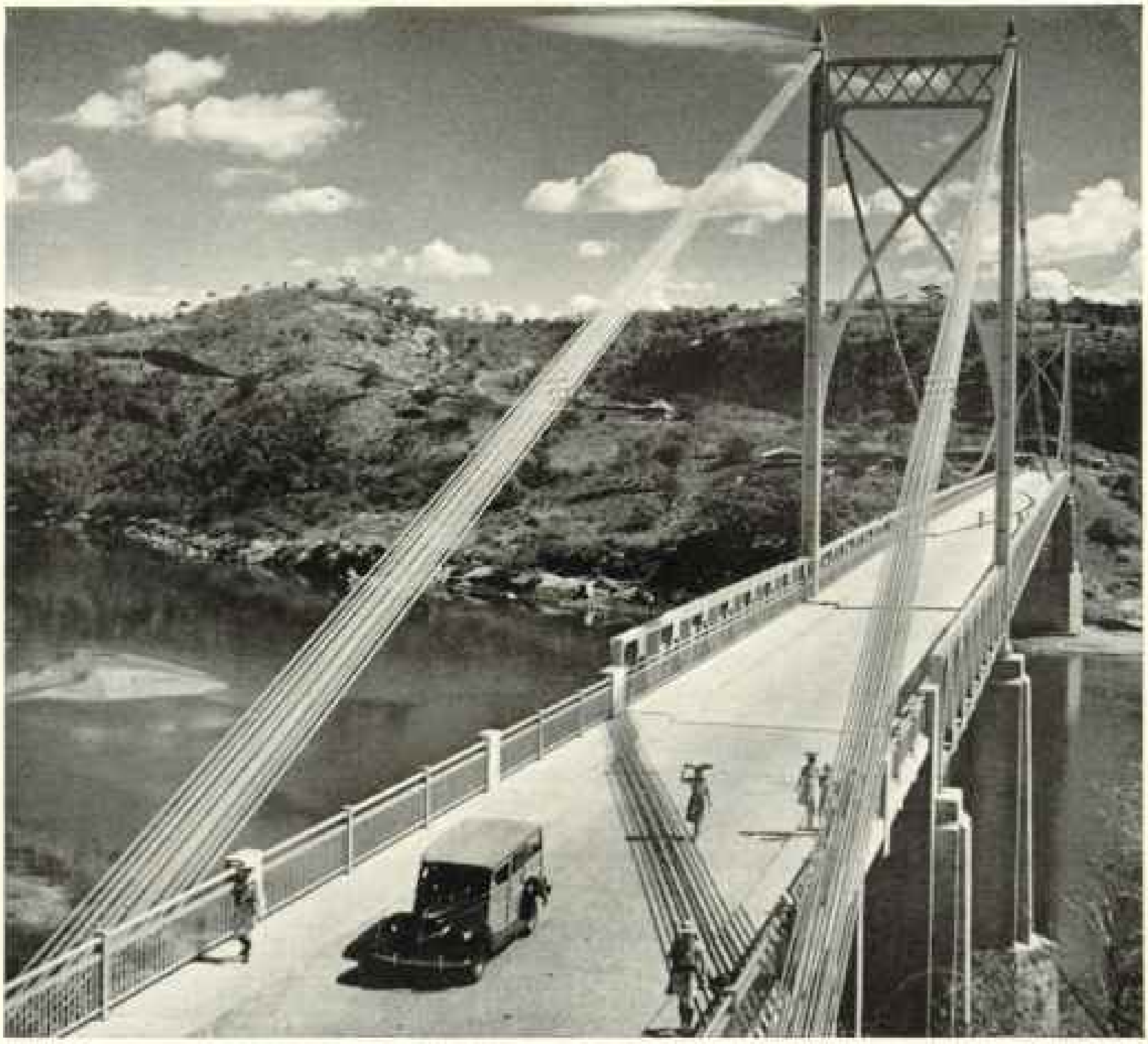
The town of Izalco lies almost at the foot of the mountain. People here pay no attention to the growling of the volcano, even though at each explosion a dull report and rumblings can be heard. They say that particularly violent explosions foretell changes of weather. For centuries people have said this of Etna in Sicily and of practically every active volcano in the world. Scientists are not so sure.

A Mountain "Bathes Itself in Fire"

From a rudimentary road high up on the mountain's skirt I watched eruptions one night. The mountain hulked dark and cold, faintly outlined against the starlit night, when all of a sudden a red flower of fire seemed to unfold at its peak and scatter a golden pollen on the mountainside. After the heavy boom of the main explosion I heard a faint crepitation, as of distant rifle fire. This was probably caused by the falling incandescent bombs striking the side of the mountain.

Local people say the mountain "bathes itself in fire," and this it does literally. Every so often a particularly large glowing bomb would strike something as it came caroming down the slope and burst in a red-gold shower.

When the ruddiness died away, the myriad stars of the clear Salvador night seemed steel-blue by comparison.



Cuscatlán Bridge Spans the Lempa, El Salvador's Biggest River

This graceful suspension bridge hums like an aeolian harp when a norther blows through the taut cables (Plate VIII). In the foreground, police of the National Guard patrol their beat. This national police force was organized in 1912 by an officer of the famous *Guardia Civil* in Spain. Its members always work in pairs.

Izalco town is divided in two: the Spanish town, and the Indian. In this region dwell the last pure-blooded Indians of the country. They are of the Pipil nation, and speak a dialect of Nahuatl, language of the Aztecs of Mexico.

Women dress in a wrap-around sarong type of skirt and a loose blouse. Often the skirt, particularly in Nahuizalco, a small village near Izalco that produces famous *petates*, or sleeping mats (Plate XIV), is woven by the women of the village, but more often it is bought from traveling salesmen who come down from Guatemala. In fact, the whole costume is similar to that worn in some Guatemala villages.

The Indians of Izalco are very devout and have many religious brotherhoods. Each has its patron saint, the image of which is kept in the home of the head of the brotherhood; each year it is taken out in procession on that saint's day.

Indians Cling to Original Dress

Women of even the more modernized villages cling stubbornly to their sarong skirts. "I will not put on a round skirt," they say, speaking of the conventional woman's dress.

When I took off in a military airplane from Ilopango airport, near San Salvador, I flew over Lake Ilopango. A volcano under the lake keeps jack-in-the-box islands popping up and down in it.

Over Santa Tecla and past bulky San Salvador Volcano we flew towards Izalco. At the foot of Santa Ana Volcano we saw the flat blue plate of the crater lake of Coatepeque, favorite vacation spot of Salvadorans. The

Honor Students Receive Prizes on Commencement Day in Santa Tecla

At the Instituto Bethania, a girls' school conducted by an order of nuns, prizes are given for scholarship, deportment, and proficiency in specialized fields. An older girl at the left wears an honor ribbon inscribed "Application"; the youngster standing at extreme right holds a book entitled *Pulgarcito*, or "Tom Thumb." Commencement is in November (page 583).

water of the lake is supposed to be medicinal; bottled Coatepeque water is sold all over the country. Salvadorans say that drinks mixed with it leave no hangover.

As we approached Izalco, the pilot spoke on the interphone from the front cockpit. "Don't expect to see a crater on Izalco; it hasn't any."

"But it must have one," I insisted. "Where does all that stuff come from?"

"I mean," the lieutenant explained, "it doesn't have one in the conventional sense. But take a look for yourself."

He banked steeply. Nearly below us lay the dun cone of Izalco. I stared into a shallow cup-shaped depression at the top of the mountain. It looked exactly like the excavation made by an ant lion, enormously magnified. I could see no sign of an opening or crevice anywhere.

As I watched, the eruption began. A cloud of gas and dust shot upward out of the center of the shallow crater and rolled up to an altitude of nearly a thousand feet. We circled, but not too close, as sometimes fragments of considerable size are thrown out.

When we banked on the downwind side, we passed through the frayed plume blown out by the wind. It was evil-smelling. Most eruption clouds contain hydrogen sulphide, which has the typical odor of bad eggs.

We felt a big bump, too, as the aircraft entered the rising hot air of the cloud, then dropped heavily down into the cold air on the other side.

When the cloud had cleared, the crater floor

Costumed Crowds Carry the Virgin of Guadalupe in Procession

On December 12 the image is taken to the capital's Basilica, towered church silhouetted against the horizon. On this day young women and children dress as Indians and carry baskets laden with fruits, vegetables, and flowers, especially poinsettias (Plates VII, XIII, and XV).

looked as solid and as innocent as before. I suppose the vent of the volcanic pipe is concealed under fragments of lava. They look like coarse gravel from the air, but actually are large; probably the force of the explosion blows them aside, and afterwards they roll back into place.

Izalco still keeps that secret, but I did get a series of photographs showing the complete eruption cycle (page 579).

Rarely do lava flows issue from the main crater. Just below the top there is a V-shaped black area; this marks the line of lava that almost continuously issues from a bocca, and glows red at night (Plate XVI).

In the past, several big lava flows have spread disaster. From the airplane we saw many tongues of cold wrinkled lava of various shades spreading from the base of the mountain. One rugose gray feeler had groped its way nearly to the town of Izalco, but so far no flow has actually reached it.

The Four-eyed Fish

A few weeks before coming to El Salvador from Nicaragua I had caught fresh-water sharks in Lake Nicaragua for the United States National Museum. In El Salvador now I heard of another queer fish—the *Anableps*, or four-eyed fish (page 606).

A Former Ruler Crowns Nena, Coffee Queen of 1944

Coronation of the queen, selected by popular vote, takes place at the Coffee Ball, held at the Casino Juvenil in San Salvador. Nena, former queens, and candidates for the title sit on bales of henequen, fiber from which coffee sacks are made. Girls' Indian costumes are decorated with coffee leaves, flowers, and berries (page 607).

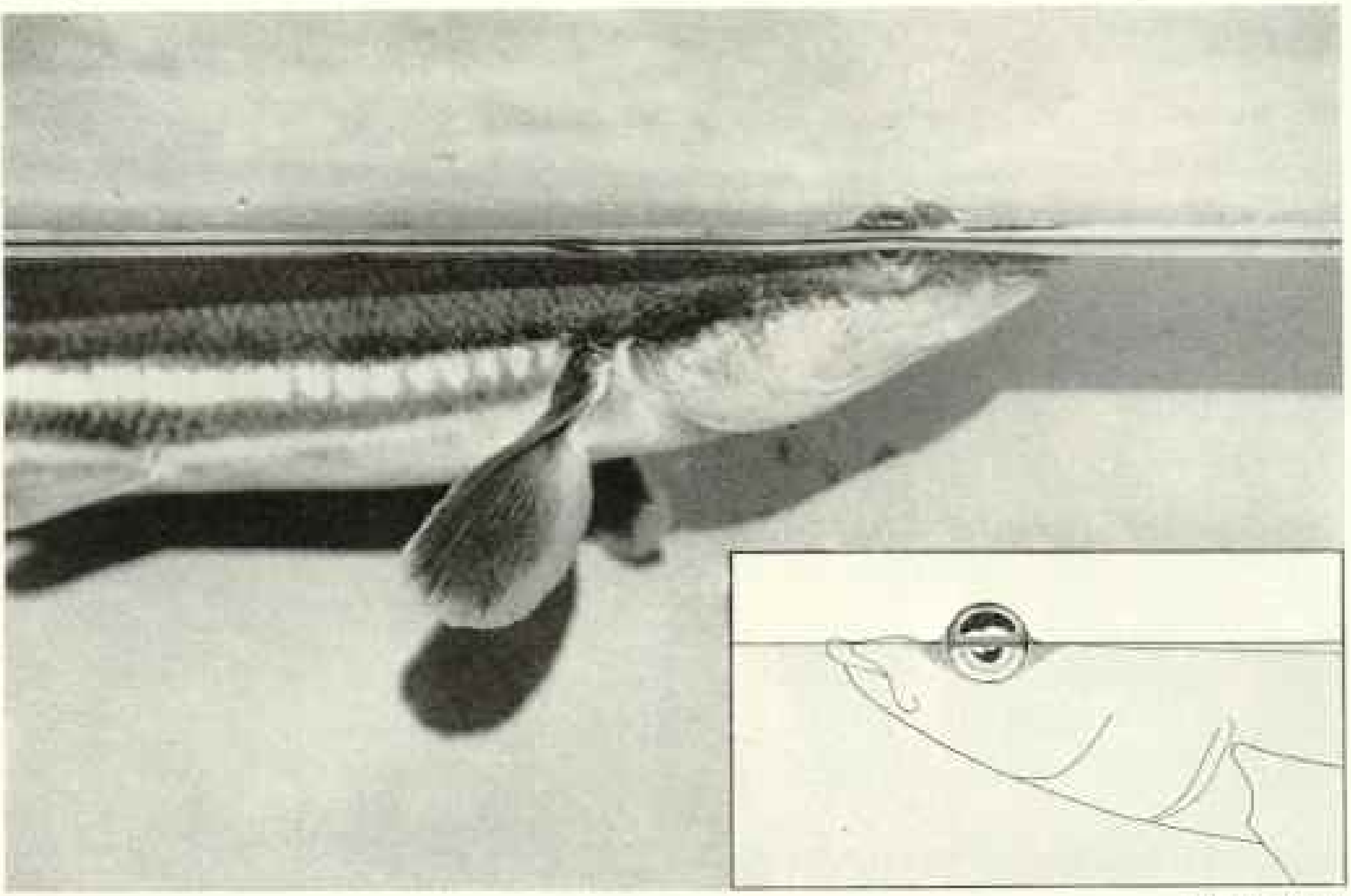
I had seen drawings of this amazing creature, but never one in the flesh. It is found in many rivers and lakes of Central America, but I saw my first in the Lempa River, under the Cuscatlán Bridge.

This graceful suspension bridge carries the Pan American Highway over the Lempa, between San Salvador and San Miguel (Plate VIII).

The Anableps (from Greek *anablepein:* to look up) almost always swims at the surface, at the "flower of the water," as they say in Spanish. Its pop-eyes are divided into halves —a lower pair for underwater vision and an upper for seeing in the air. As it swims, the Anableps has its upper eyes out of water like twin periscopes, looking for floating food, while the lower eyes scan the subaqueous world for enemies.

A local fisherman who was using a cast net under the bridge volunteered to catch some for me. After he had cast his net unsuccessfully several times at schools of fish swimming near the shore, I asked him chaffingly why he did not catch one.

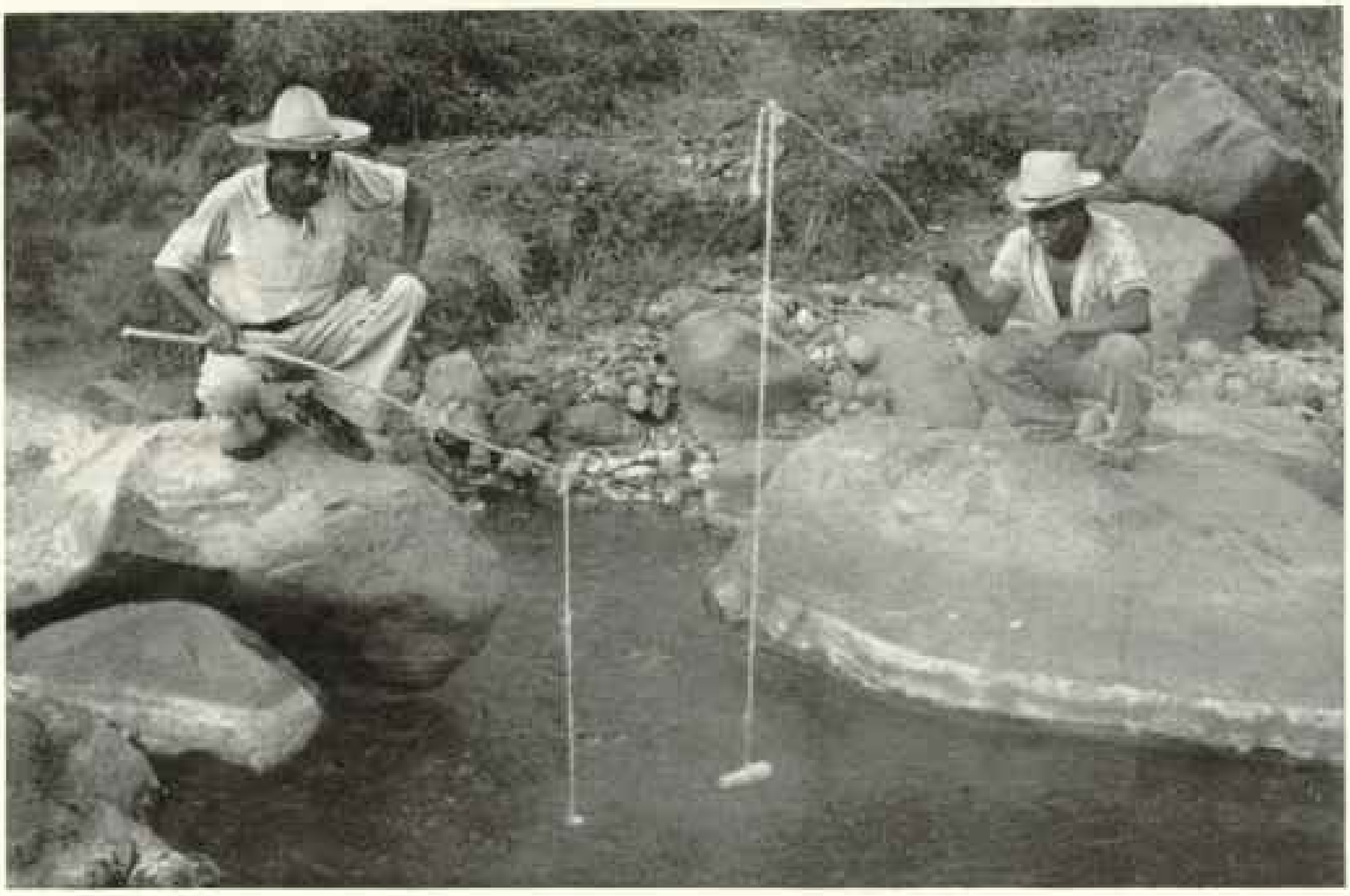
"But, señor," he said reproachfully, "you do not understand; those animals have *four* eyes!"



Mrs. A. M. Asti

Nature's Miniature Submarine, the Four-eyed Fish, Has Twin Periscopes

Each bulbous eyeball of *Anableps dowei*, the four-eyes, is divided in two. The upper part, adapted for air vision, projects from the water to scan the surface for floating food; the lower eye looks for submarine enemies. Difference in focus is compensated for by bifocal lenses. Lacking eyelids and tear glands, Anableps must constantly dip its eyes under water to keep them moist (page 604 and Plate VIII).



What's Cooking? Eggs and Corn in Hot Springs Near Ahuachapán

The *cuatro-ojos* swims with an eel-like undulation, in schools close to shore. When alarmed it jumps away in a series of leaps along the surface, like those of a flying fish without the soaring. Sometimes they will dive when frightened, but they soon rise to "periscope depth" again. As they swim, something in their eyes gleams with a silvery radiance so bright that it makes the froglike eyes look luminescent even in bright sunlight.

The four-eyes of El Salvador (*Anableps dowei*) averages about six inches long, but I have seen one specimen more than a foot in length. It is a creature of fast, highly aerated water, and soon dies if kept in an aquarium without running water.

Dr. Leonard P. Schultz, Curator of Fishes at the U. S. National Museum, says: "This fish has one of the most amazing eyes of any living creature. Though called four-eyes, actually the fish has only two, each divided in half. The interesting thing is that the part which protrudes from water is adapted for vision in air, just as our eyes are; the underwater pair is shortsighted, as with ordinary fish eyes."

Daughters Dance under Mother's Watchful Eye

At the Coffee Ball in the Casino Juvenil of San Salvador, guests wear Indian and peasant costumes. Mothers usually accompany daughters as chaperons (page 605).

Each eye has only one lens. Yet air and water vision require two focal lengths—a short and a long. The eye must be bifocal, like some eyeglasses.

Fishes do not have muscles to change the shape of the lens for focusing, as do men and some animals. How, then, does Nature solve the problem? By providing an elliptical lens. Air-vision rays pass through the short dimension; water-vision rays through the longer. (The thicker—*i.e.*, more curved—a lens the shorter the focal length.)

What does such a fish see? Does it see its topwater food and underwater enemies simultaneously or separately? No one has been able to ask an Anableps, so we can only speculate.

Some Plants Are "Delicate"; Some "Valiant"

I stopped to talk to some farmers plowing land on the banks of the Lempa. They told me of local beliefs concerning vegetables and fruits.

"Watermelons, sir, cannot stand having a pregnant woman near them. If one approaches, the melons wither on the vine."

"Yes," added another, "the tomato is also delicate: neither a pregnant woman nor a sick man can come anywhere near a tomato plant.

or it will die. Nor a man who has just come from a wake, nor one who has eaten honey. On the other hand, rice and corn are very valiant; nothing affects *them*."

Beans and tomatoes are also among the "delicate" plants, they said.

One youngster at the bridge had a name that puzzled me. When I asked my Salvadoran companion, he laughed.

"You know the country custom of naming children for the saint on whose day they were born? Well, the first of January in the saints' calendar is the day of the Circumcision of our Lord. That boy, being born on that day, was called Circumcision Pérez. They call him Circus for short."

Close to San Miguel, on either side of a straight reach of the Pan American Highway, stretch fields of henequen—sisal—in ordered rows. The blue-green agaves produce a fiber that substitutes during the war for Manila hemp in making rope. Coffee sacks in which Salvadoran coffee is exported are made from nationally grown henequen in a San Salvador factory (Plates XVII and XIX).

Oxcarts that ambled leisurely along this road symbolized San Miguel. They had solid wheels and more elaborately designed yokes than others in the Republic. Everything about San Miguel seems to speak of a greater adherence to older customs and a more leisurely mode of life than do the bustle and modernity of San Salvador (Plate VIII).

Christmas in San Salvador

On Christmas Eve I sat with friends on a hill overlooking San Salvador. The city lay like a tremulous net of lights against the shadowy bulk of the volcano. We were talking of families and Christmas presents.

"My family includes about 260 uncles, aunts, and cousins," said one. "I couldn't think of giving them all something."

"My wife gave a tea for her cousins once, and 60 came," said another.

These are not unusual figures for Latin America, where family ties are carefully maintained through all their ramifications.

As we sat beneath a thatched roof upheld on bamboo poles, we heard music of flutes and drums and children's singing faintly coming up from the road below.

"They are the *pastorelas*," one of my companions said, "groups of children who make the rounds on Christmas Eve, costumed as shepherds, the Wise Men, and others, re-enacting the birth of Christ."

As he spoke, the singing grew louder, and up the hill came a shuffling procession of children in long robes and some with false beards. Most of them carried shepherds' crooks covered with tinfoil that glistened coldly in the moonlight.

They came to where we sat and, forming two lines, began a chant, to which they kept time by shifting rhythmically from one foot to the other.

From the foot of the lines came a little boy and girl, dressed in long robes, the solemn-faced girl leaning on the arm of the boy.

"That is the Virgin," my friend whispered, "leaning on St. Joseph's arm."

With a sigh the Virgin of nine years sat heavily down on a chair brought for the purpose, while St. Joseph (seven years old), his serious little boy's face made stern by a painted black mustache, stood with one hand resting protectively on her shoulder.

One by one, the Wise Men and others came forward to sing to the Virgin and offer gifts to the invisible infant Jesus.

The Herald Angel, a pretty girl of 15, sang, "I bring you, Child Jesus, a little blue boat in which to sail to the western sky."

Another sang, "I offer, Child Jesus, to rock you in your cradle, and to make you a moon-colored dress."

As they finished, the entire company rocked from side to side singing, "He is born, He has just been born."

When the children had sung and recited the entire ritual called for by pastorela tradition (there are several versions, each by a different author), they departed, still singing softly and carrying tapers that flickered in the darkness.

As I listened to the blended voices fading into the night, I thought what a pleasant combination of old and new El Salvador is. I liked El Salvador.

 Kodachrome by David Duncan

Brown Hands Spread Yellow Strands of Henequen, War-vital Fiber, to Dry in the Sun

Hardy henequen, woven into cordage, helps make up the shortage left by Japan's seizure of the Manila hemp plantations. Yucatán's crop binds harvests in United States grainfields. El Salvador's makes sacks for coffee and sugar. Sisal is another name for the fiber.

Kodachrome by David Dunning

Carnival Time in San Salvador Packs a Street with Ferris Wheel, Side-show Tent and Fun Lovers

Frolic follows a solemn religious exercise during the Feast of the Holy Saviour, for whom republic and capital were named. This fiesta is one of the capital's most spectacular. Colorful floats parade, and citizens dress in their finest. On August 5 the image of El Salvador del Mundo (Saviour of the World) is carried in procession.

Kodachrome by David Doubilet

Acres of Henequen Dry on Racks—San Miguel Volcano Mingles Its Vapor with the Clouds

The agave's damp, fibrous skeleton has just been extracted from its pulpy dagger-shaped leaf by the mill (background). North Americans recognize the agave under its alias, century plant. Actually it blooms more often than once in a hundred years. From beverage species Mexicans make pulque, tequila, and mescal.

On the "Curb Market," Vender and Customers Bargain over Limestone

Country folk from limeless areas replenish supplies during San Salvador's fiesta week. A pinch of pulverized lime dropped in a boiling pot softens corn. The flat stones and cylindrical rollers grind corn for tortillas. In many places machines are now used in place of these stones.

 Kodachromes by David Doubilet

Hand on Wall, a Sidewalk Philosopher Watches the World Go By

Baskets, ice-cream wagon, and palm-fiber mats attract the eyes of sidewalk shoppers.

Discarded Packing Straw Cushions the Venders' Bench Below an Iron-bound Window

Grinding stones, of diverse shapes, go on sale near the central market. One pair of feet (left) is clad in *caites*, heavy-soled sandals. Pastel-walled buildings are of one-story earthquake construction. Street sellers supplement three covered markets. From clock tower in background city and suburban buses leave.

Kodachrome by David Hanson

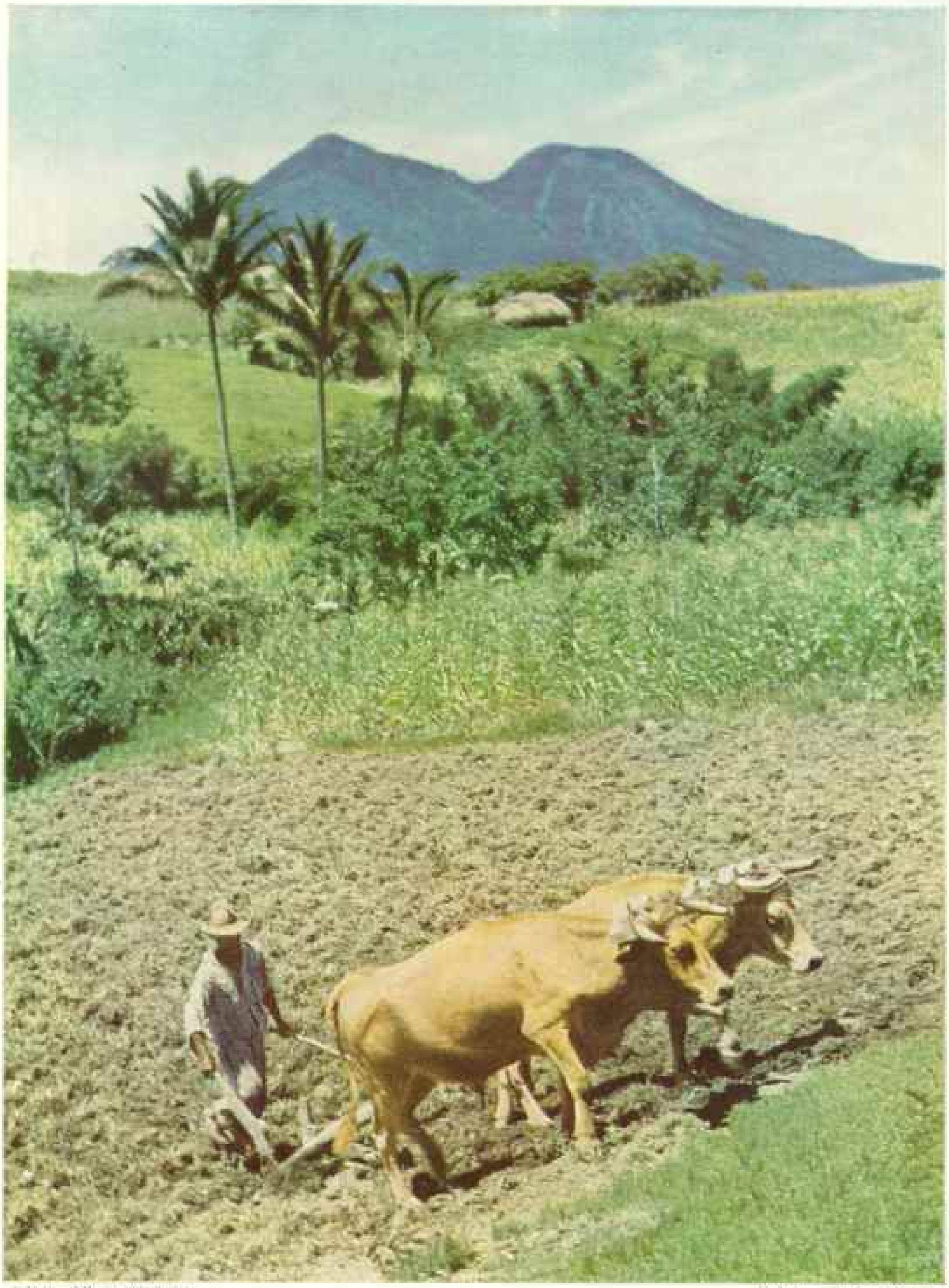
Industrious Road Builders, Salvadorans Hasten Their Volcano-studded Link in the Pan American Highway

Some day this road will carry motorists more than 13,000 miles from Alaska to Buenos Aires. Mountain and jungle sections remain to be cleared. El Salvador's stretch is now passable to the ordinary car in all seasons. Here San Miguel has ceased fuming (Plate XIX). Banana trees flourish by the roadside.

Kodachrome by David Doubilet

In a Fruit Market, the "Edam Cheeses" Are Husked Coconuts, Stoppered for a Quick Drink

Three baskets to the left contain *níspero*, or sapodillas, sweet, brownish fruit of the tree which yields chewing gum's chicle. To the right are granadillas, widely used in making liquid refreshments. Peaches occupy the remaining basket.



 Kodachrome by David Duncan

Like a Dweller on Vesuvius, This Farmer Has No Fear of 7,130-foot San Vicente

Quiescent now, the volcano encourages life, for its eruptions have made the soil mineral-rich. Cultivation is pushed up to its cone. Oxen, here pulling a metal-tipped plow, bear the brunt of a gasoline shortage on the roads. Beyond the palms is the plowman's thatched home. Corn waves in his fields.

Charting a World at War

By William H. Nicholas

With Illustrations by Staff Photographer B. Anthony Stewart

GEODESY, isostasy, terrestrial magnetism, seismology—all have gone to war!

"So what?" exclaims the colloquial layman, who may be unaware that in peacetime such erudite sciences help him go fishing, know his property lines, sail his boat, hear his radio, and drive his car over better roads.

Now the U. S. Coast and Geodetic Survey uses these and other technical weapons to back the bullets and bayonets, the warships and the airplanes, of our fighting men.

Basic weapon of the Survey is the familiar triangle of mathematics—the same triangle which intrigued the ancient Greeks and baffles generation after generation of schoolboys. The Survey even makes triangles of sound waves and measures the angles of the echoes (page 628).

The weapon is applied by intricate calculations in trigonometry and calculus, and utilized in the form of charts, maps, and delicate instruments of amazing precision.

Here are some things this veteran scientific bureau of the Government does to help America's mighty war machine operate:

Charts our coastal waters for the expanding Navy and Merchant Marine.

Compiles and prints aeronautical maps to guide our bomber and fighter pilots to their targets all over the world.

Surveys and charts combat waters.

Explores the earth's mysterious magnetism for many military and nautical uses.

Conducts precision land surveys for establishment of artillery fire-control systems and mine-sweeping controls.

Survey Men at Battle Front

Behind its big scientific words, the Survey's workers see plenty of action.

Coast and Geodetic Survey men were among the first casualties in this war. When the Japanese bombed Manila, seven Survey officers were on duty in the Philippines. With some 200 Filipinos, employees of the insular government, they were surveying and charting the archipelago.

On December 24, 1941, Comdr. George D. Cowie, in charge of coastal surveys in the Philippines, was killed in a bombing raid on Manila. Three officers were captured. Two others escaped to Corregidor and served with the Army until that island stronghold fell.

Two Survey ships, *Fathomer* and *Research*, on duty in the islands, were bombed and either sank or fell into Japanese hands.

All the charts in the Manila office were destroyed. However, as nautical charts were produced or corrected, copies had been sent to the United States. The Washington office has been printing them ever since Bataan.

Coast Survey Commander Decorated

Comdr. William McCaslan Scaife, a Coast and Geodetic Survey officer in command of a Navy survey vessel in the Aleutians, has received the Legion of Merit award.

His ship surveyed hazardous uncharted waters under enemy fire at Attu and Kiska and formed the vanguard of our invading forces.

Many of the exploits of Survey ships now in the Navy will not be known until after the war. Their work is highly specialized and secret.

Congress authorized the first survey of our coasts in 1807, under the administration of scientifically minded Thomas Jefferson. The new bureau was known as the United States Coast Survey.

Later, when the Survey's activities were increased to include a precise nationwide land-control survey, "Geodetic" was added to its name. Geodetic means pertaining to a geoid, or earth-shaped body.

Most compilers of maps do not find it necessary to calculate distances to minute fractions; so they can regard the earth as a perfect sphere. Most surveyors, working in limited areas, do not have to worry about the curvature of the earth.

But for the basic control work of this bureau, knowledge of the exact shape of the earth is essential; curvature and its irregularities must be reckoned with to determine long distances accurately.

The Survey, a branch of the Department of Commerce, began in 1926 to compile and publish the Nation's aeronautical charts, essential to all commercial aviation.

It has piled up vast experience in applying pure science to meet the practical needs of nautical and aerial navigation. Its data have become indispensable to the Army and Navy in planning and carrying out large-scale amphibious and aerial warfare.

Primary wartime job of the Survey is the

Admiral Colbert Directs the U. S. Coast and Geodetic Survey from This Nerve Center

In the shadow of the Washington Monument, he confers with key officers. Left to right: Rear Admiral Jean H. Hawley, Assistant Director; Comdr. Frank S. Borden, Chief of the Division of Charts; Rear Admiral L. O. Colbert; and Capt. Gilbert T. Rude, Chief of the Division of Coastal Surveys. Admiral Colbert is a valued member of the Board of Trustees of the National Geographic Society (page 640). On the wall hangs a portrait of Alexander Dallas Bache, Survey Director from 1843 to 1867.

production of marine charts and aeronautical maps. Go through the Washington headquarters, spread over four floors of the huge Department of Commerce Building, and you will find yourself in a veritable factory. Raw materials to keep turning out charts come from the Survey's field parties. Maps and data sent to Washington are stored in metal tubes 4 feet long and 6 inches in diameter (page 622).

More than two million nautical and sixteen million aeronautical charts, including bomb targets, rolled from the presses in 1943. This meant a 300-percent increase in peacetime personnel of the Chart Division, lengthening of work hours, and training of unskilled employees.

To ensure extreme accuracy, charts are printed by the lithographic process. A huge battery of presses must run day and night to fill orders.

Draftsmen in 1943 made nearly five million corrections by hand on existing marine charts in stock, to keep them up to the minute. The oceans constantly alter features of our shorelines; wrecks create shipping hazards which must be noted; channels are changing all the time.

Nearly 85 percent of a year's production of nautical charts goes to replace older ones which have become obsolete. An out-of-date map is about as useless as last week's newspaper. A charting error may lose a battle or cost American lives.

World-wide Aeronautical Mapping

Airplane pilots at home fly by the Survey's standard series of 126 sectional aeronautical charts of the United States. Some 350 airport charts supply landing data.

Biggest map job came when the Army called for a world-wide program of aeronauti-

Umbrella Keeps the Sun from His Telescope—Comfort Is Secondary

A survey topographic party from the *Corsair* maps Chesapeake Bay (page 621). The officer draws his lines directly on the field chart, resting on the plane table beneath his alidade. The hydrographic group in the boat resorts to old-fashioned hand sounding, for the water is too shallow for a fathometer.

George H. Copeland

A Tombstone in the "Graveyard of the Atlantic"—Cape Hatteras

The wreck of the four-master *G. A. Kohler* is a reminder of the hundreds of ships wrecked by storms in these waters. Nazi submarines took a heavy toll of United Nations' shipping off Hatteras. Ships hugging the coastline had to move some 10 miles out to sea to avoid shoals. Submarines laid in wait for them close in, in deep water. Survey men chart exact positions of all wrecks.

Projection Ruling Calls for Trigonometry and a Deft Touch

This machine draws latitudes and longitudes of exact curvature on sheets for master maps. The penholder runs along the edge of a steel strip. Flow of ink must be steady to keep lines uniform. Setscrews curve the strip to the proper arc.

cal charting. On that project the Survey now works at top speed.

Innovations cut the time of new chart compilation by half without lowering cartographic quality.

For example, a precise mechanical projection-ruling machine, developed by Survey engineers, rules off curved latitudinal and longitudinal lines for some 300 projections. This machine, operating 24 hours a day, works for Army and Navy mapping agencies too.

Four branches of the Coast and Geodetic Survey gather technical data for the charts. These are the Divisions of Coastal Surveys; Tides and Currents; Geomagnetism and Seismology; and Geodesy.

Without help from another branch, the Division of Instruments, these groups could not function. Field parties obtain accurate information only by the use of intricate precision instruments.

Welding these five Divisions into a vast and efficient war machine has been the job of the Director of the Survey, Rear Admiral Leo Otis Colbert.

The Division of Coastal Surveys started the never-ending job of charting our coastline in 1807. In early days our entire seaboard was the Atlantic coast, from Maine to Georgia. Now, including our island possessions, we have about 111,000 miles of shoreline.

From these shores, Survey ships map the ocean floor to the edge of the continental shelf, sometimes 100 miles at sea. Configuration of the floor is as much an aid to the navigator of a big ship, with modern depth-registering devices, as outstanding landmarks.

The ocean floor has its own submerged hills and valleys. The navigator's instruments tell him when he passes over them. If they are accurately charted, he knows exactly where his ship is.

I saw Coastal Survey men at work when I visited the *Corwin*, newly acquired Survey ship named in honor of the Commander who lost

When Our Bombers Go Back to Tokyo, This New Chart Will Guide Them

A war-schooled cartographer of the Survey's Aeronautical Chart section is accentuating bombing objectives on a film positive. When the chart is completed it will be overprinted with concentric circles. The heart of Tokyo will be the "bull's-eye." Last year more than 17 million aeronautical charts rolled from the Survey's battery of lithographic presses.

his life at Manila. Coastal surveying methods used on the *Cowie* never were dreamed of by Survey men a generation ago. Radio and aerial photography have revolutionized the gathering of data for nautical charts.

Formerly topographic parties put ashore in a small boat with a plane table to chart all shorelines (page 619). Now a 9-lens air camera, designed by the Survey, photographs most shorelines. Topographic parties supplement the camera's work, rectifying details and plotting control points. The big camera can photograph more than 300 square miles in a single exposure from an altitude of 20,000 feet.

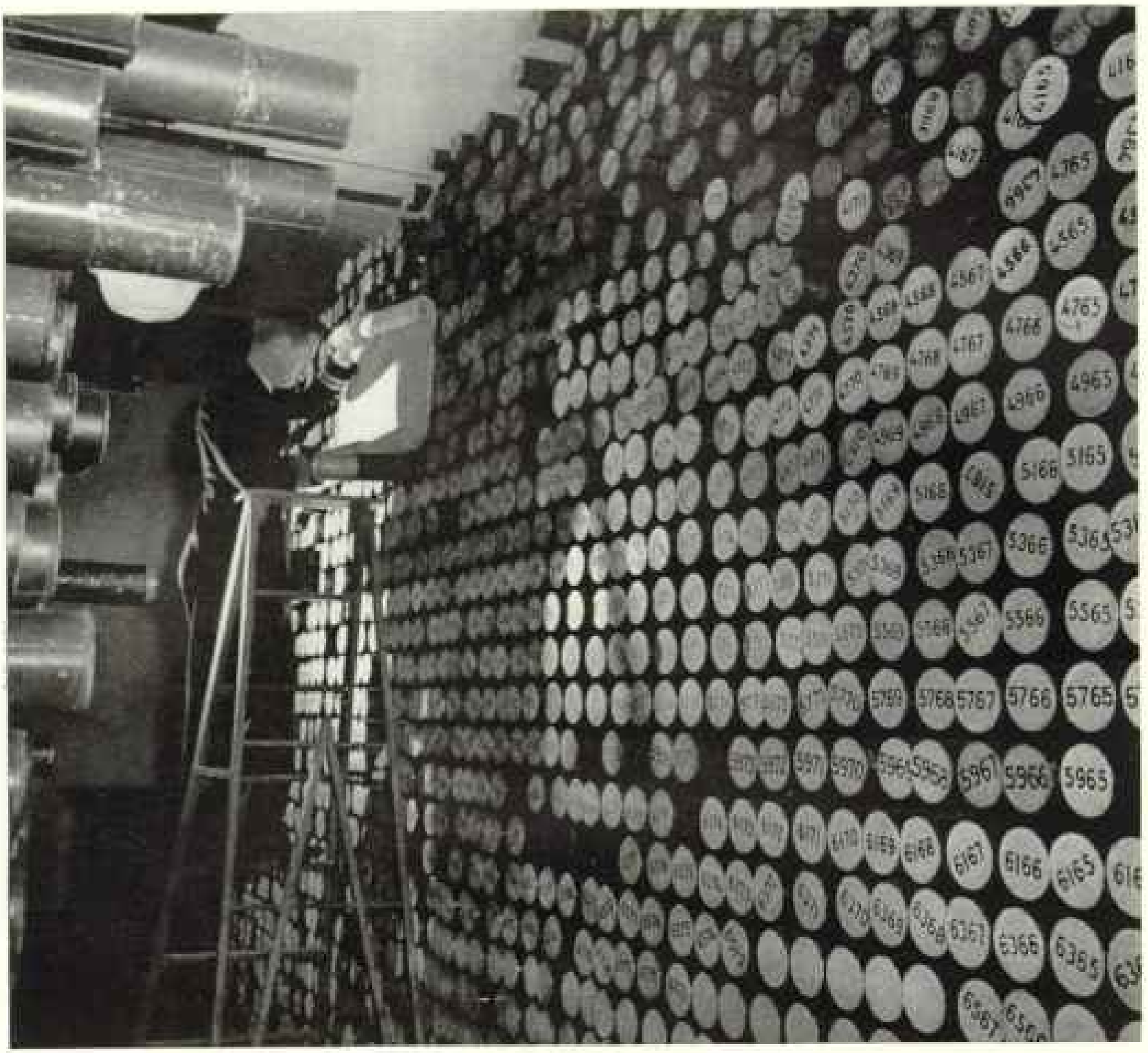
Once all soundings were made by hand. The fathometer has changed all that. This sensitive instrument, on which depths are registered by automatic measurement of the time it takes a sound to echo from the bottom, operates much faster and surer than the old hand system, except in very shallow water.

I saw a small boat cruise past the *Cowie*, with a portable fathometer automatically recording depths on a graph (page 623).

Fish Fool Fathometers

"It looks simple, but it's a bit tricky," Lt. Comdr. Benjamin H. Rigg, skipper of the *Cowie*, explained. "Sometimes a school of fish passes under the fathometer and sound bounces back from it. The record then seems to show a big rock or a series of rocks suddenly jutting up from an otherwise even bottom. Only an experienced man can recognize such interference."

Two officers stood in the boat, eyes glued to sextants aimed at control points ashore. Continuously they kept calling out to a recorder the size of the angles taken on the control points. These angle readings are coordinated with the readings of the fathometer, so that the recorded depths can be plotted on the chart.



These Metal Tubes Hold a Century-old History of American Coastline Evolution

Since Sheet No. 1 was filed in 1857, some 15,000 hydrographic and topographic surveys of our coasts have been made. They show how shorelines and bottoms have altered during the years. Rocky shores and sea floors off New England show surprisingly little change, but sandy bottoms off Florida are steadily changing and must be recharted frequently.

All precise survey work, on water and on land, is based on a simple proposition of trigonometry: if you know the length of one side of a triangle and the size of two of its angles, you can find the length of the other two sides, mathematically or graphically.

In this instance, fixed control points on shore and the readings of the angles with sextants provided enough known factors to determine the exact spot on the chart for each sounding.

Out of sight of land, soundings are plotted by radio acoustic ranging (page 628). Two or more sono radio buoys are placed in fixed positions. As the Survey ship proceeds on its line of soundings, a small bomb is tossed overboard. It explodes under water. The sound travels to a sono radio buoy, which sends it back to the ship instantaneously by radio.

Knowing the velocity of sound under water, officers can easily figure how far from the two buoys the ship was when the bomb exploded. Then the exact position of the sounding can be worked out and charted.

Deepest sounding ever made in any ocean, 35,400 feet, was taken by the German cruiser *Emden* in 1927 about 50 miles east of Mindanao, Philippines. This point is only 85 miles from a mountain more than 6,000 feet high—a difference in elevation of some 41,400 feet in a comparatively short distance.

Coastal Survey ships have discovered a submarine mountain a mile high off the California coast; a submerged canyon cut millions of years ago by the Hudson River about 50 miles at sea off the entrance to New York

Measuring Underwater Echoes, a Survey Party Takes Soundings with a Fathometer

The portable instrument sends a series of sounds to the bottom. They bounce back and are picked up by the hydrophone, or "fish," suspended just below the surface to the right. The fathometer automatically converts the time between sounds and echoes into depth measurements. Officers constantly take bearings, so that the various depths can be located accurately on the chart (page 621).

Harbor; and a submarine valley three miles long, a mile wide, and 1,200 feet deep just north of Monterey Bay on the Pacific coast.

Oil springs in the southern part of Santa Monica Bay, California, are near the head of a submarine valley. The oil comes up from a depth of 450 feet.

Attacked by a Crocodile

Coastal survey work, even in peacetime, often leads to high adventure. Take the experience of Lt. Comdr. John A. Bond. Once he was in charge of a surveying party down in the Sulu Archipelago.

Standing on the afterdeck of a motor launch, his left leg against an awning stanchion, he was waiting quietly for the boat to anchor.

Suddenly the water at the boat's stern heaved. A giant bull crocodile flashed out of the water and seized Bond's leg and the stanchion, all in one big bite. The boat nearly capsized. A Filipino Constabulary soldier thrust the muzzle of his gun down the "croc's" throat and fired. The reptile let go.

Bond's leg was lacerated and broken. He was in a Manila hospital for several months. Commander Bond still has the marks of crocodile teeth in his leg.

Philippine typhoons have provided many thrills for Coastal Survey men. Once the old *Pathfinder*, 1,000-ton Survey ship, was caught anchored off Samar.

The typhoon swept directly over the ship. The barometer showed one of the lowest readings ever recorded in the Philippines, 27.12.

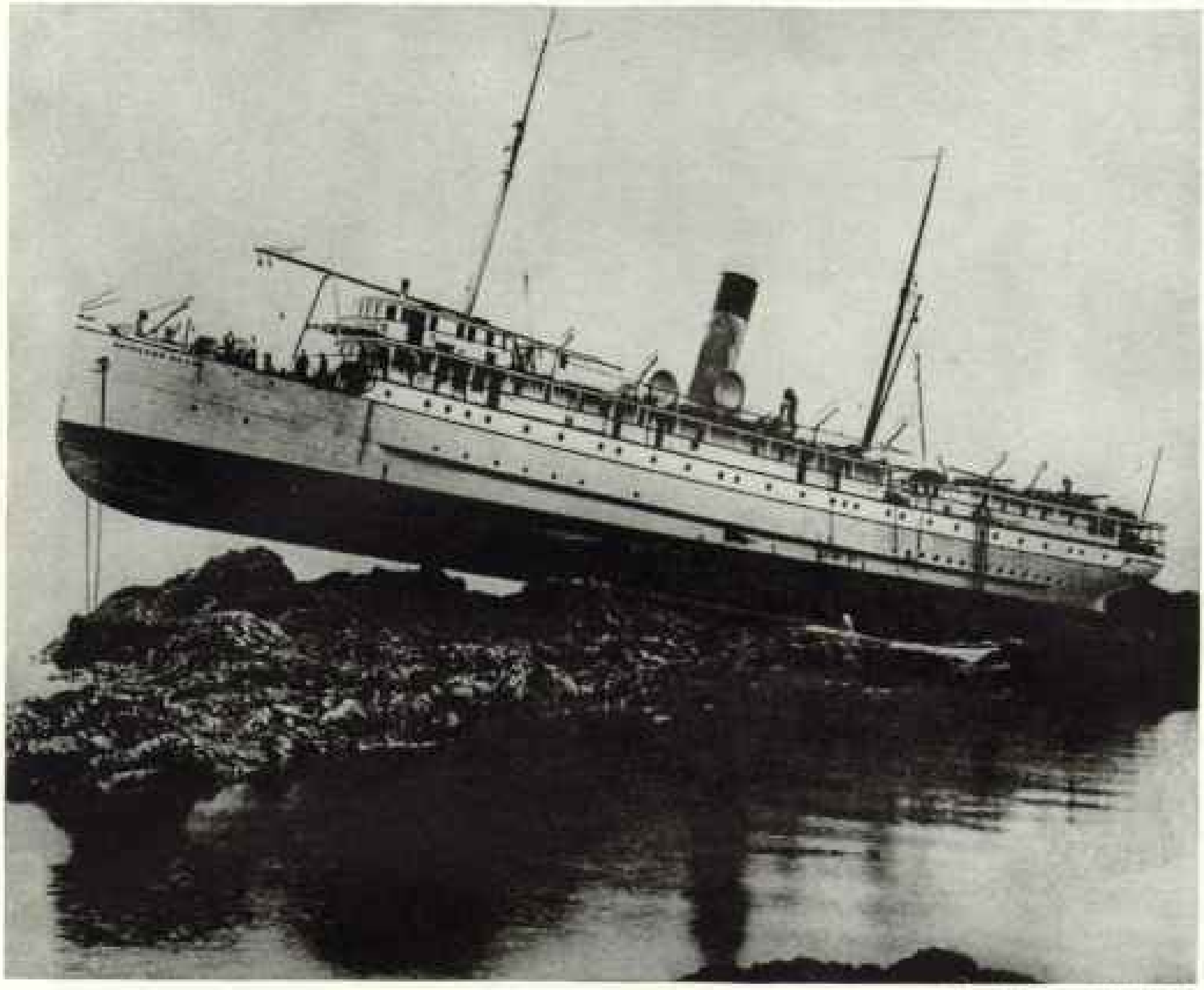
Wide World

Sheets of Spume and Spray Tower High as Surf Beats against Boardwalk Buttresses at Winthrop, Massachusetts

Energy of a wave depends both on its length and height. During such a storm, waves attain their highest development; hence are most destructive. Survey studies of coastal waves help engineers who design shoreline projects like bridges, docks, and sea walls.

With Unbridled Fury, a Hurricane-driven Tidal Wave Crashes into Falmouth, Massachusetts

Angry seas like these struck all along the New England coast in the hurricane of September, 1938 (page 626). Mountainous wind-driven waves devastated Galveston, Texas, in 1900, and Corpus Christi, Texas, in 1919. Earthquakes and submarine volcanic outbursts also produce tidal waves.



Adm. R. E. Coontz, USN, Ret.

A Fast-ebbing Alaska Tide Left the *Princess May* High and Dry

This unusual mishap occurred in 1910, when the excursion steamer struck Sentinel Rock while steaming from Vancouver, British Columbia, to Skagway, Alaska. Her skipper feared she was lost, but strangely she remained on virtually an even keel. At the next high tide she floated off, unharmed. The Survey has charted all important areas of Alaskan coastal waters, but navigation in fogs and snowstorms remains hazardous.

When the center of the storm passed, it suddenly became calm. In a few minutes the wind came from the opposite direction, with greater force than ever. The anchor chains snapped. Swept before the gale and deluge to an island near by, the *Pathfinder* piled up among the coconut trees fringing the beach. Fortunately, no one was killed.

Battling the New England Hurricane

Experience with Philippine typhoons helped Comdr. R. P. Eyman during the New England hurricane of September 21, 1938.* Eyman had taken command of the *Lydonia*, in Atlantic waters, after a long turn of service in the Philippines. With the approach of the storm, he put into New London, Connecticut, and tied up, bow out.

Eyman watched his barometer fall. The yellow sky and the scudding clouds suggested to him an approaching Philippine typhoon. As the wind increased, he ordered the engines started ahead to relieve the strain on the mooring lines. High seas made up in the river and swept into the slip, causing a violent surging on the lines, but the turning engines continued to ease the stress.

100-Mile-an-Hour Gale

Boats near by broke adrift and were carried high ashore by the breaking seas because other mariners had not taken the same precautions. The water covered the dock to a depth of two feet. The anemometer registered a wind velocity up to 100 miles an hour and then blew away. Pilothouse windows were frosted by wind-driven sand and gravel.

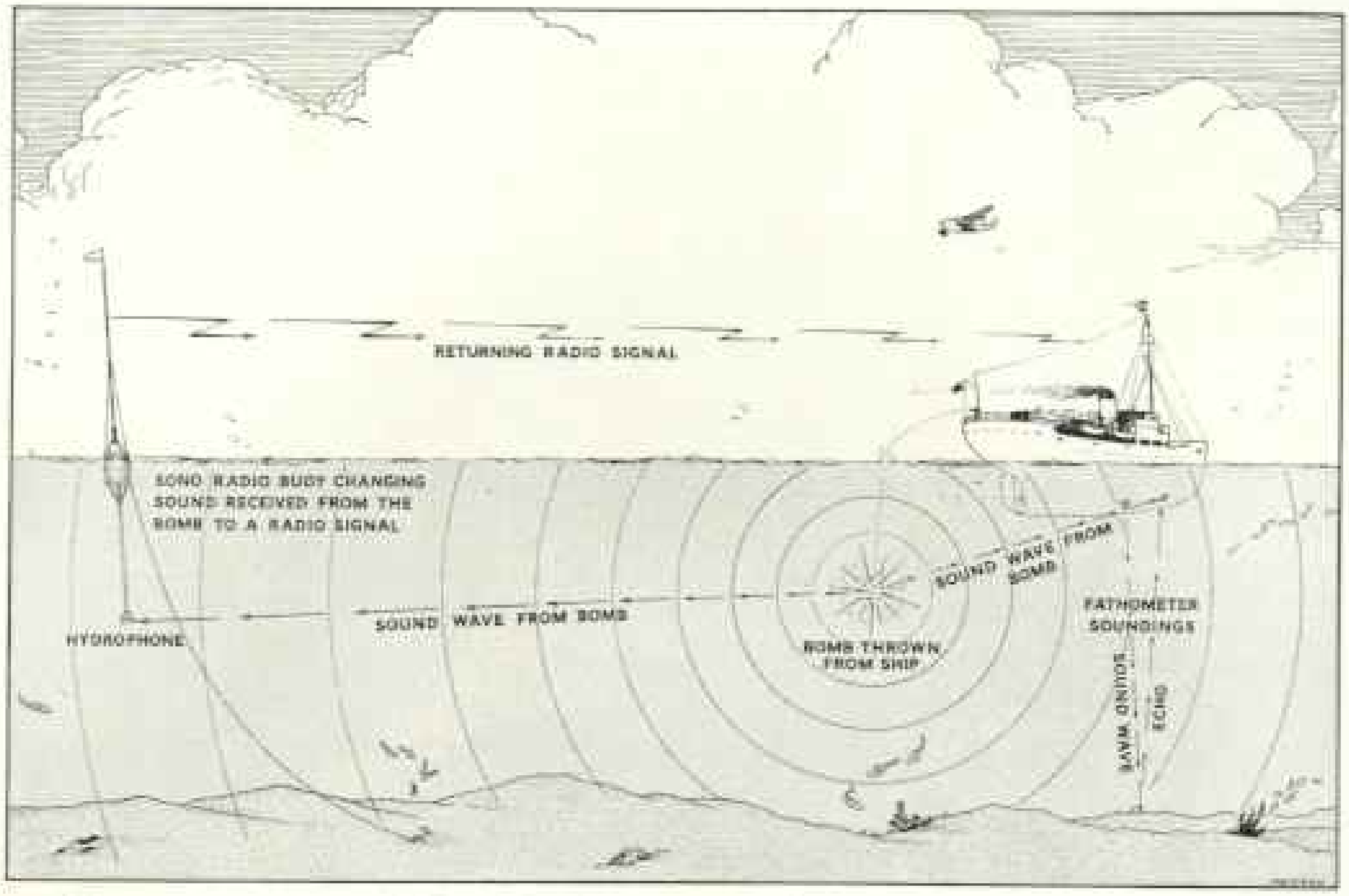
For about three hours the *Lydonia* successfully rode out the full force of the hurricane. Few other vessels in the Thames River harbor escaped serious damage or total loss.

* See "Geography of a Hurricane," by F. Barrows Colton, National Geographic Magazine, April, 1939.

© Camera Tu Ch

China's Famous Fuchun Tidal Bore—A Wall of Water Rushing Upstream

Here near Hangchow at the wide, shallow mouth of the river, water in friction with the bottom is overrun by the incoming tide, which rushes up the broad estuary in a wall several feet high. Upstream, this wall funnels into the much narrower river bed with a concentrated rush of terrific force.



Survey Men Chart Soundings Far at Sea by Radio

Sono radio buoys, like the one at left, are anchored in known positions. The ship proceeds on her course at a fixed speed, her fathometer recording depths (page 622). About every 10 minutes a bomb is tossed overboard and explodes under water. Sounds of the explosions, picked up by hydrophones attached to the buoys, are flashed to the ship by radio. Knowing velocity of sound in water and location of the buoys, Survey men can determine the exact positions of the fathometer soundings.

If you are a salt-water fisherman, you are acquainted with the tide-prediction tables published by metropolitan seaboard newspapers. The tides are predicted by the Coast and Geodetic Survey a year in advance. While the tables make stimulating reading for a sportsman planning a fishing party, they also serve much more valuable purposes.

Tides and Currents

Knowledge of the rise and fall of the tides and the flow of ocean currents is of obvious importance to mariners and tidewater engineers.

In many harbors, channels deep enough for ships to enter at high tide are too shallow at low, or are blocked by bars. Docks and piers must be designed with the tide in mind.

When Sir Isaac Newton formulated the law of gravitation, he showed that tides were one of its necessary consequences. They result from the attraction of the sun and moon upon the rotating earth.

At either new or full moon, combined attraction of sun and moon produces tides greater than usual, called spring tides. When the moon is at the first and third quarters, the tides are smaller than usual and are called neap tides.

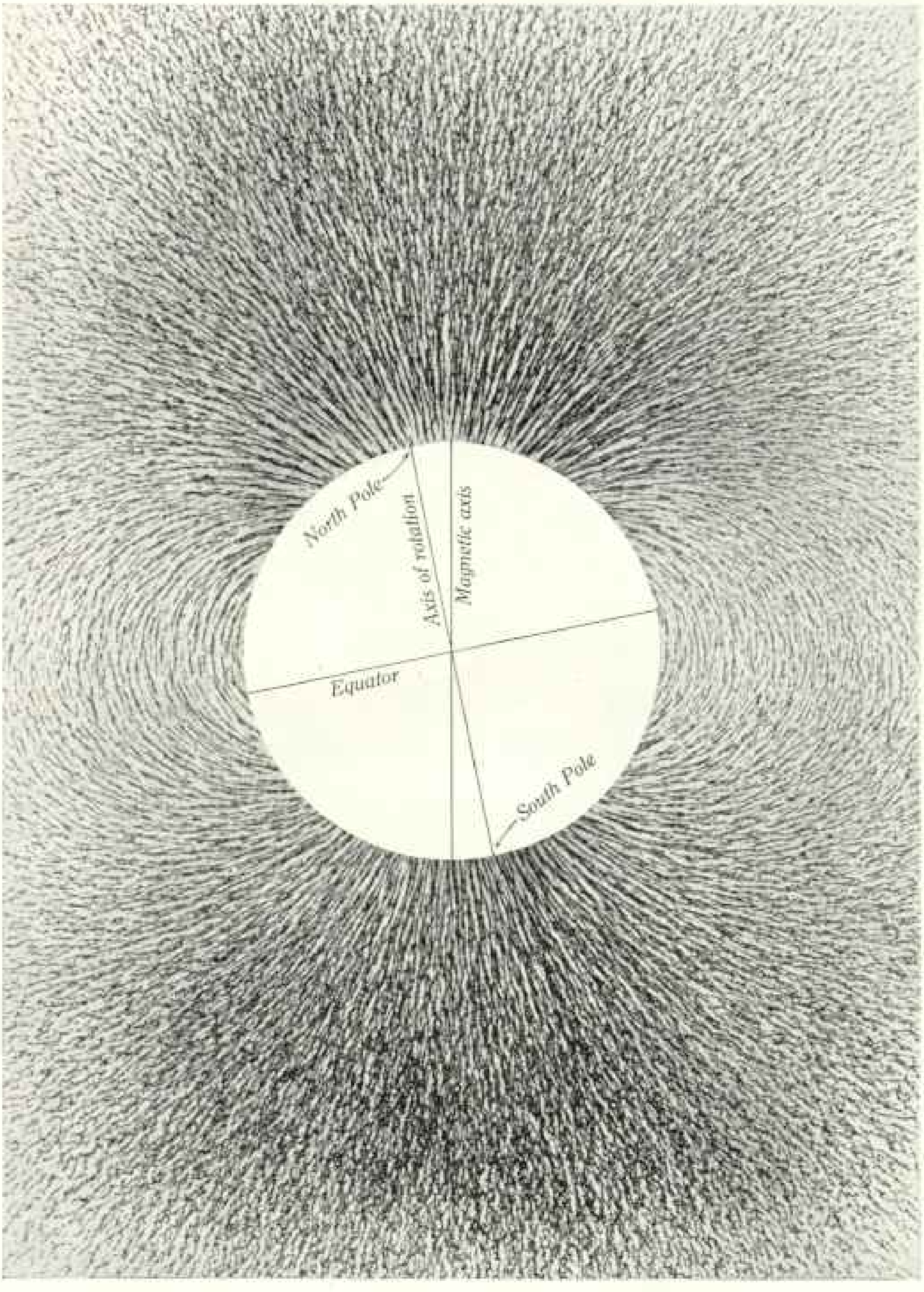
Scientists can predict future movements of sun and moon; hence it is necessary only to know local features of the tides at any one place in order to predict the time of daily high and low waters there over long periods.

High tide does come at varying times along the Atlantic seaboard. High tide at New York is 2 hours 50 minutes earlier than at Boston; 10 hours 50 minutes earlier than at Baltimore, near the head of Chesapeake Bay; and 25 minutes later than at Charleston. Differentials also exist between ports on the Pacific coast.

At nearly 100 tide stations along our coasts, the rise and fall of the tide is recorded graphically by automatic gauges.

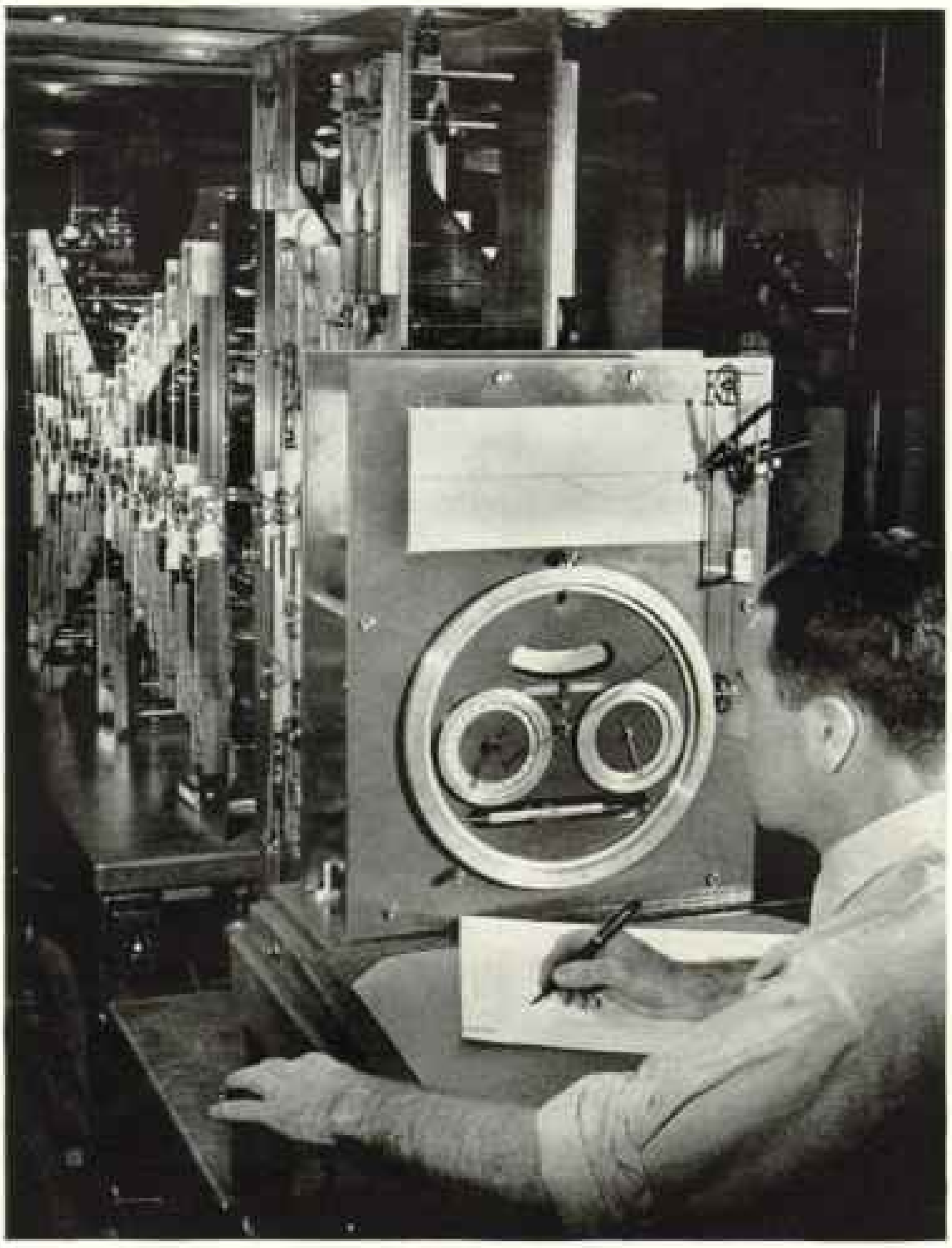
A Machine That Predicts Tides

A complicated and fascinating machine at Washington headquarters automatically predicts the time of high and low tides at any port in the world for every day of the year (page 630). Operated by one man, it does easily what otherwise would require the services of many mathematicians.



Iron Filings Clustered over a Magnet Represent the Earth's Magnetic Field

At the Equator, magnetic lines of force are nearly parallel with the earth's magnetic axis, which differs from the axis of the earth's rotation. In higher latitudes the lines bend toward the Magnetic Poles until they are virtually perpendicular. Coast and Geodetic Survey scientists devised this illustration by sprinkling filings on a sheet of glass placed over a magnet which caused the filings to assume these positions.



This Machine Predicts Daily Tides a Year in Advance

Scientists can forecast movements of sun and moon, to which the tides are allied (page 628). Hence it is necessary only to know features of the tides at any one place to predict the time of high and low waters over long periods. At 100 Survey tide stations along our coasts these data are recorded.

Tides differ greatly in their range. In the Bay of Fundy, the tide rises more than 40 feet from low to high water in about six hours. During the same interval, the rise at Nantucket Island is less than two feet. Range of tide at Cook Inlet, Alaska, is about 30 feet.

Although man has known about ocean tides for centuries, only comparatively recently did he learn that there are earth tides. The sun and moon attract the earth just as they attract the oceans. The earth has its spring and neap tides, like the seas.

There is one big difference—ocean tides vitally affect maritime commerce and many other factors in daily life; tidal rising and falling of the earth is so small in comparison that it is noticeable only to specialized scientific observers.

Fixing Sea Level

We say Mount Whitney is 14,496 feet above sea level, Death Valley 280 feet below. What is sea level?

The Division of Tides and Currents answers this question, thus providing the starting point for all leveling measurements in the United States. Mean sea level is the surface which the oceans would assume if undisturbed by tides and the effects of wind and weather. To arrive at mean sea level, the Division of Tides and Currents has averaged the height of the sea at different points along the coast.

The problem seems simple. Actually, it represents a precise and tedious scientific achievement, requiring years of observation.

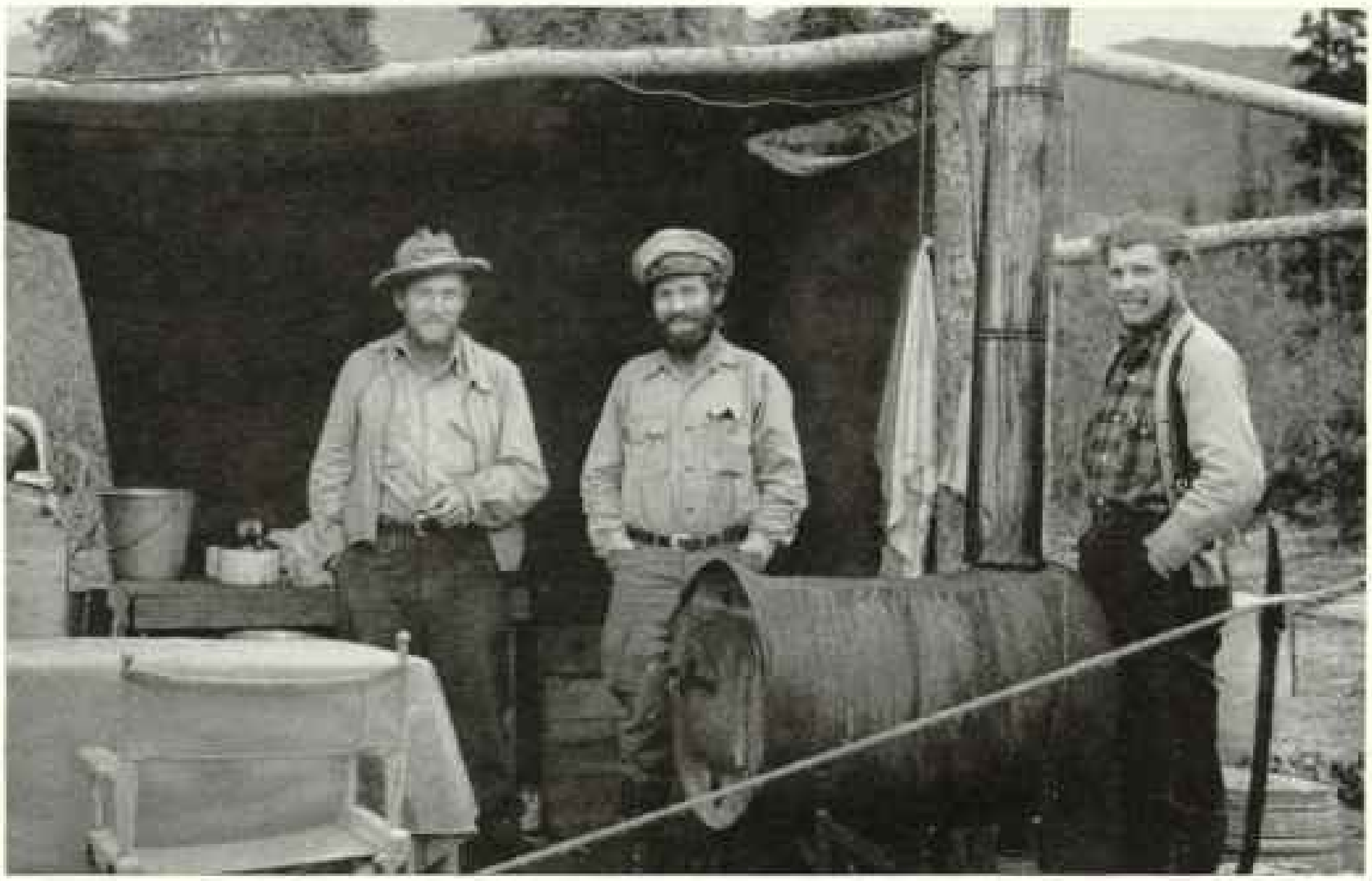
Curiously enough, it is from tide-gauge records that we can determine whether our own coasts are stable, or whether they are gradually rising or sinking. Such knowledge is important to engineers planning huge bridges and other works destined to stand for many years along or near the seacoast.

We Live on a Big Magnet

The earth is a huge spherical magnet. All about the earth is its magnetic field, which may be likened to myriad tightly packed, but invisible, lines of force. At the Equator these lines are nearly parallel with the earth's magnetic axis. In higher latitudes they bend in, at successively greater curves, until two points are reached where they are virtually perpendicular to the surface of the earth (page 629). These two points are the North and South Magnetic Poles.

How Far Does the Compass Needle Veer from True North? These Instruments Tell

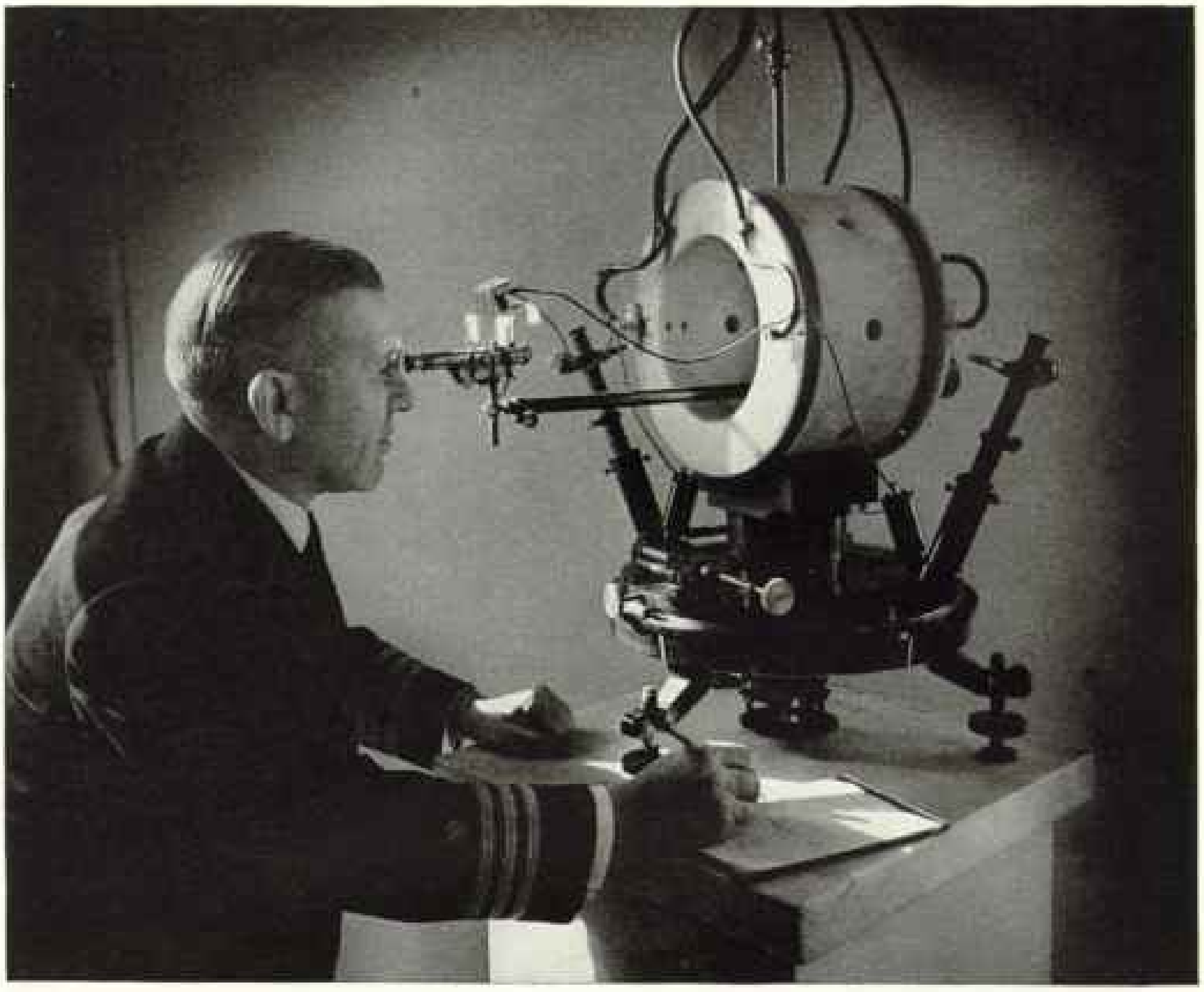
John Hershberger, left, in charge of the Magnetic Station at Cheltenham, Maryland, makes an observation with a sensitive Cooke magnetometer (page 634). His assistants use an earth inductor (center) and another magnetometer (right). Recordings like these, made all over the world, enable mariners to allow for the variation of their compass needle wherever they may be.



Lt. Comdr. John Bowie, Jr.

Survey Field Workers Follow Army Engineers up the Alaska Highway

The open-air kitchen, built in 1942 by the 83d Army Engineers along the Donjek River bed in the Yukon, was a welcome find for this Coast and Geodetic Survey triangulation party the following summer.



With a Sine Galvanometer He Finds the Horizontal Force of the Earth's Magnetic Field

This is the force which makes the compass needle point northward. It is represented by the steel filings portrayed on page 629. Comdr. Harold A. Cotton reads the complex precision instrument, which is valued at $12,000 and is the property of the Carnegie Institution of Washington.

The North Magnetic Pole, visited by James Clark Ross and Roald Amundsen, is on Boothia Peninsula, in northern Canada. The South Magnetic Pole in Victoria Land was reached by Sir T. W. E. David and Sir Douglas Mawson in 1909. These poles are not exactly opposite each other, as are the geographic North and South Poles. A line joining them would pass about 750 miles from the center of the earth.

The earth's great mass and complexity pose many baffling problems for the Division of Geomagnetism and Seismology in its task of mapping magnetism.

If the earth's magnetism were strictly like that of a simple spherical magnet, the mariner's compass would point directly toward the North Magnetic Pole. Actually, it is by no means so obliging.

Although the needle points northward, its direction is neither true north nor toward the North Magnetic Pole. The amount of this variation, or declination, of the compass from true north differs all over the globe. To make matters more complex, variation of the compass at any given point is always changing slightly.

The Wandering Compass Needle

In the eleventh century mariners were using the compass—a magnetized needle mounted on a pivot so it can move freely in a horizontal plane in any direction. Invariably, the needle rests in a northerly-southerly position.

Every Coast and Geodetic Survey nautical chart carries several compass roses which show compass variation in the area mapped and give the estimated annual rate of change in variation. This estimate is based on observations made over previous years and affords a means of correcting variation until a new chart is issued. Compass roses are revised with each edition of a chart.

A skipper reads his compass, notes the variation from true north as indicated on the compass rose, allows for his own compass error caused by local magnetism in his ship, then plots his course accordingly.

In 1580 the compass needle at London pointed 11° *east* of true north. In 1812 it was pointing 24° *west* of true north, or a change of 35° in 232 years.

Since that time its pointing has progressed eastward again. In 1944 it is 10° *west* of true north.

To visualize a change of 35°, notice on your globe how it would affect an ocean passage such as the voyage of Columbus from the Canary Islands to the Bahamas. The effect would be to carry the mariner far southward, to the shores of Brazil.

Today, in the northeastern part of Maine, the compass needle points about 22° *west* of north; in northwestern Washington it points 25° *east* of north.

The earth's small horizontal magnetic force causes the compass needle to point northward. In high latitudes the lines of force dip downward steeply, thus reducing the horizontal component.

Where this force is too greatly diminished, the needle becomes sluggish and unresponsive. Within a considerable area surrounding the Magnetic Poles, it behaves so erratically that it cannot be depended upon for navigation.

A Compass Found Michigan's Iron Ore

Large deposits of iron ore set up magnetic fields of their own, causing the needle to veer when it comes within their influence.

A deputy U. S. surveyor, William A. Burt, discovered the huge Michigan iron ore fields in 1844, while surveying township lines with a magnetic compass. He noticed remarkable variations in the needle, some as much as 87° from normal. He concluded iron ore was near by and soon found outcroppings.

Geologists use magnetic survey methods to find oil-bearing formations and new deposits of strategic minerals.

Every type of formation, whether exposed or hidden under many yards of overlying strata, has its own effect on the magnetic field at the surface.

Where irregularity is sufficiently pronounced, local magnetic poles are set up. One of these was found off Banks Island, in the Arctic, by Vilhjalmur Stefansson. Robert F. Scott located another in the western part of Ross Sea, north of Ross Island, in the general direction of the South Magnetic Pole. These affect the compass.

In the ship channel at Port Snettisham, Alaska, variation of the needle from normal is 60°.

George Washington Surveyed with Magnetic Compass

George Washington and other surveyors used the magnetic compass. Philadelphia and Boston were laid out by compass, and boundaries were defined in deeds by compass bearings.

When old compass boundaries come into dispute today, we must know the change in variation of the needle since the original survey was made. Then an old survey can be accurately retraced if one original boundary line can be determined. Coast and Geodetic Survey data are the recognized authority in the United States in settling such disputes.

The magnetic compass played a big part in building the Alaska Highway, the new military road which links the United States and Alaska.*

Low-flying airplanes, steering by compass, laid off parts of the road; engineers afoot, guided by the needle, marked other sections. In some cases, bulldozers steered for distant points selected by compass bearings.

The way we combat the enemy's magnetic mines at sea and on land is a military secret. But a fundamental principle lies in knowing the vertical intensity of the earth's magnetic force.

Such knowledge also is essential in combatting the effect of magnetic storms (not to be confused with electrical and rain storms). Magnetic records which the Survey has kept for many years are of much value to radio.

If you live in a northern State, you have seen the splendor of the aurora borealis, or northern lights, with their undulant draperies and ever-active arcs, bands, and rays (page 640).

The more brilliant displays always are associated with severe magnetic storms. Both the display and the magnetic activity are evidences of electric currents which surge over vast conducting regions of the stratosphere.

Predicting Magnetic Disturbances

A magnetic storm is accompanied by a series of conflicting earth currents which at times is as effective in disrupting communications as a short circuit would be in putting out the electric lights in your home. The effect is much the same. In the big storm of Easter Sunday, 1940, and also in the mag-

* See "Alaskan Highway an Engineering Epic," by Froelich Rainey, National Geographic Magazine, February, 1943.

Miniature Washington Monument in a Manhole

The Coast and Geodetic Survey installed this concrete obelisk 150 feet south of the Capital's familiar landmark 45 years ago to observe and study settlement of the monument. It is 13½ feet high and tapers toward the top, which is just below ground level.

netic storm of September 18, 1941, telegraphic as well as radio communications were seriously impeded.

To cope with such disruption becomes vital in wartime, since radio is a necessity in handling both ships and ground forces in large movements. So the Coast and Geodetic Survey furnishes War and Navy Departments with daily reports on magnetic conditions.

Armed with this information, transmitting stations try to select radio frequencies and routings which will avoid magnetic disturbance.

Geomagnetism is world-wide. Thousands of temporary Coast and Geodetic Survey observation posts have been set up in continental United States and our island possessions. The Carnegie Institution of Washington supplies to the Coast and Geodetic Survey technical data gathered at observation posts all over the world and also lends it many intricate measuring instruments.

Five observatories are operated by the Coast and Geodetic Survey to measure the magnetic elements continually. They are at Cheltenham, Maryland, near Washington, D. C.; San Juan, Puerto Rico; Tucson, Arizona; Sitka, Alaska; and Honolulu.

Each of these observatories records the magnetic declination and the horizontal and vertical intensity of the earth's magnetic force.

Nonmagnetic Walls 4 Feet Thick

The thick walls of the Cheltenham Observatory contain four feet of sawdust, interspersed with dead-air spaces and wooden partitions.

Such precautions keep the change of temperature down to 0.1° Centrigrade daily, and 1.7° monthly, year in and year out.

Since a principal part of each instrument is a magnet, observers cannot carry their keys with them into the room or wear suspenders with metal fasteners. Women visitors cannot

Elizabeth Hartley, 11 Days Old, Sets Out to See the United States in a Trailer

Her father has been a Survey fieldworker nine years. Her brother, Danny Lynn, also a Survey baby, had traveled 3,000 miles by the time he was three months old. Photographed at Canal Fulton, Ohio, Mrs. Hartley had just brought baby Elizabeth from the hospital to her trailer home (page 638).

wear girdles with steel stays. Employees must park their cars at a respectful distance from the building.

Desks and chairs in the rooms are pegged, not nailed. The heating stove is of non-magnetic bronze.

The sine galvanometer, on which readings of the earth's horizontal force are made, is a revelation of precision and exactitude (page 632).

Watching for Jap Earthquakes

If an earthquake should rock any part of the Japanese Empire tomorrow, in a few hours the Division of Geomagnetism and Seismology would know, within 25 miles, where the shock centered. Jap censorship couldn't keep it a secret.

In the United States the Survey coordinates the records of scientific groups which study earthquakes. It also has the help of 75,000 volunteer watchers in our western States. When they notice an earth shock, they send brief accounts of its intensity to a State collaborator. Did chimneys topple? Did dishes fall from shelves? Such information, from widely separated points, helps the bureau to determine the intensity and extent of the quake.

Teleseismic instruments are very delicate and pick up tremors thousands of miles away. As a result, they can't record an earth shock of violent intensity close to them.

In 1932 the Survey, in cooperation with the National Bureau of Standards, developed a strong motion instrument which withstands close shocks. Information from this less sensitive apparatus helps structural engineers and architects to design buildings which will withstand severe shaking. Such an instrument does not operate continually, but stands idle until a strong tremor puts it into action.

A few months after the strong motion devices were in use, the violent Long Beach

On a Far-off Light (Opposite) a Survey Man Trains His Telescope

The observer makes a control survey at night from a platform 103 feet up. When he picks up a flash from the distant signal tower, he will read the angle. The telescope stands on an inner tower, rising through a hole in the platform so movements of the workers will not jar it.

earthquake of 1933 occurred. Response of one of these new instruments located there was magnificent. Just to make sure, the Survey hastily sent technicians to the scene with more strong motion instruments to check on the first one.

The men set up their models on various floors of a tall hotel, installing one in the bathroom adjoining their bedroom. Fatigued from their hasty trip and rapid installation work, they retired. In the middle of the night a second severe shock occurred. The men slept through it soundly, but the instruments all functioned perfectly.

Every building, tower, or bridge has its natural vibration period, and this can be measured by the Coast and Geodetic Survey vibration meter.

When engineers built the Golden Gate Bridge at San Francisco, its natural vibrations were measured at various stages of construction, to study the reaction of the bridge to any possible earthquake.

Making a Jigsaw Puzzle of Triangles

A famed orator used to interpolate his speeches with the question, "Where are we at?"

The problem seems simple; as a matter of fact, getting the answer requires highly complex calculation.

Every day, almost every hour of every day, we must know "where we are at." We must know where to address a letter, or travel, or call on a friend, or go to the store, or tell the time of day.

Usually we know the answer only in relation to something else—the name of a street, the number of a house, a postal address, the direction of a road, fixed time zones.

But back of all these were, somewhere, perhaps long ago, the hard footwork and patient computation of a surveyor.

Prewar vacationers, motoring over the length and breadth of the United States, often came upon round bronze markers firmly embedded in concrete posts or in rocks. They bore the legend, "United States Coast and Geodetic Survey," and some other data.

This tremendous project has now assumed the form of a network of more than 100,000 marked points in the United States. The plan is to furnish stations where they are needed as basic controls for engineering and mapping.

Since the outbreak of war, survey parties of the Division of Geodesy have confined

their efforts to mapping areas of vital interest to the War Department. One of the biggest achievements to date has been the control surveys along the Alaska Highway.

The familiar triangle is the basis for geodetic surveying, and field units are known as triangulation parties.

Triangulation Trucks and Trailers

Triangulation center for North America is Meade's Ranch, Kansas. From it radiate the surveying projects. Our system has been adopted by Canada and Mexico, thus widely extending a uniform basis of control, known as the North American Datum.

I watched a triangulation party at work in an important industrial area south of Akron, Ohio.

Twenty-eight men, 15 with their wives and families, and three women make up this mobile unit which travels over the country in trucks and trailers. They were under command of Lt. Comdr. A. P. Ratti.

When I caught up with them, their trucks and trailers were parked in the recreation area of Canal Fulton, seven miles northwest of Massillon.

Survey work here was being completed and the party was about to move to Alabama for the winter. It was early December and rather chilly for outdoor work in Ohio.

Two portable Bilby steel triangulation towers had been erected about four miles apart (page 639). One was 103 feet high. In such rolling, partly wooded areas, these towers are necessary so observers and recorders may have unobscured vision over the lines they are measuring.

Observations are made at night, because more accurate results can be obtained then and because it is difficult to see small objects at any great distance during the day. A lightkeeper operates an electric lamp, powered by batteries, atop one tower. An observer on the other trains a telescope on the light and reads the angle measurement on the theodolite, calling his results to a recorder.

Such a night observation may last four or five hours, until the observer is satisfied that his readings, made through a microscope, are accurate.

For the first time in Coast and Geodetic Survey history, a tower lightkeeper and a recorder were girls. They had taken the

Her Flashing Beam Cuts through the Darkness across Ohio

Verna Lee Moffett blinks the lamp on and off in obedience to signals from the observation tower (opposite). The line between the towers is an unmeasured side of a triangle. The length of another side, the base line, is known. By measuring two of the angles, the length of the other two sides of the triangle can be computed.

With Nonstretching Tape, He Measures a Base Line

The 50-meter invar line, an alloy of steel and nickel, expands and contracts at a rate only 1/25th that of steel. Survey fieldworkers have driven stakes in a straight line for several miles across this Ohio terrain. When the tape is pulled to a standard tension between two of them, the distance is measured precisely.

place of men who had gone into the armed forces. Commander Ratti was enthusiastic over their work.

Girls Take to the Tall Towers

Night after night Mrs. Verna Lee Moffett climbed to the top of an isolated light tower and sat there, obediently flashing her light on and off at signals from the observer in the other tower. With the male observer sat Miss Mary C. Smith, the recorder. Here again was the eternal triangle, but it was strictly mathematical!

"Aren't you afraid to climb to the top of that spindly tower?" I asked Mrs. Moffett.

"Oh, no," she replied. "I know it's perfectly safe. You see, my husband is the one who puts it up."

She had traveled with the party in the Moffett auto-trailer home for several years and knew all about towers; so, when the war created an emergency a few months ago, she was ready to step in.

Miss Smith, a South Dakota schoolteacher, became acquainted with Commander Ratti's group when she visited her brother, former member of the unit, before he went into armed service. She had been climbing the towers for four months.

"Now, if I can just get some huskier girls," Ratti said, beaming, "I'll let them put the towers up, too."

The towers seldom come to grief, despite their fragile appearance. Observers stay on the ground during high gales.

Once in Arizona lightning struck a mountaintop occupied by a surveying party and fused all the metal in the instruments.

Between July 1 and December 1, Ratti's party had surveyed 3,000 square miles and measured 25 miles of base line.

In measuring base line, Survey men attach a thermometer to the tape so that the small amount of its expansion or contraction can be measured and allowed for.

Commander Ratti's party was like a big family. I visited several of the trailer homes and found 30 little children in them, all under school age.

"We have an addition to the family," one pleasant Survey wife told me. Mrs. E. L. Hartley had returned from a hospital with an 11-day-old daughter (page 635).

Mr. Hartley invited me to call at his trailer. Inside, I found tiny Elizabeth sleeping peacefully in her bassinet in the living room. Her brother, Danny Lynn Hartley, two years old, was very proud of her.

His father had been with Coast and Geodetic Survey parties for nine years. Four years ago he married and bought his trailer home. Like his baby sister, Danny Lynn was born "in the service." By the time he was three months old, he had traveled 3,000 miles.

No wives or children accompanied the Alaska Highway survey parties. When the first group, old hands at field work, reported for duty in Alaska, Army officers greeted them with enthusiasm, for they came fully equipped to handle all their own problems in the rugged wilderness. It was just another assignment for them. Five parties were used in 1943 on this job (page 631).

Pistol-packin' Surveyors

In one respect the party under Lt. Comdr. John Bowie, Jr., was too well equipped. To cope with Alaska's big bears, each member on his own initiative provided himself with side arms.

All the Survey men had heard the story about Lt. Comdr. S. B. Grenell. Years before, on Montague Island, he and his party had come face to face with a giant brown bear. No one had a loaded gun. The men tried to scare the bear away, but their efforts only roused her. She reared and charged.

Grenell faced her with an empty rifle which he tried to use as a club.

With one swoop of a paw, the bear knocked it out of his grasp. Just in the nick of time, one of the men got his rifle loaded. He rushed up, pushed it against the bear's chest, and fired. The bear staggered toward a tree and died. Later her two cubs were found in the tree.

Black Bears Ran Away

The Alaska Highway parties had no such dramatic experience. They saw only black bears, and few of these failed to run when the men shouted at them.

Surveying in Alaska and Canada is hard going. To build observation towers the men had to fell their own timbers. Bad weather was the rule. Many observation stations could be reached only by back-packing in mountainous, trailless country; yet the work was carried out without a hitch.

Father of the United States Coast Survey was the almost legendary Ferdinand Rudolph

To Measure the Land, She Climbs Skyward

Before the war, ascending the portable steel tower to record angles was a man's job. When the Army made inroads on Survey field crews, Miss Mary C. Smith proved that a girl could master the climbing technique and vertigo, too (page 638).

Wide World

Manhattan's Bright Lights Find a Brilliant Rival in the Aurora Borealis

Dazzling displays of northern lights always are associated with severe magnetic storms (page 633). Both are evidences of electric currents surging over vast conducting regions of the stratosphere. This photograph was made from atop the R.C.A. building in New York City on September 18, 1941. Telegraphic and radio communications were seriously disrupted. Four years ago the National Geographic Society and Cornell University jointly instituted a scientific study of the baffling aurora borealis, under the leadership of Dr. C. W. Gartlein. This inquiry still is going on.

Hassler, a native of Switzerland. The basic principles of precise control surveys which this brilliant scientist established in the early 19th century have been followed with little change ever since.

Distinguished Scientists Headed Survey

Hassler was something of a genius, eccentric and tactless in many respects, but outstanding in scientific thought. All of his successors have been distinguished men of science and have added new luster to the reputation of the organization.

Five of them, Thomas C. Mendenhall, Henry Smith Pritchett, Otto H. Tittmann, E. Lester Jones, and Raymond S. Patton, were trustees of the National Geographic Society, as is the present Director, Rear Admiral Leo Otis Colbert (page 618).

Admiral Colbert, who has served as Director since 1938, has transformed the Survey into a full-time war organization. Acquainted with every detail of its work through 37 years of service, he has mustered all its resources to perform successfully the unprecedented task of charting a world at war.

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDINGS
SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON 6, D. C.

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded fifty-six years ago, the National Geographic Society publishes this Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest week of man in the American for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 300 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society–U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

The Society granted $25,000, and in addition $75,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

DAD, WHERE DO THE TRACKS GO?

"SON, if you walked those tracks west, you'd walk into a country so big you'd feel about knee high to a grasshopper.

"You'd see Indians sure—and cowboys, too—but you'd see lots of other things. Miles and miles of grain, more sheep than you ever counted—cattle galore; sky-scrapin' mountains that look like they had a hunk of ice cream on top of 'em.

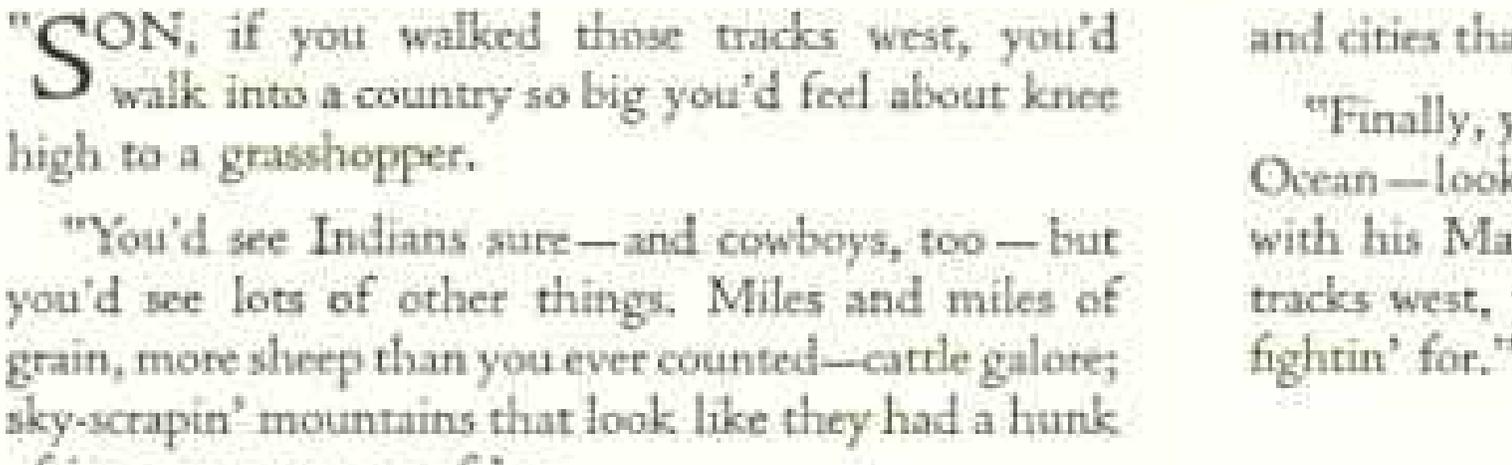
"You'd see rushin' water turnin' factory wheels and changin' yellow waste country to land as green as our pasture; apples half as big as your head and trees as tall as Jack's bean stalk. You'd meet friendly people, livin' on farms and ranches and in up-and-comin' towns and cities that ain't much older than you, as towns go.

"Finally, you'd wind up lookin' out over the Pacific Ocean—lookin' west to where your brother Jim is with his Marine outfit. Yes sir, if you'd walk those tracks west, you'd see a powerful lot of what Jim's fightin' for."

★ ★ ★

The Milwaukee Road tracks lead to new opportunities. You can choose your climate and scenery—the type of endeavor you're fitted for. Live in old established communities or pioneer in "young" country. If you're thinking of making a move in the post-war days look to the west and northwest!

11,000-MILE SUPPLY LINE FOR WAR AND HOME FRONTS



THE MILWAUKEE ROAD

Filmo Movies ... your personal historian

Do you remember how beautiful your wife looked in her wedding dress . . . or Junior's "baby look" before his first haircut? Don't you wish you could hold such scenes in your memory forever?

You can . . . for our research in OPTI-ONICS promises you new and finer ways to film and project those precious bits of personal history on your own home screen.

Tomorrow's B&H Home Movie Cameras will be simpler to operate, more accurate in results. Projectors will be refined to re-create scenes more clearly.

And in addition to the thrill of re-living your own personal history . . . you'll see and hear the finest in professional film entertainment, in your own home, with sound motion pictures from the famous Filmosound Library.

Thus the combined sciences of OPTIcs, electrONics and mechanICS . . . OPTI-ONICS . . . will help you preserve a pleasant personal history of your most treasured memories. Bell & Howell Company, Chicago; New York; Hollywood; Washington, D. C.; London. Established 1907.

WAR IS WOMEN'S WORK, TOO

There are thousands of important war production jobs awaiting women's willing hands. In most plants you can get valuable training for jobs with peacetime futures. See about a war job today . . . help get your son or husband or sweetheart back home faster.

Buy . . . and HOLD . . . War Bonds

WHAT YOU SEE— YOU GET

Opti-onics

Bell & Howell

FOR 37 YEARS MAKERS OF THE WORLD'S FINEST EQUIPMENT FOR PERSONAL AND PROFESSIONAL MOTION PICTURES

Send for a free copy

"YOUR COMING RADIO" AS FORECAST BY

GENERAL ELECTRIC

There's an exciting new booklet that lifts the curtain of secrecy on post-war radio and television. It's yours for the asking.

Here are some of the most startling innovations you will find described and illustrated in full color:

Radio virtually free from static, FM (Frequency Modulation) an entirely new kind of radio that re-creates all the tones in their original "Natural Color" beauty!

Revolutionary radio-phonograph that reveals harmonies and melodies on your records you have never heard before!

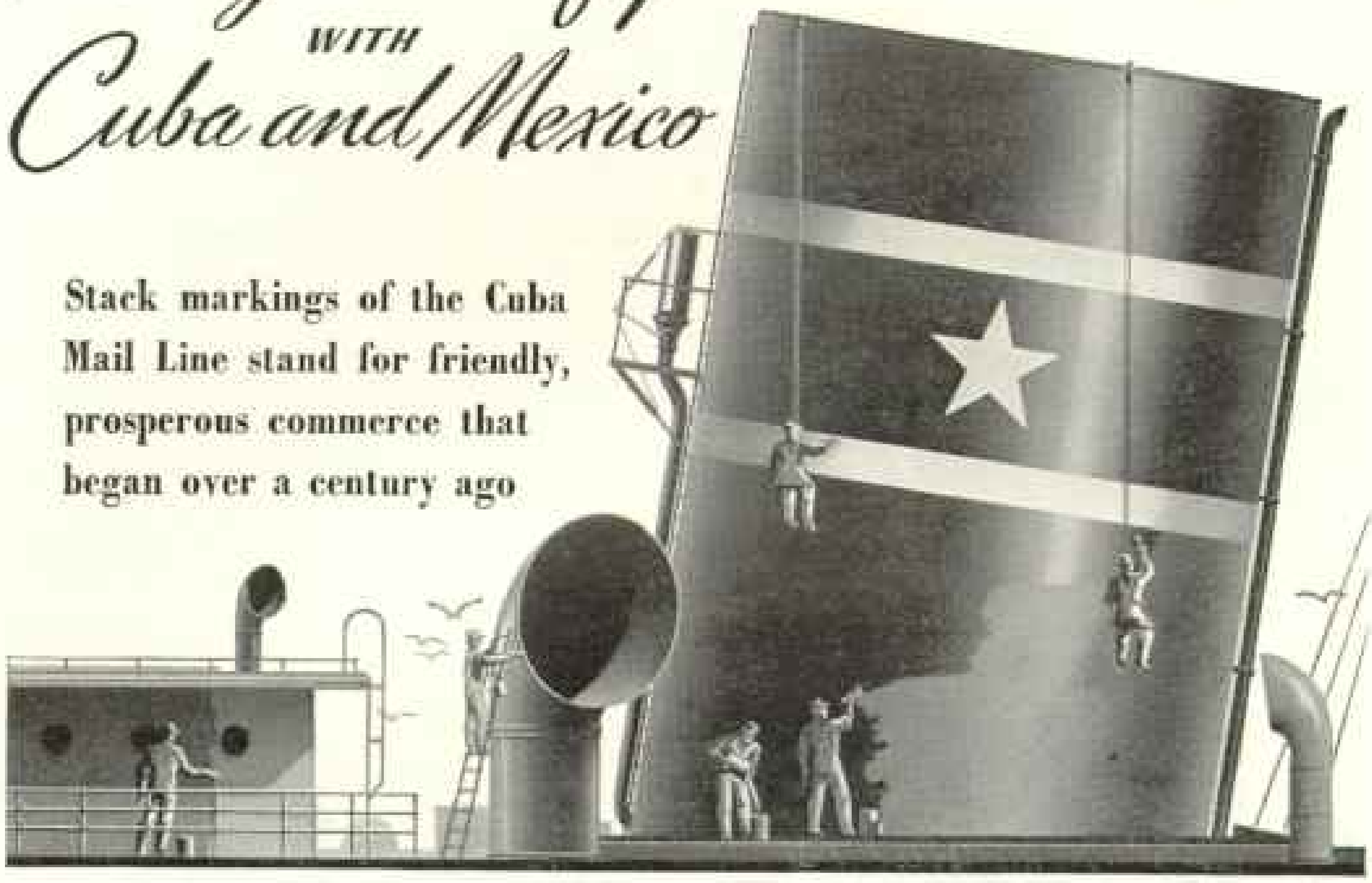
Self-charging portables that play 20 hours anywhere—and renew their own power just by plugging them into your house current!

Television in your home with large, clear images of surpassing quality!

For the fully illustrated story of these coming General Electric Radio and Television sets, just send a postcard to Electronics Department, General Electric, Schenectady, N. Y.

Tune in General Electric's "The World Today" News, every weekday 6:45 p. m. E. W. T. on CBS and the G-E "All-Girl Orchestra," Sunday, 10 p. m. E. W. T. on NBC

A symbol of peacetime trade WITH Cuba and Mexico



Stack markings of the Cuba Mail Line stand for friendly, prosperous commerce that began over a century ago

WITH the coming of peace, resumption of world trade as a whole involves many complications and delays.

Happily, however, our normal maritime export-import relations with our Good Neighbors of Cuba and Mexico can be re-opened quickly the moment conditions permit.

These countries have built up large credit balances in the United States through the sale of strategic materials. Their lands are untouched by war. They are hungry for goods bought from the United States in peacetime—farm machinery, electrical equipment, cars, trucks, and a host of other items.

And they are eager to export to us quantities of tobacco, sugar, tropical fruits, copper, zinc, lead, wax, fibre, vegetables and other products for which sufficient shipping has not been available because of the mighty war effort.

Cuba Mail has served our Cuban neighbors for more than 100 years; our Mexican friends, for over fifty. As soon as Cuba Mail ships return from war duty to their established routes, docks and warehouses will be ready with trained personnel to resume—by sea or by air—the expeditious handling of passengers and freight for which Cuba Mail has so long been famous.

CUBA MAIL LINE

ATLANTIC GULF and WEST INDIES STEAMSHIP LINES

AGNY LINES

Foot of Wall Street, New York 5, N. Y.

Cuba Mail Line ★ Porto Rico Line ★ Clyde-Mallory Lines ★ Southern S. S Co.

Serving Cuba, Mexico, Puerto Rico, the Dominican Republic, Texas, Florida and the South

Buy MORE War Bonds

Strato-Flak *by Fisher*

The Army-Navy "E" flies above four Fisher Body plants for excellence in aircraft production and from two others for tank production, while the Navy "E," with four stars, is flown by still another Fisher Body plant for its naval ordnance work.

NO one had ever seen a gun like this three years ago.

But when bombers took to the stratosphere, Army Ordnance engineers realized the need for a 120-millimeter gun, deadly to both air and ground targets at long ranges, and capable of a high rate of fire. So they worked it out with Fisher Body.

Practically every tool, jig and machine used in production was especially designed for it. But our special pride was the automatic loader and rammer—a Fisher contribution which can set the timer before the shell is shoved home. A lot of midnight oil was burned before these black mushrooms began to burst at 60,000 feet.

Once more, we were grateful for the Fisher skills and techniques that saw us through. The same Fisher Body craftsmanship that has turned out tanks, guns, bomber assemblies and other armament concentrated on this new puzzler—and came up with the right answers.

Our fighting men rate the best fighting tools in the world. We intend, now as always, to help give them whatever they need, and the best we know how to build.

* * *

Every Sunday Afternoon
GENERAL MOTORS SYMPHONY OF THE AIR
NBC Network

armament BODY BY Fisher

DIVISION OF GENERAL MOTORS

SCOTT
FINE RADIO RECEIVERS

The impertinent Piccolo punctuates fine music with a voice shrill, sibilant, insistent... exciting to hear if you listen with a Scott!

The Piccolo pipes up among the more austere instruments with a high brash assurance that often makes them seem dull and throaty by comparison. An octave higher than its cousin the Flute, it brings a shrill brilliance to any theme, whistles excitement into any score.

But you may never have *heard* the Piccolo truly, if your radio dulled its staccato voice! Then indeed you will want more than ever to be a Scott owner after-the-war . . . to have it bring to your unbelieving ears each single instrument in the orchestra, in its own voice and timbre, as in a "living performance."

Meanwhile the Scott has sterner work to do. A Scott goes aboard the ships of our Navy, our tanker fleet, and merchant marine, wherever the flag flies, bringing news broadcasts and favorite programs from home to lonely seamen. The Scott went early to war because it was the *first* safe broadcast and short wave radio, its low radiation affording no telltale leakback to submarine direction-finders.

So instead of begrudging a Scott to those men at sea who need them urgently now—make sure that one will be yours in the earliest days of peace. A good way is to buy BONDS, BONDS and MORE BONDS now.

E. H. SCOTT

E. H. SCOTT RADIO LABORATORIES, INC.

E. H. SCOTT RADIO LABORATORIES, Inc.
Dept. IT-8, 4448 Ravenswood Ave., Chicago 40, Ill.
Please send me a complimentary copy of your new booklet on radio, "Achievement Through the Years."

Name .....

Address .....

City ..... State .....

4448 RAVENSWOOD AVENUE

CHICAGO 40, ILLINOIS

THERE'S NOTHING LIKE a band to lift the human spirit...to quicken the pulse...and steel the heart. The cheer and inspiration of music is helping no end to keep chins up at home, in civil life and in the training camps. In the schools alone, America has three million young bandsmen!

But can you imagine a band without *brass*?

Only the ductility and free-machining qualities of this time-honored copper alloy could produce the flowing curves and graceful tapers and glistening bells of modern band instruments, with slides and stops that must be airtight, yet operate with freedom and lightning speed at the lightest finger pressure. And only brass can produce the rich tonal quality so much desired by musicians.

Thus, next time you are inspired by band or orchestra music, give a thought to copper, the basic, indispensable metal that makes such beauty possible and, at the same time, is essential for so many other purposes in every walk of life.

From a safety pin to a door hinge, from a hot water tank to a marine condenser, copper and its alloys provide the utmost in service and durability. It should be easy, therefore, to understand why all industry is waiting for these versatile metals to return from all-out war duty to the arts of peace.

H10 B

THE AMERICAN BRASS COMPANY

Subsidiary of Anaconda Copper Mining Company

General Offices: Waterbury 88, Connecticut

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

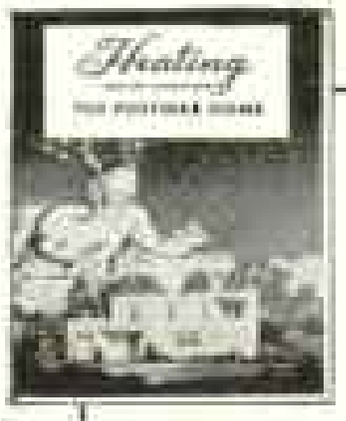
WAR BONDS are your investment in a free America . . . *BUY MORE!*

ANACONDA

Anaconda Copper & Brass

You will enjoy comfort in your home beyond anything you have ever known, when it is equipped with the new "Moduflow" Heating Control System — developed by Minneapolis-Honeywell ... "Moduflow" is available <u>now</u> for installation in a limited number of homes having any type of automatic heating plant. The cost is surprisingly reasonable.

For More Information . . . Send for the Free Booklet
Heating and Air Conditioning the Postwar Home
or . . . . See your Heating Dealer AT ONCE



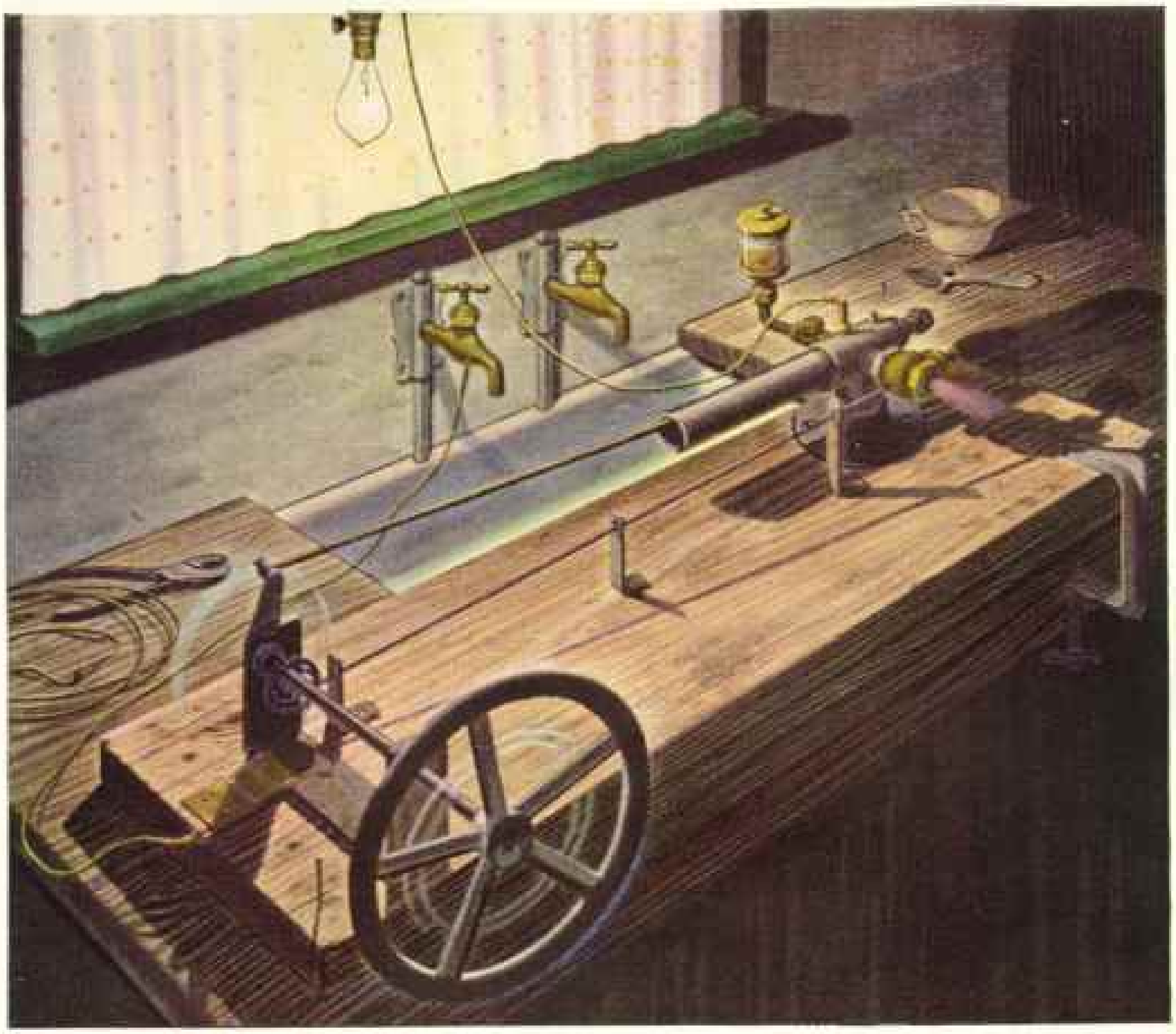
Minneapolis-Honeywell Regulator Co.
2908 Fourth Avenue South, Minneapolis 8, Minn.

Please send my free copy of "Heating and Air Conditioning the Postwar Home."

Name _____

Address _____

City _____ State _____



In the Ford kitchen . . . this little trial engine sputtered into life

IT HAPPENED far back—in the very early 1890's. In the kitchen of his Detroit home, a young engineer, named Henry Ford, was testing a principle of the internal combustion engine.

His apparatus, clamped to the kitchen sink, was a piece of one-inch gas pipe, reamed out for a cylinder—the flywheel, a hand-wheel from a lathe. Gasoline was fed from an oil cup. A wire connected to the kitchen light furnished the spark.

He spun the flywheel. Flame came from the exhaust, the sink shook and the trial engine was running under its own power Mr. Ford was satisfied. He put the engine aside. It had served its purpose. His idea was proved.

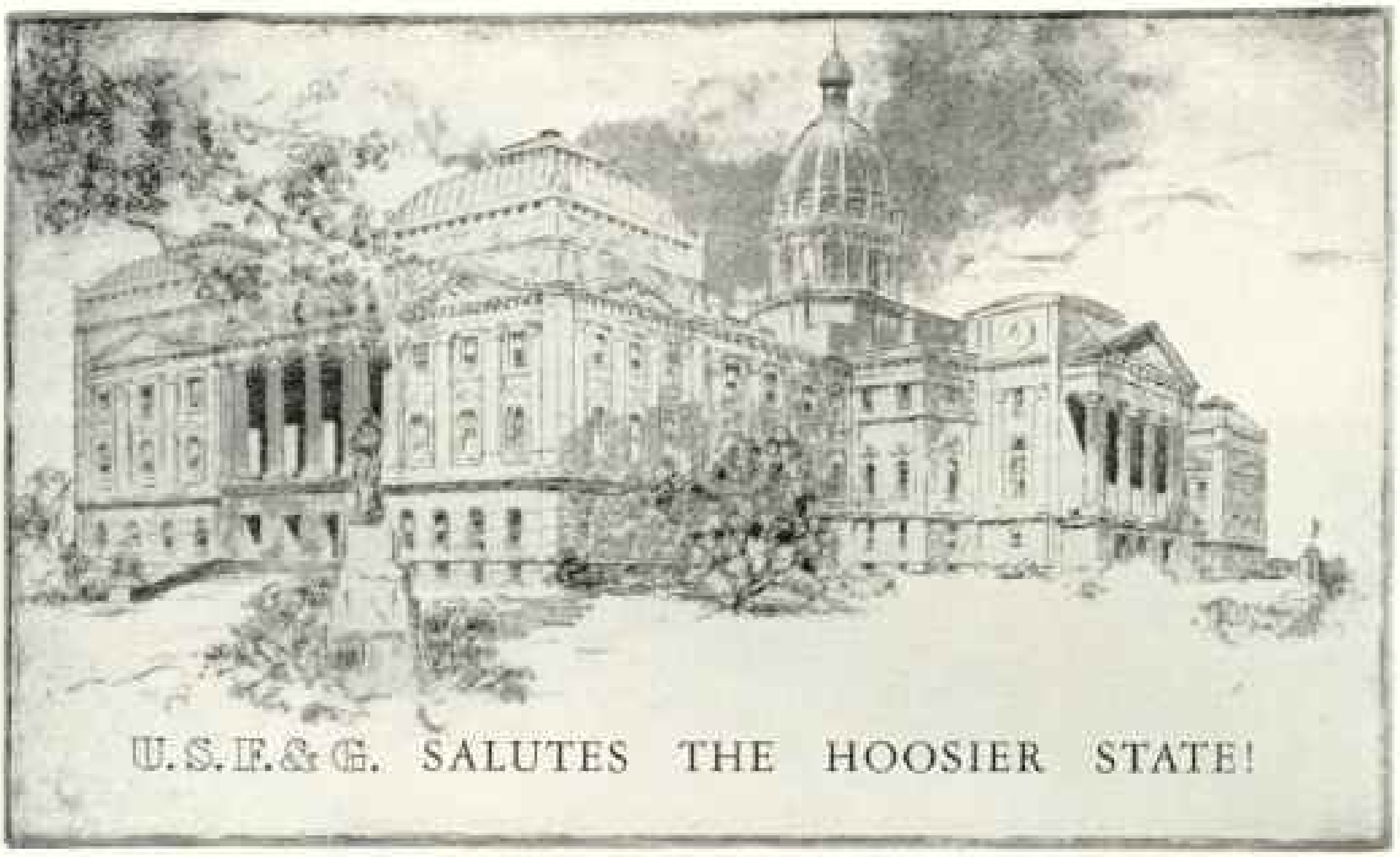
But he did not stop to applaud himself. "The man who thinks he has done something," Mr. Ford once said, "hasn't even started." His mind was already stirring with thoughts of a new and larger engine for transportation use.

Just ahead lay the pioneering which was to produce the Ford automobile of world-wide use. Ahead lay the creation of the first industrial assembly line, hundreds of inventions and improvements, the building of 30,000,000 low-cost motor cars and trucks to serve the needs of *all* the people.

Today, at Ford Motor Company the pioneering still goes forward. New methods, new materials, new devices are continually being developed. You don't hear about many of them, because Ford assignments now are military.

But one day the story of this modern pioneering can be told. It will be told, you may be sure, through the medium of Ford, Mercury and Lincoln cars so advanced in both style and engineering that new millions will seek to own them—for comfort, for smartness, for reliability, and for economy.

FORD MOTOR COMPANY



Indiana's Beautiful state capitol at Indianapolis . . . constructed largely of native Indiana limestone . . . is typical of the stately buildings that grace the Hoosier State. U.S.F.&G. is proud that its contractors' bonds helped assure construction of many of these imposing public works.

Indiana Builds to Last!

"PERMANENCE" is the word for Indiana. You can see it in her massive public buildings . . . in her rich farmlands, kept black and fertile generation after generation . . . in the stark strength of the Calumet region, one of the world's greatest industrial centers. Crossroads of America, Indiana is a state that looks to the future, a state that builds to last!

With this determination to build strongly and well . . . this resolve to forge ahead in unchecked progress . . . it is only natural that Indianians should seek certainty in insurance. To serve this insurance-minded state, U.S.F.&G. requires a large branch office at Indianapolis . . . agency offices in 197 cities and towns throughout the state. Thus nearly every community in Indiana is served by a U.S.F.&G. representative.

This complete U.S.F.&G. coverage is not restricted to Indiana alone. Few communities in the United States, its territories, and Canada are without the services of a U.S.F.&G. agent. So wherever you are and whatever you do, look to your local U.S.F.&G. representative for guidance in all casualty insurance and bonding problems. He welcomes an opportunity of serving you. Consult him as you would your doctor or lawyer.

Consult your insurance agent or broker as you would your doctor or lawyer

U.S.F.&G.

UNITED STATES
FIDELITY & GUARANTY CO.
affiliate
FIDELITY AND GUARANTY FIRE CORPORATION
HOME OFFICES: BALTIMORE 3, MD.

4,000 New York Cabs Get Top Mileage

from GENERAL SYNTHETIC TIRES

Since 1923, General Tires have been first choice among cab operators in New York City . . . leading all other makes by a large margin.

When Synthetic Tires Came, it was only natural for these same operators to look to General for continued long-mileage leadership. Since the first General Synthetics went on the wheels in September, 1943, 4000 cabs have rolled up the astounding total of 698,400,000 tire miles.

Typical among these is the huge fleet of Terminal System, Inc., which is 100% on General Synthetics. Using General Tires exclusively since 1930, Daniel Arnstein, President, *knows* when he says: "Mileage from the original treads is highly satisfactory and because of General's stronger carcass these tires take the same number of recaps as pre-war."

No Stronger Proof of mileage can be found than this performance of General Synthetics in the most punishing passenger tire service in America.

. . . goes a long way to make friends

BUY MORE WAR BONDS!

Fix these words in your mind:

Zenith Specializes in "RADIONICS EXCLUSIVELY"

★

This Zenith Policy
is your assurance of the World's Finest
in your coming New Radio

SAY THAT WORD, "RADIONICS" out loud. It sounds just like what it means . . . a compound of radio and electronics which includes many new, secret developments born in the heat of wartime necessity.

It's a broad field, RADIONICS. A field so revolutionary and fast-moving that it requires complete concentration to remain its master. That's why Zenith specializes in "RADIONICS EXCLUSIVELY." No spreading out into unrelated fields like refrigerators, washers, electric irons, cooking ranges and vacuum cleaners. Zenith has no intention of competing with lifelong *specialists* in those fields.

This policy of "RADIONICS EXCLUSIVELY" has made Zenith one of the largest Radio manufacturers in the world.

It is the reason why millions of owners of pre-war Zeniths are still enjoying top radio performance with least service expense.

And it is the reason why today, down vast Zenith production lines, flow record numbers of superbly performing Radionic devices for the armed services —many of them so "hush-hush" they can only be hinted at. They are not only helping to save lives and win battles but they are also doing their jobs under the most severe fighting and weather conditions.

SO, OUT OF WAR'S proving ground—out of Zenith's background of "RADIONICS EXCLUSIVELY"—will come the finest in radio for you. For through unrivaled war work and years of experience in "RADIONICS EXCLUSIVELY" Zenith has won unquestioned leadership in High Frequency—the basis of FM Radio, Television and Short Wave.

MARK these words . . . the Zenith Radionic Revolution is on its way! Watch for it in the coming new Zenith Radionic Radios, Radio-Phonographs, and Global Portables. It's an exclusively Zenith revolution that will begin a new era of engineering advancement and precision quality at low cost . . . a revolution that assures you greatest value per dollar in the coming new radio for your home!

Keep your eye on Zenith for the best in radio . . . and see Zenith first.

★ ★ ★

ZENITH RADIO CORPORATION, Chicago 39, Ill.
All Production Now for War or Rehabilitation

Keep Your Eye on ZENITH for the Best in Radio!

•LONG DISTANCE• RADIO

RADIONIC PRODUCTS EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER

RADIO · FM · TELEVISION · RADAR · SHORT WAVE · RADIO-PHONOGRAPHS · HEARING AIDS

"My dollar says an Hour!"

The private picked thirty minutes—the sergeant forty-five.

Who'll win the pot? The one who comes the closest to the time their G. I. pal spends dickering before he makes his purchase.

And the *time* he spends is even more important than the money, for, as it says in the War Department's Pocket Guide to Syria:

> "*. . . bargaining when making a purchase is customary. It is part of the social life of the people. They do not trade just for the money . . . but to practice their skills and judgments. To bargain intelligently is to show understanding in values.*"

That's the *custom of the country* . . . one that's *new* to many boys who are stationed there.

There's a custom of our *own* country, too, that's new to many boys in service. It's the American custom of *traveling in comfort*—which troops are doing at the rate of 30,000 every night.

Lots of them have never slept in Pullman beds before. So *going Pullman* is thrillingly *new*. And that's what it will be to *you* when the war is over.

Then, new Pullman cars will give you comfort and convenience beyond any you have known. One new-type car will be *all rooms*.

Your room—in one of these post-war Duplex-Roomette cars—will be like a private room in a fine hotel, providing every facility for your comfort and convenience. But Pullman plans that a Duplex-Roomette will cost you little—if any—more than a lower berth costs now.

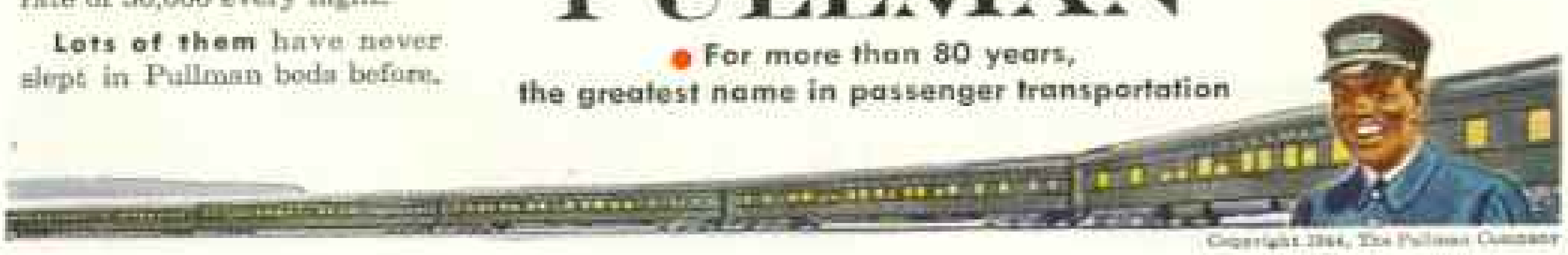
Another new-type car will provide Pullman comfort and convenience for *less* than the present rate for a berth in either standard or tourist sleeping cars.

When these two new-type cars go into service, *going Pullman* will be more than ever the *custom of the country*.

NOW'S THE TIME TO BUY ANOTHER WAR BOND!

PULLMAN

For more than 80 years, the greatest name in passenger transportation



This will never change!

but when he comes back there'll be newer, finer ways to enjoy the land he fought for

Maybe we will take our post-war meals in pink, green and purple pills...*maybe* we'll swoosh to work in rocket cars...*maybe so!*

But there are a few things that eleven million G. I. Joes want to see just as they left them—just as they've dreamed about them through all these long months. Such as the unchanging love of a girl who waited—*such as the magnificent National Parks and playgrounds that are the heritage of every American—all the exciting and wonderful things there are to see and do along seventy thousand miles of American highways!*

These will not change—but it's going to be a lot easier to visit and enjoy these and all the natural wonders of This Amazing America than it has ever been before—Greyhound promises you that. In the days after Victory look for finer, roomier motor coaches—for more spacious, better equipped terminals (perhaps with helicopter landing decks!) *Expect great things of Greyhound in the good days to come.*

GREYHOUND

Buy War Bonds — to Have and to Hold

Another Boeing Superfortress starts for Japan

They're beginning to roll off the assembly lines in ever-increasing numbers . . . these Boeing B-29 Superfortresses, only a few of which have yet seen action.

They have behind them one of the most gigantic production programs ever conceived for any weapon of war. It is considered a major achievement that the Superfortress is a quantity-production airplane as well as a high-performance airplane.

As creator of the Superfortress, Boeing assumes the responsibility of providing all engineering data to hundreds of co-operating companies . . . making all design changes and passing them along . . . supplying master gauges that control the interchangeability of parts . . . making available to all of the other companies tooling and production information, including new Boeing-developed manufacturing techniques, and successfully co-ordinating all the combined activities.

The group of manufacturers participating in this huge production program includes the Martin and Bell aircraft companies, also producing completed Boeing B-29's, and other companies producing major sub-assemblies—Briggs, Cessna, Chrysler, General Motors, Goodyear, Hudson, Murray and A. O. Smith.

While fulfilling the responsibility of servicing these co-operating companies, Boeing also carries the major loads in production. When all facilities reach capacity, Boeing will produce approximately 75 per cent of all B-29's.

The Superfortress and the famous Flying Fortress represent Boeing's effort to provide the Army's great bombing crews with the best possible airplanes for their important missions.

After Victory, Boeing principles of design, engineering and manufacture will be turned to peacetime products . . . and you can always be sure that, if it's "Built by Boeing," it's bound to be good.

DESIGNERS OF THE FLYING FORTRESS • THE NEW B-29 SUPERFORTRESS • THE STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**

*Jascha Heifetz, painted for the Magnavox collection of great artists by Boris Chaliapin

Recipe for a great violinist

"You always hear of the 'delicate, sensitive violinist'" says Heifetz. "Well, I assure you that it takes the nerves of a bullfighter, the digestion of a peasant, the vitality of a nightclub hostess and the tact of a diplomat to lead the strenuous life of a violinist."

And after all, who should know better than Jascha Heifetz? Born in Russia 45 years ago, he actually cannot remember a time when he did not know how to play the violin, for he learned at the age of three on a quarter-size instrument. At seven, he made his debut —*and has been self-supporting* ever since! His concert career has taken him four times around the world—and he estimates that he has played over 75,000 hours.

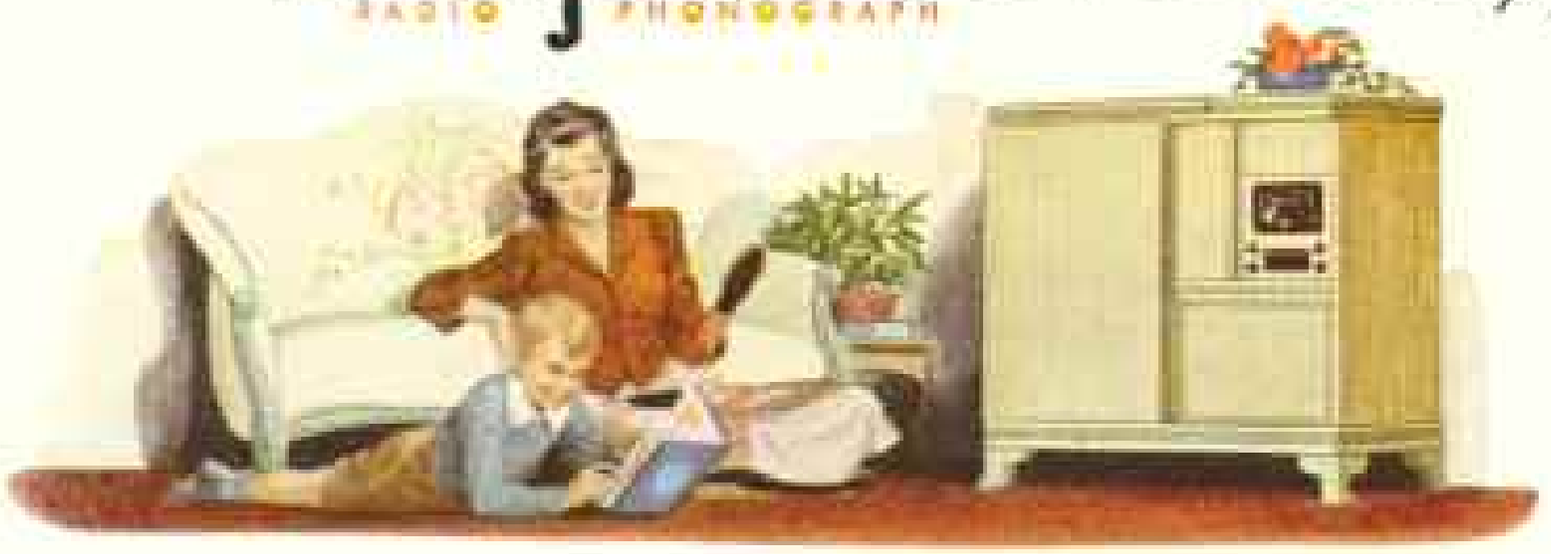
Today he keeps an extensive concert schedule—and also gives numerous performances to service men in camps and overseas. He believes that in wartime music is important. "In these days," he says, "I feel that my audiences are really with me, that we are as one, enjoying a brief escape from realities."

When Jascha Heifetz *plays*, he uses his precious Guarnerius violin dated 1742—or his Stradivarius made in 1731. When Jascha Heifetz *listens* to recorded music, his instrument is the Magnavox.

To enjoy to the full one of Heifetz's masterly recordings hear it played by the radio-phonograph he prefers above all others. So beautifully does the Magnavox reproduce great music, that Kreisler, Horowitz, Beecham and Ormandy have joined Heifetz in choosing it for their own homes.

*Send for Reproductions of Paintings: Set of ten reproductions of paintings from the Magnavox collection—size 11¼" x 9", suitable for framing—50¢ at your Magnavox dealer. Or send 50¢ in War Stamps to Magnavox Company, Department NLG11, Fort Wayne 4, Ind.

Magnavox RADIO PHONOGRAPH • *The choice of great artists*



MAGNAVOX FM

To appreciate the marked superiority of the Magnavox listen to a Frequency Modulation program over this instrument. Magnavox was an FM pioneer and the reproduction qualities required to take full advantage of FM broadcasting are inherent in the Magnavox radio-phonograph.

Buy that extra War Bond today.

Back in the '50's, locomotives such as the Mastbom of the Boston & Maine Railroad puffed through the Berkshire Hills of Massachusetts, to give the New England of those days the latest in transportation.

Today, 3400-H.P. Diesel locomotives—newest and largest railroad motive power in use on any New England road—haul as many as 125 freight cars at former passenger train speeds. They are introducing another new era in New England railroading. They have aided greatly in keeping New England warm with their loads of precious oil and coal.

HERALD OF TRANSPORTATION'S FUTURE

IN the spectacular job America's railroads are doing there is a design for finer future transportation.

It centers upon the performance of the General Motors locomotive.

Part of this performance lies in this locomotive's work. It is quick to get away—carries through its job with few or no stops for service—gets there on clipped schedules.

In run after run these locomotives are hauling heavy freight faster than passengers were carried a few years back.

These achievements are elements in railroad progress. They are forerunners of a great new era of transportation efficiency in the days which lie ahead.

KEEP AMERICA STRONG
BUY MORE WAR BONDS

GM
GENERAL MOTORS
DIESEL POWER

LOCOMOTIVES . . . . . ***ELECTRO-MOTIVE DIVISION,*** *La Grange, Ill.*

ENGINES . . *150 to 2000 H.P.* . . *CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio*

ENGINES . . . *15 to 250 H.P.* . . . . . *DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.*

BUY WAR BONDS AND STAMPS

When the wounded come home

They come more quickly, more comfortably and with higher hopes than ever before in history. American doctors and nurses are doing a magnificent job of healing both body and spirit.

Dairy products are a prime part of the treatment. For example, the medical officer of a hospital ship which handled 4039 South Pacific casualties and lost only seven, reports:

"Ice cream was served the patients every day as a food and a medicine. It helped build both strength and morale. To those wounded men, ice cream most nearly represented home and civilization."

And landing again in the U. S. A. is a tonic to appetites, too. Listen to the busy mess officer of an army hospital, where patients roll right in from the gang-plank.

"Those 700 boys have drunk up 1500 quarts of milk and the day's not over. There won't be enough milk in the state to fill them up!"

We know you'll willingly share your ice cream and milk with boys like these—even if it sometimes means doing with a little less. For our part, we're proud that our laboratories have been able to develop for the Army and Navy so many products made from milk—nature's most nearly perfect food.

Dedicated to the wider use and better understanding of dairy products as human food . . . as a base for the development of new products and materials . . . as a source of health and enduring progress on the farms and in the towns and cities of America.

NATIONAL DAIRY
PRODUCTS CORPORATION
AND AFFILIATED COMPANIES

Motorola Radio "Handie-Talkie" co-ordinating our march to Victory

The story of every great Victory of our armed forces has been a story of teamwork . . . split-second timing and miraculously unified attack. Radio ties all combat arms together . . . makes of them a united, irresistible team.

In close cooperation with the U. S. Army Signal Corps, Motorola Radio Engineers have developed, built and delivered in great quantity such battle-famous radios as the Walkie-Talkie, the "Handie Talkie", the Cavalry Guidon Set, and the powerful two-way unit that moves on wheels.

Much of this equipment has been of the F-M (Frequency Modulation) type. This is the static-less, noiseless kind of radio that you will enjoy when Victory restores peace and normal living to our America.

LIKE THE "HANDIE TALKIE", THIS TINY PORTABLE WAS A NOTABLE MOTOROLA RADIO FIRST!

Thousands knew the Motorola "playboy" as the smallest, most powerful personal portable radio on the market. It played richly, beautifully, on planes, trains . . . in steel constructed buildings. The marvelous thing about the Motorola "Playboy" was its size . . . no larger than a snapshot camera . . . just a mighty little handful of radio pleasure. Watch for the new post war Motorola "Playboy". It will be a 'Honey'! Buy more war bonds!

GALVIN MFG. CORPORATION
CHICAGO 51, ILL.

Motorola Radio

F-M HOME & CAR RADIO • AUTOMATIC PHONOGRAPHS
TELEVISION • F-M POLICE RADIO • RADAR • MILITARY
RADIO COMMUNICATIONS

Sunny Phoenix is the place to find your place in the sun

Phoenix, Arizona—in the Valley of the Sun—is just the place to spend a winter vacation. Phoenix' famous sunshine and *Certified Climate** are tailor-made for basking and bronzing . . . for luxurious loafing or all-out activity. And its hospitality is as warm and friendly as its weather. Let Phoenix be your destination when you can travel again. But PLEASE don't come without reservations!

*. . . "Certified" when the Valley of the Sun was chosen by the U. S. Army as one of America's foremost aviation training centers because of its unexcelled climate and weather conditions.

For free, profusely illustrated booklet and cartograph map, write Valley of the Sun Club, 434 Chamber of Commerce Bldg., Phoenix

Every Day is a Sunny Day

Phoenix Arizona
In the Valley of the Sun

acclaimed by music lovers everywhere

walco

Tru-Trac FLOATING JEWEL

$2.50

No needle noise or scraping at the record. 10,000 plays, less wear. Ask your dealer for the Walco Tru-Trac.

ELECTROVOX CO., INC.
MAPLEWOOD, N. J.

Authentic in Style and Design

GUILD PLAYING CARDS

Bird Prints

WESTERN PLAYING CARD CO. • RACINE, WISCONSIN

"Buy U. S. War Bonds—They Identify You"

BLACK MAGIC! 95,000,000 tons of it

travel over New York Central yearly

SOMEWHERE, paratroops attack, floating to earth on Nylon 'chutes, made from . . . ***coal!***

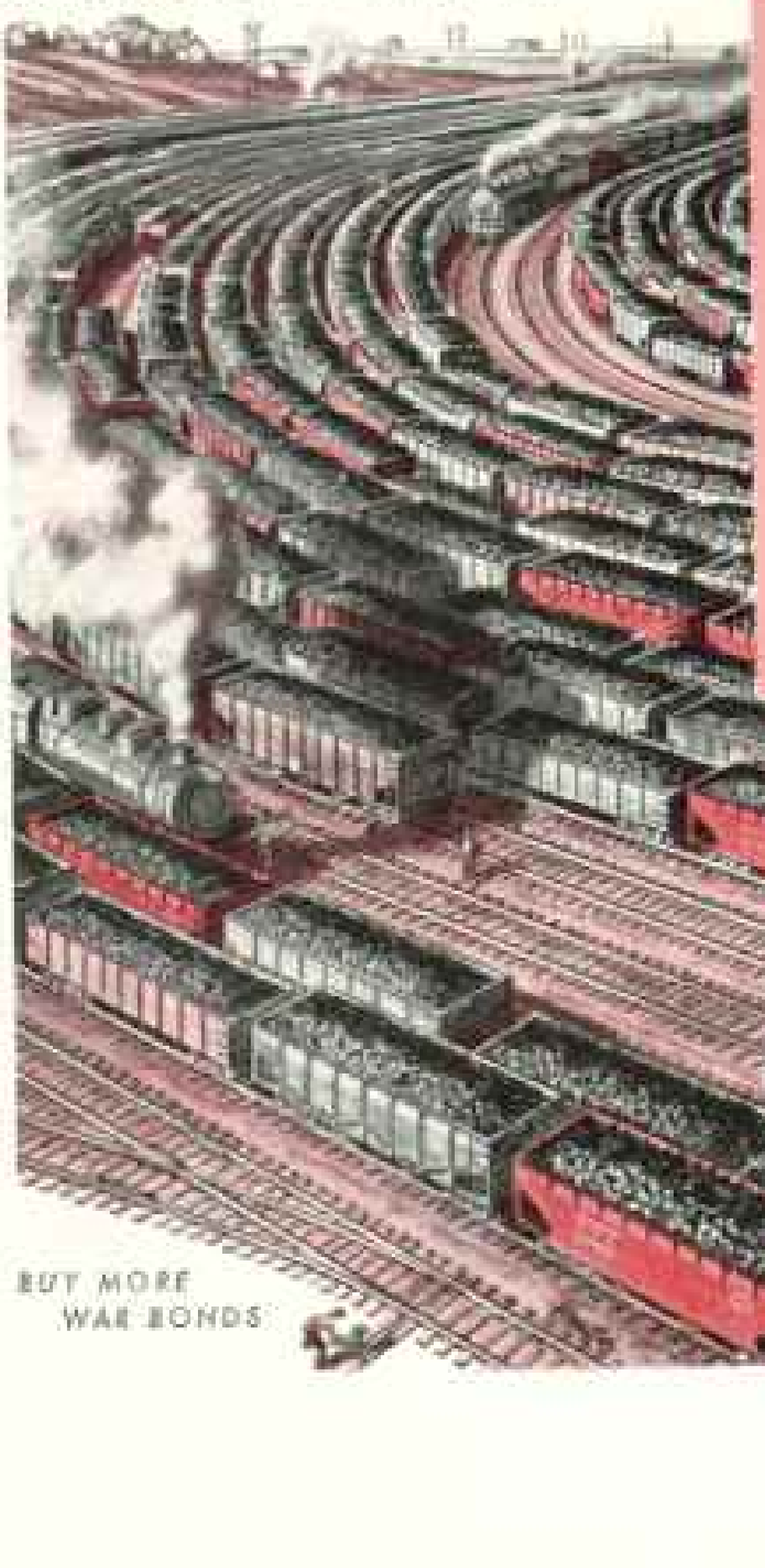
Somewhere, a girl welder directs a hissing electric spark generated by the power of . . . ***coal!***

Somewhere, a trainload of war materiel is sped on its way to port by the driving force of . . . ***coal!***

There's black magic, modern magic, in every lump of coal. And New York Central is proud to have this fighting fuel as its largest customer. For this railroad acts as a giant mechanical stoker . . . picking up coal from mines and other railroads . . . and feeding it to industries, docks and dealers along its 11,000-mile right of way.

Some 60,000 coal cars now wear the "N.Y.C." But even these must be reinforced with cars of other roads to haul a yearly coal total of 95,000,000 tons . . . including millions of tons used by the railroad itself.

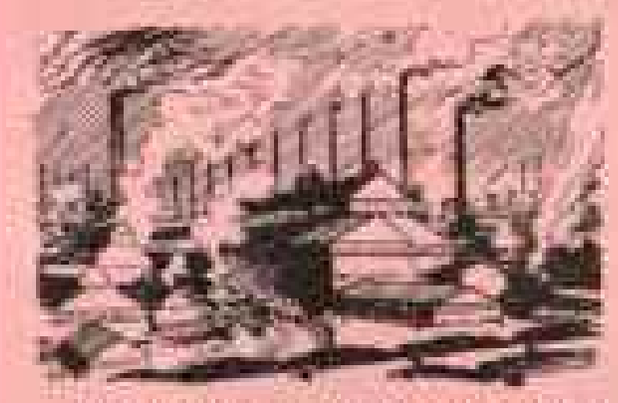
Today, only careful timing and organization keep coal flowing to where it is needed. Tomorrow, that war experience will pay dividends . . . in still more efficient fuel delivery to industries and homes of post-war "Centraland."



BUT MORE WAR BONDS

"SPURS" TO VICTORY

New York Central "spurs" tracks and branches serve mines in five leading coal states. At each mine, loaded cars must be picked up daily and replaced by empties to maintain the vital flow of coal.

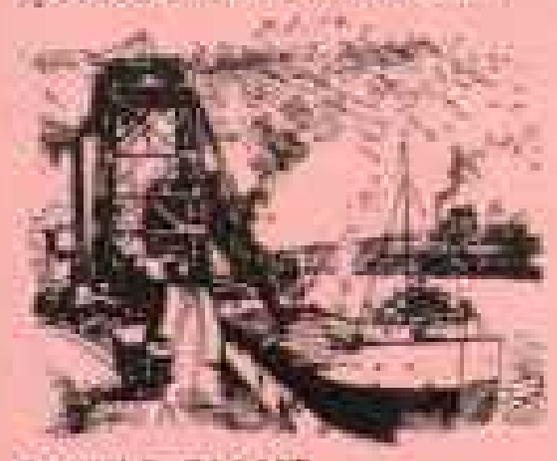


STOKING THE FIRES OF WAR

One big plant may burn as much as 200 carloads of coal a day. Those cars must be delivered in endless procession from the mines to the plant siding . . . and the empties speeded back for more coal.

HELP SAVE FIGHTING FUEL

Due to war demands, it's not always possible to deliver to your dealer as many cars of coal as he or we or you could wish. So please use your coal supply with care . . . help conserve America's fighting fuel.



GENTLE GIANT

This giant coal dumper picks up a car and pours its 70-ton load into a ship as easily as you'd pour sugar from a spoon. Gently, too. For New York Central takes extra care to prevent coal breakage.

NEW YORK CENTRAL SYSTEM

NEW YORK CENTRAL

ONE OF AMERICA'S RAILROADS—ALL UNITED FOR VICTORY

ONE DAY'S COAL TRAFFIC

If all the coal Central hauls in *one day* were gathered in this lakeside yard, you'd see 4,500 cars . . . 35 solid miles of them!


"When Johnny Comes Marching Home Again!"
He'll be Looking for
Inter woven Socks
Now he knows what a difference there is in Socks ... Comfortable ... Good-Looking socks that Wear and Wear ... and WEAR.
INTERWOVEN – the Greatest Name in Socks.
IF YOU CAN'T ALWAYS GET JUST THE INTER WOVEN SOCKS YOU WANT ... PLEASE REMEMBER ... EVERY DAY — THOUSANDS AND THOUSANDS OF PAIRS OF INTER WOVEN SOCKS ARE GOING TO THE MAN IN THE SERVICE
German Goering Brau
* REG. U. S. PAT. OFF.
Copyright by Interwoven Stocking Company 1944

"HEART DISEASE

...but I've never been sick in my life!"

Why should heart disease strike a man of health and vitality?

Well, the doctor explained, you know how age affects your face and hands and hair. Over the years, your heart grows older, too, so that it may be less able to meet the demands of strenuous living. Unless you learn to know and live within the capacities of your heart, you *may* risk serious coronary heart disease even in the very prime of life.

Sudden exertion is a thing to avoid.

Just what is coronary heart disease?

Coronary heart disease means that the walls of the coronary arteries—the arteries feeding the heart muscle—have hardened up a bit, become thicker, and have lost some of their elasticity. As a result, the heart muscle receives less blood and thus less food and oxygen. Naturally, if you then make excessive demands on your heart, you're inviting trouble.

Coronary heart disease is the most common form among men past forty. Even at younger ages you should watch for such possible warning symptoms as excessive fatigue, shortness of breath, chest pains, or oppression near the heart.

What can be done about it?

First, see your doctor and be guided by his advice. If the attack is severe, he may prescribe a period of rest in bed.

The doctor will surely recommend the rules for living which everyone over forty would be wise to follow as a PRECAUTION against heart disease.

For example, the doctor will advise moderation in all things. He will stress the importance of avoiding sudden exertion—the wisdom of getting plenty of sleep and avoiding overweight. Periodic physical examinations will probably be recommended, including X-ray, laboratory, or other tests.

Must patients become invalids?

No—so long as they don't overdo. Diagnosed early, the damage to the heart may be negligible. Besides, it should not be cause for needless worry. Today, thousands of people who have heart disease, and who take care of themselves, are living virtually normal lives. Strict self-discipline, to gain freedom from all worry and strain, is of primary importance. Less strenuous forms of physical recreation should be found. In other words, it is necessary *to relax.*

For more information, send for Metropolitan's free booklet, 114-N, entitled, "Protecting Your Heart."

New York's oldest inhabitant

According to geological records the Phytosaur is one of the first known residents of the New York City area.

He lived about two hundred million years ago in what geologists call the Triassic period. A reptile about twelve feet in length, he had a curious beak-like snout armed with sharp teeth.

The Phytosaur was a crawler and a swimmer. In many ways he resembled our modern crocodile. But he differed in two important respects.

His nostrils were set back near his eyes instead of at the end of his snout. And the teeth at the tip of his snout were long and curved like nippers on a pair of tongs.

The Phytosaur was equipped in this strange way for a very good reason.

With his nostrils so far back, he could float along just under the surface of the water with just the top of his head protruding, and thus sneak up on his unsuspecting prey.

As the Phytosaur illustrates, nature's creatures were fitted to the particular conditions under which they had to live.

But few of the earth's inhabitants have ever been able to protect themselves against the consequences of a sudden change in environment.

Man is an exception.

Through insurance, he protects himself and his family against the consequences of sudden changes that might otherwise bring financial disaster.

If you should be deprived of your earning power because of injury following an accident, accident insurance will provide an income for you and your family and will pay your medical bills while you are away from your job.

If a fire or windstorm should damage your property, fire or windstorm insurance will pay for the expensive repairs which must be made. If burglars should break into your house, theft insurance will cover the loss you suffer and the damage which is done.

And, of course, life insurance will protect your family if something should happen to you.

Consult your local Travelers agent or broker about the forms of protection you need to guarantee the financial safety of your family and yourself.

Moral: Insure in The Travelers. All forms of insurance and surety bonds. The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, Hartford, Connecticut.

Lifetime® SUPREME VALUE AMONG PENS

"TRIUMPH" MODEL

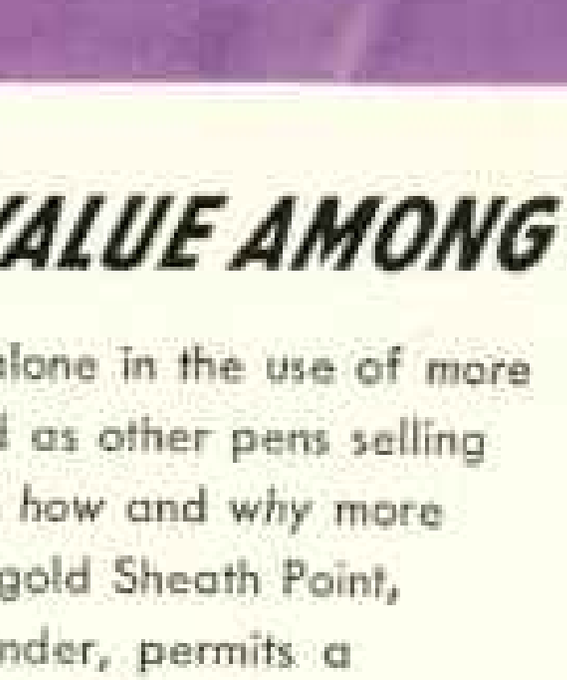
Greater worth—not alone in the use of more than twice as much gold as other pens selling at the same price—but in *how* and *why* more gold is used! This 14 karat gold Sheath Point, stronger because it is a cylinder, permits a *larger diameter* fluid feeding mechanism giving *safe* fluid control under all atmospheric conditions! W. A. Sheaffer Pen Company, Fort Madison, Iowa; Toronto, Ontario, Canada.

"TRIUMPH" *Lifetime*® pen, with clip, $12.50; pencil, $5. "TRIUMPH TUCKAWAY" model, without clip, for men or women, carries safely *in all positions* in purse or pocket—pen, $12.50; pencil, $4. Other sets with 14K gold trim, $35 to $125.

*All *Lifetime* pens, identified by the White Dot, are unconditionally guaranteed for the life of the first user except against loss and willful damage—when serviced, if complete pen is returned, subject only to insurance, postage, handling charge—35c if you send it to the factory yourself; slightly more if you request the dealer to do it for you.

Listen to SHEAFFER'S WORLD PARADE with UPTON CLOSE
NBC Complete Network—Sundays, 3 to 3:30 P.M. E.W.T.;
2 to 2:30 P.M. C.W.T.; 1 to 1:30 P.M. M.W.T.;
12 to 12:30 P.M. P.W.T.

THE BOTTLE WITH THE TOP WELL!



Top Well keeps fingers clean. Only SKRIP has the Top Well. SKRIP successor to ink. Regular size, 25c—School size, 15c.

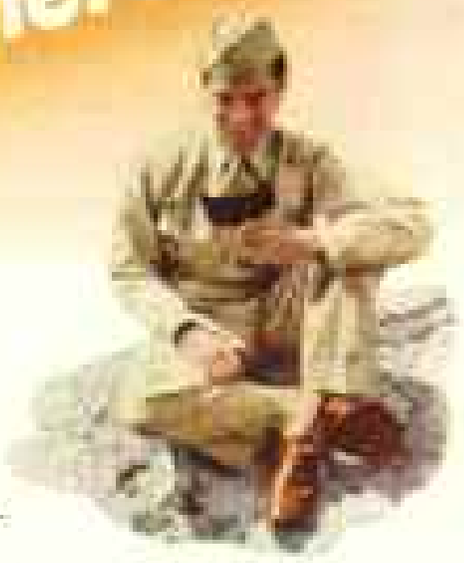
Ask for Sheaffer's when you ask for Leads. Look for complete Sheaffer lead department containing all sizes, colors and grades—strong, smooth-writing, grit-free—Flintline leads were developed for Sheaffer by Jos. Dixon Crucible Co. Economy package, 25c; regular package, 15c.

SHEAFFER'S

Kodak Minicolor Prints...

2X Minicolor Prints, reduced in size

make a big hit over there...



• Send your service man a leather-finish pocket case with one . . . two . . . three Minicolor Prints made from your Kodak Bantam or 35-mm. Kodachrome Film transparencies. Minicolor Prints, full-color photographic enlargements, reproduce all the natural beauty of your original transparencies. Three sizes. Order Minicolor Prints and pocket cases through your Kodak dealer.

He also has easel folders for Kodacolor Prints—the full-color prints on paper made from your Kodacolor Film negatives. Kodacolor Film is scarce; but there's a little to be had. At your Kodak dealer's . . . Eastman Kodak Company, Rochester, N. Y.

THE MARCH OF COLOR

IN 1928 Kodak brought out a film for making home movies in full color.

IN 1935 Kodak introduced full-color Kodachrome Film—making color movies available to every American home.

IN 1936 Kodachrome "still pictures," shot with a Kodak Bantam or 35-mm. camera, became the joy of tens of thousands.

IN 1938 Kodachrome sheet film led to full-color photographs as magazine and newspaper illustrations.

IN 1941 Kodak introduced Minicolor Prints from miniature Kodachrome Film transparencies—the first direct full-color photographic prints.

IN 1942 Kodacolor Film fulfilled the dream of generations—color snapshots, full-color prints made from color negatives in an ordinary roll-film camera.

Kodak Research

has made color photography a part of everyone's life

THRILL YOUR FRIENDS WITH

Fabulous Fruit

FROM OREGON'S BLUE GOOSE ORCHARDS

Fruit so large and unusual, few have ever seen it! Christmas Boxes of du Comice pears, once grown in France as the luxury of Kings. Baskets of du Comice pears and other equally rare fruit.

Order now as all supplies and cartons are short. We shipnone time after October 15.

Everything is guaranteed to be exactly as advertised and to arrive in perfect condition.

BOXES OF DU COMICE PEARS

So large, each Pear is a "handful." Sweet, tender, dripping with juice, considered the finest pears in the world. Box of 10 to 11. Express prepaid. $2.95

De luxe Box (21 to 24 Pears) . . . $5.15

HOLIDAY BASKETS

Gleaming white, hand-woven, heaped with du Comice Pears, giant red and yellow Delicious Apples, immense Oranges, Emperor Grapes, White Figs, Coachella Valley Dates. As illustrated above with red ribbon and cellophane wrapping. Weight about 20 lbs., express prepaid. $10.95

Smaller size, weighing about 15 lbs., $8.95.

Shipments guaranteed to arrive in perfect condition (only military camps are at your own risk). Send check or money order. No orders outside U.S. No C.O.D.'s. Reference: 1st National Bank, Medford.

BLUE GOOSE ORCHARDS
American Fruit Growers, Inc.
221 Fir Street — Medford, Oregon

War hasn't changed Tucson's *famous* climate!

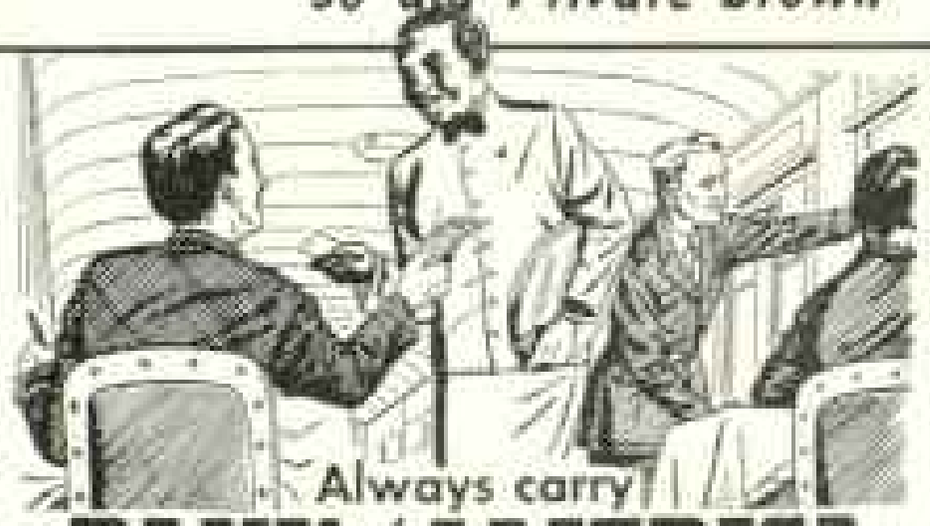
Sun still shines practically every day of the year. Air is dry, warm and tonic, regardless of the war. Nowhere else in the U. S. can you find this rare combination of moderate altitude and climate.

For free booklet and information write our 25-year, non-profit *Tucson Sunshine Climate Club*, 4404-B Rialto, Tucson, Arizona.

P.S. Confirmed reservations for living accommodations are imperative!

Your place in the sun is TUCSON

The General paid with a Travelers Cheque . . . and so did Private Brown



Always carry

BANK of AMERICA TRAVELERS CHEQUES

They're cashable everywhere, self-identifying, insure your money against loss or theft.

Backed by the resources of a three billion dollar bank

Sold by banks and travel agents everywhere

Issued by Bank of America National Trust and Savings Association, CALIFORNIA
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
London, England, Branch: 12 Nicholas Lane, London, E.C.4.

"Buy U. S. War Bonds—They Identify You"

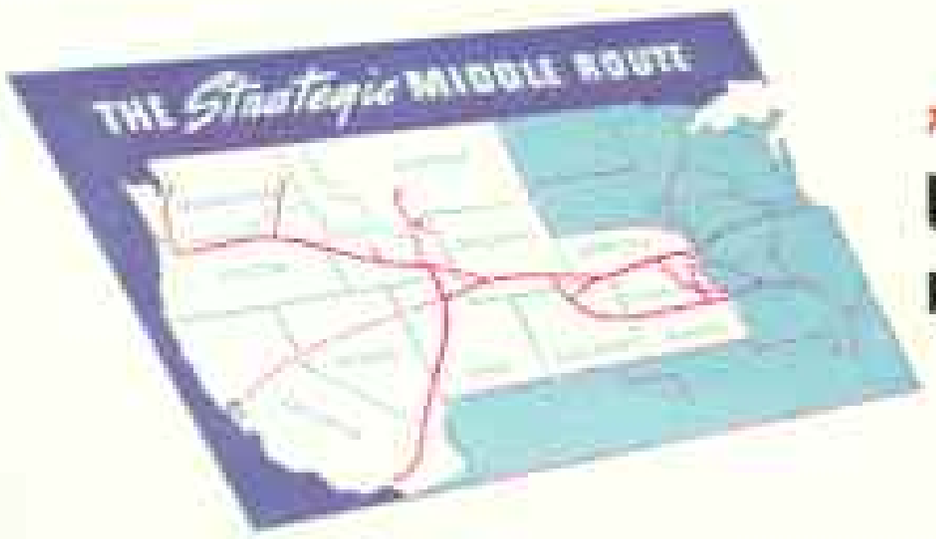
They "Keep 'em Rolling"

The demands of wartime place a heavy load on the nation's railroads. Materials must be kept moving—troops, too—with utmost efficiency. To do so, all equipment must be maintained in good condition.

Union Pacific locomotives, for example, are periodically inspected. If repairs or new parts are required, the work must be done with painstaking care and no loss of time. That's the job of the men in the shops. They "keep 'em rolling."

These men know how important it is that our fighting men get an adequate and constant supply of materials and food; know that it can't be done without dependable home-front transportation. But their incentive for hard work and sacrifice is more than victory. It's also the urgent desire to keep this country the way it always has been . . . a land of opportunity where enterprise and initiative are recognized and rewarded.

★ *Extra war bonds bought today will speed the day of victory.*



THE PROGRESSIVE

UNION PACIFIC
RAILROAD

GEOGRAPHIC MAPS—timely, accurate!

Ideal for Following War or Peace Developments

Ten-color Series Now Includes a Greatly Enlarged World Map

National Geographic Society ——— 1944
Dept. C-I, Washington 6, D. C.

Please send me the items indicated below:

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I enclose remittance of $ ____ payable in U. S. funds.

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THE all-important geographic factors of World War II and the coming peace are shown on the National Geographic Society's ten-color maps. Widely used by our Government and Armed Forces, they will help you also to understand problems of war and peace and to follow each day's fateful events. Because The Society's spelling of geographic names has been adopted by leading press associations, places mentioned in news dispatches may be readily identified on these charts. With their corresponding Indexes they are indispensable guides to world geography . . . Mail the adjoining order blank today to obtain the best maps for personal use or thoughtful giving.

ENLARGED WORLD MAP

A 67½ x 43½-inch edition of The Society's World Map has been made available at the request of schools, libraries, lecturers, and students of military affairs. Enlarged from 41 x 26½ inches (the size of the standard edition) and printed in ten colors on heavy chart paper, this handsome map is highly legible. It is ideal for wall display in schools, lecture halls, offices, training camps, or wherever a really big map is needed. The Index to the standard World Map applies also to this enlargement.

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These useful Indexes are available for all maps marked with asterisk*. Each Index describes the area covered, gives geographic data, and contains alphabetical listings and location keys to all the geographic names on the corresponding map. Indexes are bound in protective covers, 7 x 10 inches.

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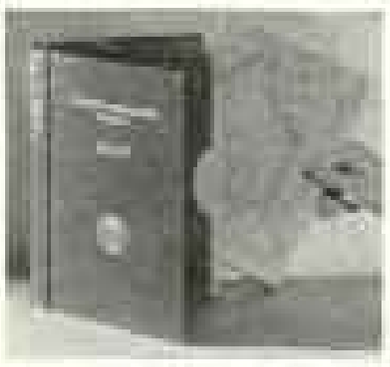

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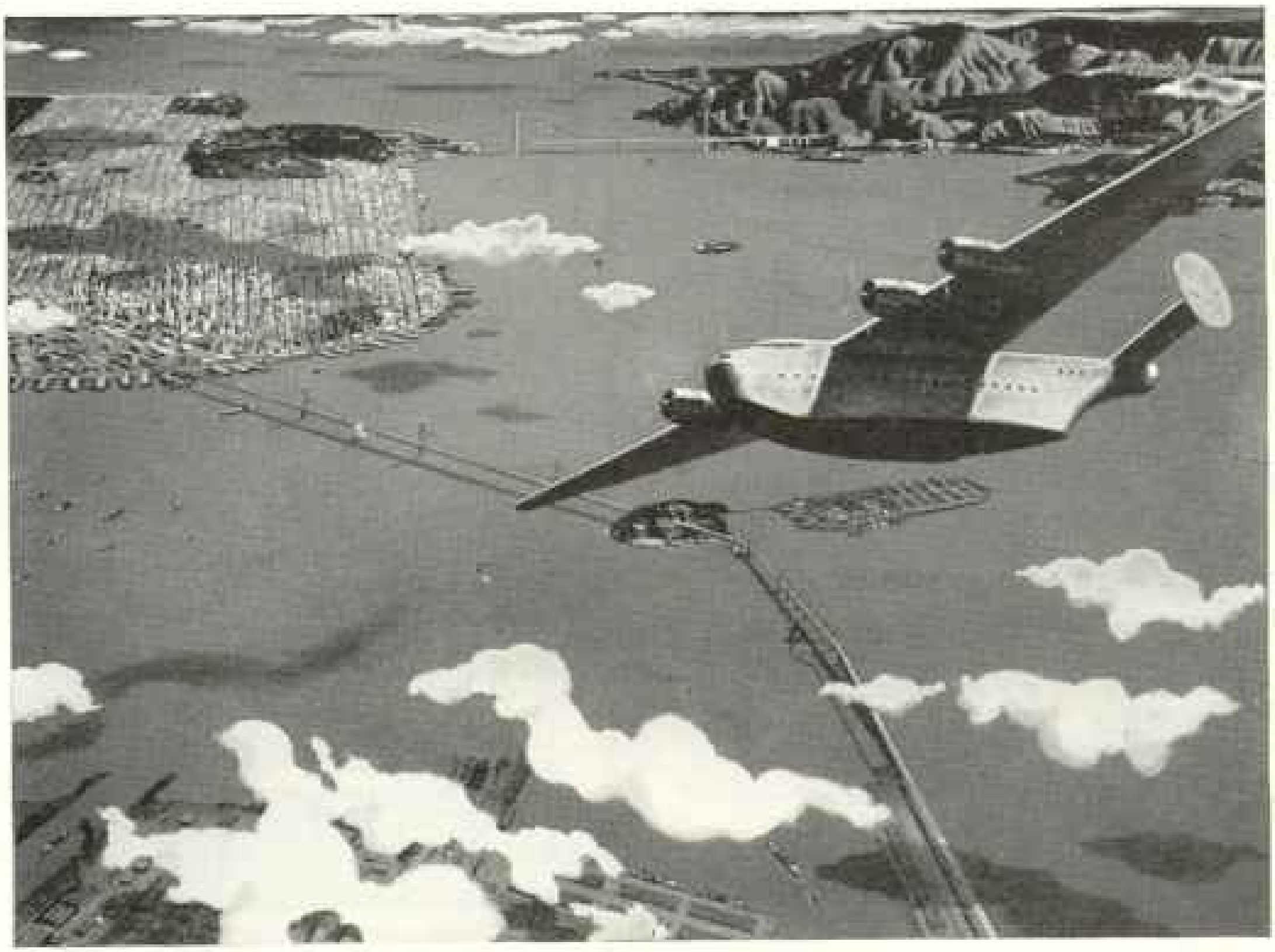
Obtainable only from the NATIONAL GEOGRAPHIC SOCIETY, Dept. C-I, Washington 6, D. C.



THE GOLDEN GATE

What the sailors missed, a soldier found

This is San Francisco Bay, and the deep strait that joins it with the Pacific Ocean ... the Golden Gate. This Bay, with its 450 square miles of anchorage, could accommodate at one time all the ships of the world.

For nearly 300 years after the discovery of the New World, vessels of the maritime nations searched for this legendary harbor. All missed the Golden Gate.

What the sailors missed, a soldier found. A land expedition led by Captain Don Gaspar de Portola discovered San Francisco Bay in 1770. It was inevitable that there should be here a city worthy of this harbor.

Yerba Buena was its childhood name—a drowsy pueblo where the Spaniards traded hides and tallow for things the shrewd New England traders brought.

Then gold was discovered on the American River, in 1848. Ships from all the seas set sail for the Golden Gate. In 1849, 500 vessels lay in the Bay abandoned by their gold-crazed crews. And the city was born. San Francisco! Forthright, whole-hearted, cosmopolitan. A city of the sea.

The Gold Rush brought people from everywhere to San Francisco. They brought color to the city, profoundly influenced its manners and its food, made it gay, worldly wise and tolerant.

Cable cars were invented to climb this city's hills. Piers fanned out into the Bay. Towers rose upon the heights. An incredible bridge was spun across the Bay, to Oakland; another across the Golden Gate.

Then, Pearl Harbor! America at war in the Pacific turned at once to San Francisco Bay. It became the main port of embarkation on the West Coast. As the might of the nation grew, it became also the world's greatest naval base. And here have been launched nearly one third of all American ships built in this war.

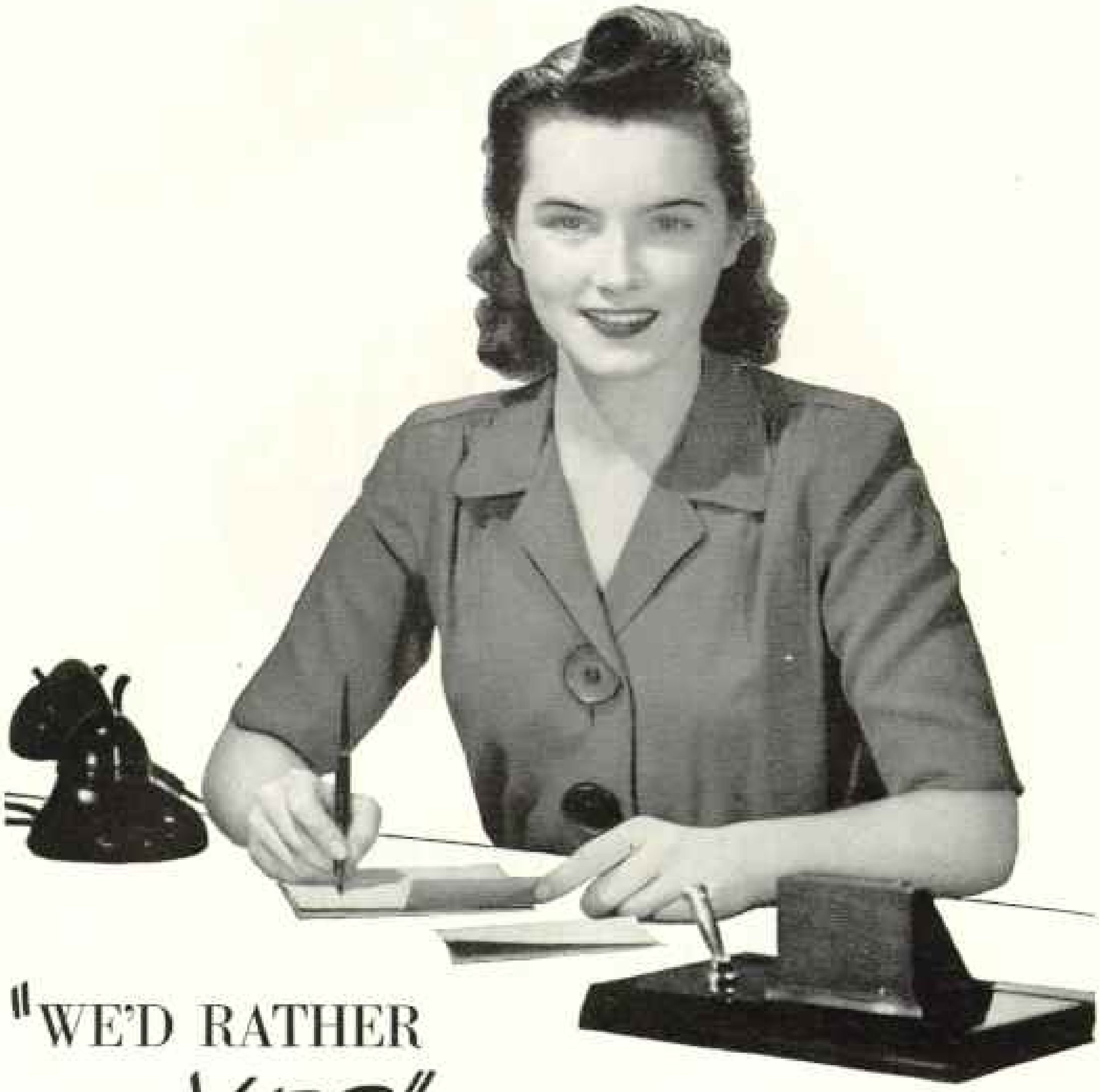
War workers poured into the Bay area, increasing the population to 2,127,000. Army and Navy personnel came and were stationed here in mounting numbers. Today all facilities of the area are taxed to capacity. This is why we must ask pleasure-seekers not to come here now.

But do see San Francisco and the vacationland it centers after the war. Plan to come here on your Victory Vacation. See America's most fascinating city; Yosemite National Park and Lake Tahoe in the High Sierra; the quaint gold towns along the Mother Lode; the Redwood Empire with its giant trees; the charming land of Del Monte, Carmel and Monterey; Shasta Dam in the Shasta-Cascade wonderland ...

Buy War Bonds now and hold them. See California on your Victory Vacation, after the war.

CALIFORNIANS INC.

703 Market Street, San Francisco 3, California



"WE'D RATHER SAY *YES*"

We don't like to tell people that they'll have to wait to get a home telephone. We'd much rather say "yes" to requests for service. That's the way it always used to be.

But the needs of war still have first claim on available telephone equipment and on telephone manufacturing facilities and manpower. Delays in filling civilian orders just can't be helped.

All of us telephone people sincerely appreciate your patience and understanding in this war emergency.

BELL TELEPHONE SYSTEM

Chemicals that protect your car!

HERE ARE THREE CHEMICALS that you are probably better acquainted with from the way they *act* as anti-freeze in your car than from the way they *look* in print.

These chemicals are manufactured in large quantities by CARBIDE AND CARBON CHEMICALS CORPORATION. Uncolored, they are water-white. To the chemists, who must know what they will do in your car, they are compounds of carbon (the atoms of which are shown here in the molecular models in *black*), hydrogen (*orange*), and oxygen (*blue*).

ETHYLENE GLYCOL, ETHANOL and METHANOL are the bases of anti-freezes —and they help to take one of the worries out of winter for millions of motorists.

TODAY AND TOMORROW

Over the years, CARBIDE AND CARBON CHEMICALS CORPORATION and other Units of UCC, notably NATIONAL CARBON COMPANY, INC., have kept at their research—both in the laboratory and on the road—for the constant improvement of anti-freeze and anti-rust protection for your car. This is an important reason why you can depend on the following wherever and wherever you find them:

"Prestone" ethylene glycol-base anti-freeze. One "shot" gives all-winter protection.

"Trek" methanol-base anti-freeze, which is again available to the extent that the production of methanol has caught up with its war-critical uses.

"Blue-Fin" ethanol-base anti-freeze. Not being manufactured this year because ethanol (ethyl alcohol) has a bigger war job to do.

Certain other anti-freezes formulated and manufactured by Units of UCC for large national distributors.

"Rustone" corrosion preventive which, when added to the water in a clean cooling system, inhibits the formation of rust.

▼

Car owners are invited to send for the booklet E-11, "Manual of Cooling System Service." It will be sent without cost or obligation.

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