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THE NATIONAL GEOGRAPHIC MAGAZINE

A Map Maker Looks at the United States

By NEWMAN BUMSTEAD

LAST spring a National Geographic Society map maker, with maps in hand, took off from Washington, D. C., on a 9,500-mile air trip over 28 States of the Union. Colored lines, dots, and shading took form and substance—the maps came to life—as the great American scene unrolled below me.

While the ground sped to our rear and fell away beneath, rapidly at first and then more and more slowly, I compared The Society's large-scale map of Washington, produced from a special aerial survey, with the actual terrain (page 713).*

Doughnut in Cloverleaves

On land as on map, the Pentagon Building to me is a geometrical doughnut (pages 706-707). When I saw from the air the graceful but intricate system of highway cloverleaves that tie it to downtown Washington, across the Potomac, I felt sympathy and quiet understanding for the driver of the crowded bus who lost his way in the vicinity of the Pentagon during the war.

Motors and passengers alike seemed to settle back and relax as we climbed to 18,000 feet. Far below, clouds hung motionless in a lazy pattern, perfectly matched by shadows on the Virginia countryside.

Map makers, judging by myself, are accustomed to a thought process that flows from the earth's full-sized spherical reality to a certain mathematical reduction of it on flat paper.** On this trip I was reversing the process and becoming one of the millions who use The Society's maps. I let the map herald the unfolding, mile after mile, of the mountain peaks, fertile plains, rivers, lakes, and deserts that constitute America.

With my route penciled on two sets of sectional maps, I had cut out overlapping oblongs to fit a pocket notebook.† By dividing elapsed times between take-offs and landings into 10-minute intervals, I marked map positions for approximate orientation.

"Must be raining down there in West Virginia," mused the young lady sitting beside me. She was flying to Hong Kong and Formosa for a two-year hitch with the United States Foreign Service.

In a World Apart

I shared her obvious disappointment at the sudden appearance of solid cloud cover which separated us from the landscape. But whatever the weather below, ours was that of a world apart, a world of deep-blue sky and perpetual sunshine.

Two hours, 500 miles, and one fine meal later the clouds became broken; the earth reappeared. The time was 1:55 p.m., and the corresponding position in my notebook atlas was in northern Indiana.‡

Although few cities are labeled with signs that are legible from the air, they all show their "fingerprints"—no two are identical—of highway or railroad patterns.§

Reading the fingerprint of the city below, I

* See "A Pocket Map of Central and Suburban Washington, D. C.," NATIONAL GEOGRAPHIC MAGAZINE, September, 1948.

** See "The Round Earth on Flat Paper," by Wellman Chamberlin. Published by the National Geographic Society.

† Large-scale regional maps of the United States issued with the NATIONAL GEOGRAPHIC MAGAZINE: Northeastern United States; Southeastern United States; North Central United States; South Central United States; Northwestern United States; and Southwestern United States.

‡ See "Indiana Journey," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, September, 1936.

§ See "Skyway Below the Clouds," by Carl R. Markwith, NATIONAL GEOGRAPHIC MAGAZINE, July, 1949.

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Pentagon, World's Largest Office Building, Was Built Like a Spiderweb to Save Steel

"Why, everything comes in fives!" visitors to the labyrinthian Pentagon often exclaim. The building has five sections, one nesting within another, each with five stories and five sides. The central court totals five acres. Seventeen and a half miles of corridors knit the structure together.

With this unorthodox plan, architects saved enough structural steel to build a battleship. Crews working under floodlights finished the $70,000,000 job January 15, 1943, sixteen months ahead of peacetime speed.

The Department of Defense's headquarters houses 28,000 workers, divided among Army, Navy, and Air Force. Each floor is painted a distinguishing color. Visitors have wall maps and printed floor plans to guide them. Even office workers sometimes become lost in the building's complexities. When General Eisenhower was new to the Pentagon, he once had to ask assistance in finding his office.

707 National Geographic Photographer J. Baylor Roberts

Cloverleaf Roads Baffle Random Motorists

The Pentagon, too big for downtown Washington, stands in Virginia beside an inlet of the Potomac (left). A small city in itself, the building contains five cafeterias, two dining rooms, nine snack bars, department store, barber shop, post office, newsstand, drugstore, laundry, and bank.

Parking lots for 6,600 cars are not enough; space for 1,600 more is being created. Generals, admirals, and high civilians park near the entrances; small fry use the distant "buckwheat," or "Siberia."

found that its "whorls" of steel and concrete matched the black (railroad) and red (highway) lines that met at South Bend on my map.

Suddenly from under the plane's broad wing slipped Lake Michigan, flecked with the white sails of small week-end pleasure boats. The lake seemed more like mottled glass than water. An empty Lakes freighter, red hull riding high, plied its way northward. Off to the south spread Gary, Indiana, tied to low-hanging clouds by a pall of smoke from its steel mills.

I watched the rapid transition from tightly built lakeside Chicago (pages 730-31)* to less and less crowded residential areas which finally blended into rich farmland. Somehow the maze of city streets had combined and merged into the rectangular highway system shown on The Society's map of North Central United States.

Designers of linoleum could learn a lesson from the artistry of northern Illinois truck farms. Crops planted in various-sized squares and oblongs form an intricate green mosaic, relieved here and there by black swatches of freshly plowed ground.

All lines in this rectangular pattern run north-south or east-west. Basic division is the 6-mile-square township, provided for by the Ordinance of 1785. These in turn have been cut up into 36 sections of one square mile each. Smaller and irregular divisions have followed, especially in the most heavily farmed areas, but strict adherence to the original compass-point rectangularity is the general rule.

Arable areas throughout much of the country are thus as well marked with the cardinal directions as if a Bunyanesque draftsman had scribed the land itself with parallels and meridians. With this system in mind, I found it a simple matter to compare map and ground in terms of actual compass points.

Although 2,500,000 times larger, how like my map was the scene below! † Davenport and Rock Island, neighboring black spots beside a blue ink line on the map, I easily identified in reality at the junction of the Rock River with the

* See, in the National Geographic Magazine: "Mapping the Nation's Breadbasket," by Frederick Simpich, June, 1948; and "Illinois, Crossroads of the Continent," by Junius B. Wood, May, 1931.

† The scale of The Society's map of North Central United States is 1:2,500,000, or 39.46 miles to the inch. At a speed of 250 miles per hour, the air traveler will advance his route on this map at the rate of 6.3 inches per hour.

708 U. S. Air Force

Trained Eyes Appraise the Shooting by Air Force Cameramen

Air Force color photographs accompanying this article were made during tests of a photoelectric aperture control for plane-borne cameras. This new device automatically assures accuracy of exposure in varying light, even at jet speeds. Col. George W. Goddard (right) commands the photographic laboratory at Wright-Patterson Air Force Base, Dayton, Ohio. He and two assistants here examine huge (9 x 18 inch) color transparencies on an illuminated table.

Mississippi. Just beyond, in Iowa, Muscatine marked the larger river's sharp turn to the south.

Clouds Hide Plains to Denver

My map-to-land comparisons were again interrupted by a solid cloud layer which was to hide the plains to Denver, where we landed at dusk.*

Early next morning I left my hotel to catch the 6:35 milk run to Salt Lake City. A pea-soup fog, unusual for Denver, greeted me at the airport. Two hours later the fog and I were still there, but conditions had improved sufficiently to meet the Civil Aeronautics Administration's safety requirements.

We took off. For two or three minutes the plane climbed through the dense mist. Suddenly we "surfaced" upon a sea of sunlit rollers which extended to the slopes of the upthrusting Rockies.

I picked up Pikes Peak, which was clearly labeled by the switchbacks of its motor road. They appeared as loose stitches of white thread, coarse near the mountain's base and finer toward the summit.

Nestling in clear morning air at the foot of this huge memorial to Zebulon Montgomery Pike was 6,000-foot-high Colorado Springs, resort city of fine residences, hotels, and (it's no secret, they're proud of it) virtually no industry! No smoke!

Forty miles to the south I spotted Pueblo, a sprawling mass of smoking factories on the plain beside the Arkansas River. Here in Colorado's industrial center we made our first of seven stops between Denver and Salt Lake City.

Gone was the early-morning fog. In made-to-order weather we soared above the Arkansas River to Canon City, distinguishable from the air by the gray stone walls of Colorado State Penitentiary.

On the field I asked the steward, "Do we fly over Royal Gorge?"

"No, it isn't on our route; but if we leave here on time, the pilot might consider taking it in," replied the genial young man.

Minutes later our plane, steeply banked, was circling over the Royal Gorge. Into this

* See "Colorado, a Barrier That Became a Goal," by McFall Kerbey, National Geographic Magazine, July, 1932.

1,000-foot-deep defile, which seems scarcely wide enough to accommodate the Arkansas River, man has crowded a railroad track. Across its top he has stretched a lacy highway suspension bridge. From bottom to top, on the sheer slope, he has built a funicular railway.

Across the Continental Divide

In 20 minutes we came to the Continental Divide. Like the motorists on the winding road below, we took advantage of Monarch Pass, low point in the Sawatch Mountains. Flanking the pass on the north and south were the 14,000-foot peaks of Antero and Ouray.

Dropping to 7,600 feet, we landed at Gunnison, site of Western State College, a fact conspicuously proclaimed by an immense W high on an adjacent mountain slope.

From the air here, and westward through Montrose and Grand Junction, the valley floors resemble green rivers, so sharp is the color line between them and the barren, steep valley walls.

In these verdant "rivers" the airborne cartographer sees three lines: First, the life-giving, lazily meandering stream, seeming to seek, like the loitering schoolboy, the longest way; second, and in sharp contrast, the railroad, bending no more than necessary, in smooth, reluctant, almost haughty curves; third, striking a healthy mean between its companions, the highway, sometimes gracefully accompanying the railroad but more often inclined to the ways of the carefree stream.

In 1853 Lt. E. G. Beckwith, a member of Capt. John W. Gunnison's transcontinental railroad surveying party, referred to the lower valley of the Gunnison River as a desert unfit for cultivation and habitable only by savages.

Aloft, I marveled at the transformation wrought by irrigation. Beckwith's "desert" is today productive farmland.

Habitable? Grand Junction, its trading center, is home for 14,000 people, none of whom appear to be very savage.

On the next hop, to Price, Utah, we passed the Roan, or Brown, Cliffs. This evenly stratified formation looks like the laminated cardboard relief models The Society's cartographic department has produced of Peru and China for study of these mountainous regions. As a

709 National Geographic Photographers B. Anthony Stewart and John E. Fletcher

No Wonder the Author Likes Flying

Newman Bumstead, the National Geographic research cartographer, demonstrated that, if you fly, it's more fun to fly with maps. Touring the United States, he followed his progress by comparing the terrain with The Society's maps. Cities identified themselves with "fingerprints" of highways and railroads. Rivers wrote out their names with meanders. Here Mr. Bumstead points out Lake Erie to United Airline hostesses Betty Housel and Solange Rioux.

Lauriston Lowry

Cape Cod Ends in a Sandy Buttonhook

English explorer Bartholomew Gosnold, fishing these waters in 1602, pulled in so many cod that he named the Massachusetts peninsula for the fish. Pilgrim Fathers signed the Mayflower Compact in Provincetown Harbor (at tip of the hook) but settled on the mainland. Today the Cape is New England's favorite summer playground. Inlets, ponds, and patches of trees darken the maplike white surface of this air view. Cape Cod Canal (left), by cutting 60 miles off the trip, saves shipping a six-hour run. Woods Hole (lower right) is the site of the Oceanographic Institution.

model maker, my reaction to the Brown Cliffs was that a little more clay between the steps of the laminations would improve the job.

Provo Centered in Checkerboard

Between the Wasatch Range and Utah Lake lies Provo, in the midst of a green checkerboard—squares of orchards, squares of truck gardens, squares of grass spotted with cattle; and in the corners of some squares tight clusters that are homes and farm buildings and shade trees.*

Yes, "This is the place!"

I was struck with the truth of Brigham Young's words as we flew over his bountiful land. At Provo and northward to Salt Lake City the thought repeated itself again and again. It returned once more, 24 hours later, as I left Brigham Young's city, which makes a show of its cleanliness, friendliness, and abundance of water.

* See "Utah, Carved by Winds and Waters," by Leo A. Borah, NATIONAL GEOGRAPHIC MAGAZINE, May, 1936.

North to Pocatello, Idaho, I flew over mountains covered with geometrically patterned wheat fields.* Some were oval and appeared from the air like rush door mats laid over the irregular slopes. Others were rectangular with sharp corners and straight lines.

The oval fields belong to wheat growers who practice what is called "cross-the-slope farming." This type of cultivation is used in areas where terrain is too cut up with ridges to permit following exact contours.

The rectangular fields are cultivated and planted with little or no regard for modern soil conservation methods.

Between Pocatello and Idaho Falls, on the broad, flat plains of the Snake River, spread the lavas. These grotesque outcroppings appear as if they might have been molten but a few days ago. They reminded me of chocolate fudge spilled and burnt on my mother's cook stove.

Every seat of our DC-3 was occupied when

* See "Idaho Made the Desert Bloom," by D. Worth Clark, NATIONAL GEOGRAPHIC MAGAZINE, June, 1944.

we left Salt Lake City, but we had dropped a few passengers at each stop until now, en route from Idaho Falls to Jackson, Wyoming, I found myself the only passenger. I persuaded the pretty stewardess to wangle an invitation for me to the cockpit.

"Got to get her up to 9,500 feet and do it pretty quick," explained my host, the smiling young pilot. He pointed to the altimeter, and I watched its wavering needle as, with each lurch of the plane in the rough air, it registered our rapid climb.

Tetons Come into View

Already the Tetons had changed from a hazy ridge on the eastern horizon to a massively buttressed range straight in front of the cockpit.*

We talked fishing and wondered how it would be in the mirrorlike and inaccessible little lakes high on the slopes below.

Alpine parks, lush, grassy-green areas surrounded by high trees, rivaled the neatness of the pampered grounds of The Society's administration building in Washington.

As we crossed the range at the required 9,500 feet, Grand Teton loomed majestically some 4,000 feet above our port wing. Its summit is 13,766 feet above sea level.

We started down at once because Jackson's airport, although a scant seven air miles away, was 3,000 feet lower.

No sooner had the plane set me down with my bag than it was off again. Mouth and eyes wide open, I stared across the flat valley from which the Tetons poked up with awe-inspiring grandeur (pages 732-33). Suddenly the spell was broken when a woman's voice demanded, "Where are you going?"

"Who, me?" I responded.

"Yes, you. You can't stay out here."

I explained that I had a reservation in town.

"Get in my car over there and don't mind the dog. He won't bite."

Obediently I joined the little cocker, who welcomed me by wagging himself and his tail at the same time.

"I am Mrs. H. H. Francis," she offered as the car started. "My husband and I run the Francis Motel."

When I "mentioned the National Geographic" and told her that I wanted to see all I could of Jackson Hole in a single day, she briefed me on points I should not miss.

Next morning I was on my way at 4:30, with an addition to Mrs. Francis's plan—I would see the sunrise on Grand Teton from Jenny Lake, I thought. But not so. Lofty Grand Teton gets its sunrise long before night ends in Jackson Hole.

When I finally realized this, a fact that one of my calling should have foreseen, I stopped the car where I was, turned off the lights, and got out into the still, frosty darkness. High in the starlit western sky the peaks of the Teton Range were beginning to appear, like a dull pink nocturnal mirage.

It was little more than daylight in the valley when I entered the Church of the Transfiguration across the road from the "town" of Moose. Through the large plate-glass window in back of the altar of this little log chapel I looked out on the Teton Range, now fully bathed in sunlight. "I will lift up mine eyes unto the hills . . ."

Next, as directed by Mrs. Francis, I stopped my car on a bluff overlooking the beaver ponds, where with luck I might see a moose or two at breakfast.

"Must be too late," I thought as I looked everywhere except directly below me. But no hurry. Whiffs of rising mist and wild ducks feeding unconcernedly held my attention.

Eye to Eye with a Moose

How long his brown eyes had been looking at me when I acknowledged his presence with a gasp, I do not know. Immediately below me, some 20 feet—much nearer than my type of wildlife interest demanded—was a moose.

In the split second during which I was negotiating with my feet for a quick return to the car, the more-than-horse-size animal snorted and moved away a few steps. So I held my ground. For perhaps 10 minutes I watched him leisurely cross the pond, stopping now and again to sample some underwater tidbit and not failing to throw an occasional glance at me.

Of the trip's next leg, my map told of highways, railroads, reservoirs, waterfalls, and towns that combine with the Snake River to form a giant crescent from the towering Tetons across southern Idaho to the depths of Hells Canyon. Dominating the crescent's black, red, and blue lines on the map is the blue line, the Snake River. Through the gates of the dam at Jackson Lake (page 732) I had watched the infant flow, its precious meted waters destined to wet many a fertile acre in southern Idaho.

As we flew over the Big Hole Mountains, breaks in the clouds afforded glimpses of the tumbling stream, eager to be done with the confinement of canyon walls.

Once clear of the mountains, the Snake,

* See, in the National Geographic Magazine: "The West Through Boston Eyes," by Stewart Anderson, June, 1949; "Cloud Gardens in the Tetons," by Frank and John Craighead, June, 1948.

Washington's Aerial Portrait Reveals the Geometric Layout of Its Mall Axis

Like a tremendous bowling alley, the Mall proper extends a mile from the distant Capitol to Washington Monument. Construction of the Reflecting Pool lengthened the axis three-quarters of a mile. Railroad tracks once crossed the Mall; buildings dotted it. Formal landscaping was done within the present century.

French-born Pierre Charles L'Enfant drew up the National Capital's plan, including the Mall, in 1791. He presented a bill for $95,000, but Congress paid only $3,894. L'Enfant's possessions were valued at $45 when he died in 1825.

Lincoln Memorial stands on reclaimed land. Jefferson Memorial, domed in white marble, faces the blue Tidal Basin. Arlington Memorial Bridge spans the muddy Potomac to the Virginia shore.

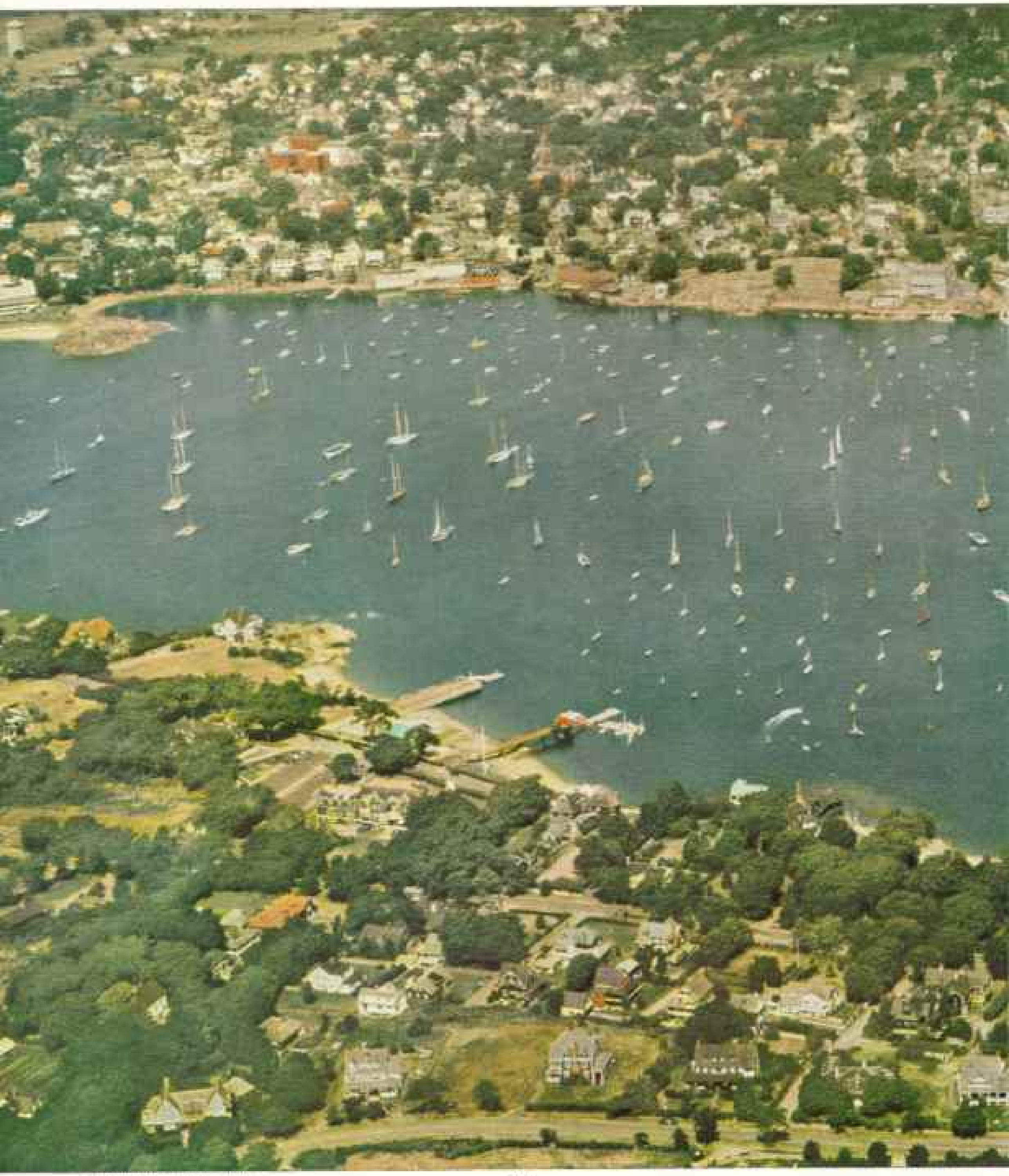
Unable to Expand Outward, Manhattan Island Builds Toward the Sky

Two million New Yorkers sleep in the island's 22 square miles. Commuters swell the daytime population to an estimated four million. Terraced white structure stands at the East River end of Wall Street, financial heart of the Nation. Freighter, tug, and ferry ply the Hudson (background). Warships tie up to the shore (upper right).

Air Force Color Photo

Brooklyn Bridge, Opened 68 Years Ago, Was the First of Six East River Spans

The builders, John and Washington Roebling, here introduced steel suspension cables spun in midair. On-the-job accidents killed the father, crippled the son. For years the latter directed work from a sickbed. A 16-year job, the bridge was hailed as the engineering marvel of the century. Here it wears fresh rust-preventive paint.

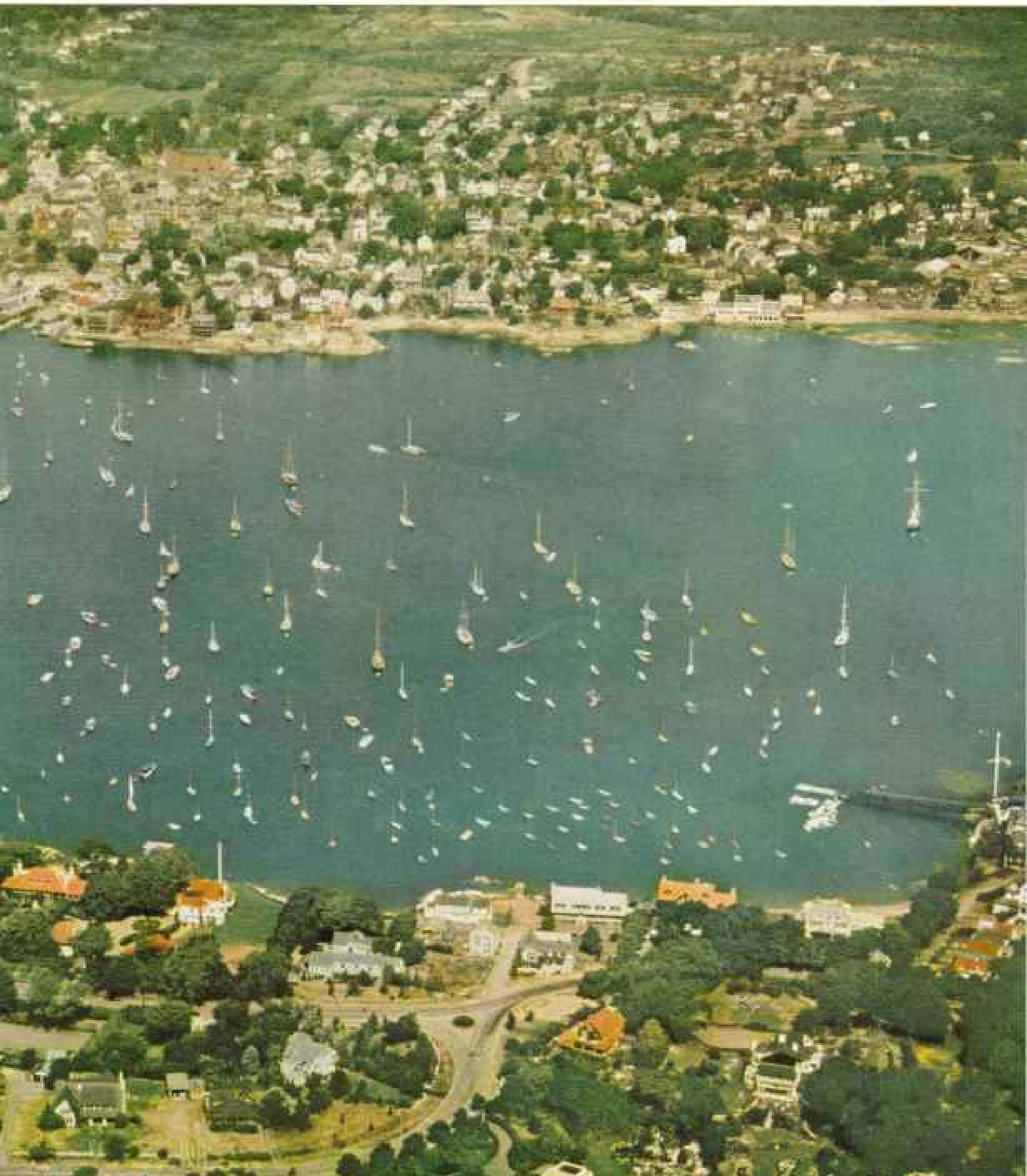


Marblehead's Elm-arched Streets Have Tales to Tell of Colonial Days

Pre-Revolutionary mansions dot this Massachusetts town. Several, now museums, recapture the flavor of sails and wooden ships. Old town lies across the harbor; the near shore is Marblehead Neck.

Cornwall and Channel Islands fishermen settled here in 1629. Their descendants helped fight our sea battles in the Revolutionary War and War of 1812. Most of the U.S.S. *Constitution's* original crew were Marblehead men. For its patriotism, the port paid the price of blockade and economic prostration.

When other cities won its maritime trade, Marblehead returned to prominence as the "yachting capital of the eastern seaboard."



Anchored White Sailboats Fleck the Harbor Like Gulls Resting on the Sea

Generations of Marblehead youngsters have learned sailing fundamentals in small centerboard boats affectionately known to them as "brutal beasts." Seven or eight sailboat classes compete in Saturday races from mid-June to mid-September. Largest are schooners, ketches, and yawls. Climax of the season is Race Week, the first in August. Boats compete near harbor entrance to the right (not shown).

Lower shore line's large, multiwindowed building (left), with flagpole and pier, houses the Eastern Yacht Club, whose 1877 regatta made Marblehead a yachting center. Pennant mast (far right) marks the Corinthian Yacht Club. Boston Yacht Club stands on far shore (center).

With a Never-ending Roar, the Niagara River Plunges 169 Feet down American Falls

Erosion in 20,000 to 35,000 years has moved Niagara Falls upstream 6½ miles from the original site at Lewiston, New York. Wind-whipped spray still nibbles the soft shale, undermining the river bed's hard limestone shelf (note fallen fragments).

In places the falls retreat upstream at the rate of four to five feet a year. Unless it is checked, the cataract will be lost in Lake Erie, 18 miles distant, in about 20,000 years.

Erie, 572 feet high, flows into Lake Ontario, 246 feet, through Niagara River. Their difference in elevation accounts for the rapids and the falls.

This air view, snapped above Canada, shows American Falls, smaller Luna, or Bridal Veil, Falls, and a part of Horseshoe Falls (right). Between them lies Goat Island, named for a hardy billy goat which survived a cold, lonely winter there in 1779.

719 Air Force Color Photo

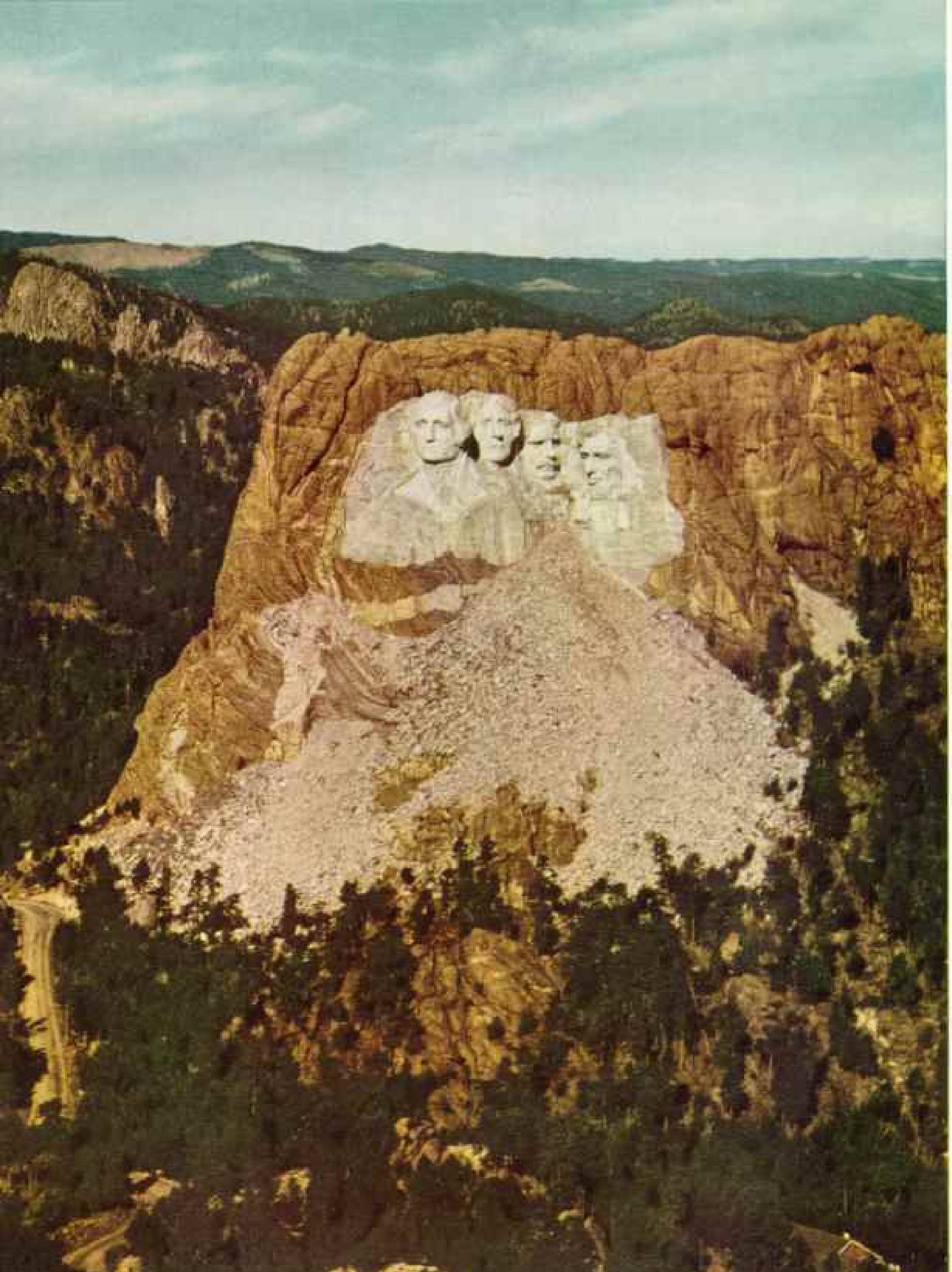
Frenchmen, Lured by Indian Tales of Thundering Waters, Found the Falls in 1678

So moved were La Salle's followers that they fell to their knees in prayer. They saw "wild beasts" attempt to ford the upper river, then vanish over the precipice. Other explorers told tales of canoe-borne Indian maidens cast adrift above the brink to appease angry gods.

Of all great waterfalls, Niagara has the steadiest flow—212,000 cubic feet a second. Guaira, or Sete Quedas, Falls, on the Brazil-Paraguay border, and Khon Cataracts, Indochina, carry larger volumes measured across the year. Angel Falls, Venezuela, drops 2,648 feet, 15 times as far.

Only the United States portion of Horseshoe Falls is shown (right). Most of its sweeping curve lies in Canada. It drops six feet farther than American Falls.

Rainbow Bridge links Niagara Falls, New York (upper left), with Niagara Falls, Ontario. The excursion boat *Maid of the Mist* docks between American Falls and bridge.



Air Force Color Photo

Washington, Jefferson, Theodore Roosevelt, and Lincoln Keep Watch in the Black Hills

Gutzon Borglum, scaffolding Mount Rushmore, carved the 60-foot heads from living granite. He died in 1941, just as the 14-year job neared completion. He predicted one inch of stone would erode in 100,000 years.

now mature, begins to work its way through Idaho.

As we followed the Snake's crescentlike course across the State, I looked down on dams that shunt its water into canals that feed it into irrigation ditches, which in turn lose themselves in green fields of potatoes, sugar beets, alfalfa, and beans.

Impressed with the importance of the Snake River to Idaho's economy, upon my return home I looked for its reflection in the 1950 Census figures. The result? No less than 71 percent, or approximately 420,000 of Idaho's 588,637 citizens, live within 25 miles of the main channel of the Snake.

Airlines Avoid Hells Canyon

From Weiser to Lewiston the Snake flows north through the Seven Devils country and Hells Canyon, deeper than the Grand Canyon. I had hoped to soar over this 7,900-foot gorge, but airlines avoid the area, no doubt with good reason.

So I flew to Lewiston in a big westward detour which took me over the spring-green slopes of the Blue Mountains to Pendleton, Oregon; to Pasco, where the Snake joins the Columbia; and to Walla Walla, which in Indian language, and fittingly, means "Place of Many Waters."

In Lewiston I looked up Kyle McGrady, riverman and postman extraordinary. At the time of my visit he was delivering mail by boat once a week to the handful of sheepherders, cattlemen, and placer miners who live in the rugged, roadless valley of the Snake between Lewiston and Hells Canyon (page 748).

Because the Snake River is the Idaho-Washington boundary along the first part of the run and the Idaho-Oregon boundary the rest of the way, Kyle filled mailboxes in three States. All mail bears the same address: River Route, Lewiston, Idaho. So here's a place where you can live in one State and have an address (tax free) in another State.

Next morning, with a twin-engine roar and a mountainous wake, we headed upstream with the mail.

"She'll do nearly 40 miles an hour in still water," shouted Kyle of his 28-foot craft.

"But why this talk about still water? There's none around here. And what about those rocks and rapids ahead of us?" (This to myself as I nodded understandingly to "the captain of my fate.")

With resounding whacks and thumps against solid water, the powerful boat ascended the first of River Route's 46 rapids.

The sensation was that of hill climbing, but I doubted my senses. Not until I consulted detailed maps weeks later could I fully believe my own experience. In Pleasant Valley Rapids, for example, we were gaining altitude at the rate of 38 feet per river mile.

Total climb in the 92 river miles between Lewiston and route's end at Rush Creek is 555 feet, the exact height of the Washington Monument.

These figures raised the eyebrows of "staff canoeist" Ralph Gray, who allows that a drop of 20 feet per river mile is fast water for shooting rapids in a canoe, to say nothing of going upstream in a powerboat!*

Once clear of that particular stretch of raging white water, Kyle threw it a glance of respect, respect born of many encounters, and said, "Those rapids have been given various names, but 'Pleasant Valley' is the only one you can print."

Typical mail stop was a burlap bag tied to a pole where a threadlike trail off the canyon wall met the river's edge.

Out jumped Kyle's helper Everett with the mail—letters, a bundle of newspapers, a bag of flour, a box of dynamite, or a crate of eggs, as the case might be. Instead of "ringing twice," Everett simply upset the pole and burlap bag.

Stray Lamb on Passenger List

On the return trip we carried a stray lamb in a sack with a hole just big enough for his head to stick out; we picked up a gold miner who was going to town after a solitary winter at his diggings; and we picked up a 79-year-old National Geographic Society member, Thomas Morgan, with quick, blue eyes set in a smiling bronzed face. He talked about "lambing" 1,200 sheep (his business on the Snake), about prospecting, and about oceanography (Dr. Maurice Ewing's articles in the NATIONAL GEOGRAPHIC in particular).†

Airborne again, I shared a seat between Lewiston and Spokane with a boiler inspector from a well-known Hartford, Connecticut, firm.

"I have a heck of a time figuring towns from the air," he complained. "Things seem a little different."

The steward joined us, and we three, aided by The Society's map of the Northwestern United States, spotted Colfax, Steptoe, and

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Down the Susquehanna by Canoe," July, 1950, and "Down the Potomac by Canoe," August, 1948, both by Ralph Gray.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE: "New Discoveries on the Mid-Atlantic Ridge," November, 1949, and "Exploring the Mid-Atlantic Ridge," September, 1948, both by Dr. Ewing.

Rosalia, trim communities set in the alternately wooded and farmed landscape below.

Coming into view shortly before we landed at Spokane, the beautiful valley of the Spokane River stretched eastward toward Coeur d'Alene. Towns named Opportunity and Greenacres attest to its character.

From Spokane I drove 90 miles to Grand Coulee Dam to obtain an on-the-ground impression of this American colossus.

My map had much to say of this area. It told of the dam's upriver effect on the Columbia, now wide enough to merit a double blue line and the name Franklin Delano Roosevelt Lake. It showed seven towns that were born and grew with the building of Grand Coulee Dam. Grand Coulee, ancient course of the Columbia, and Dry Falls were other items in my map's account of the region.*

I watched green water fall clear for 40 feet from the dam's 1,650-foot spillway, then break suddenly into a cottage-cheese texture and whiteness for the final plunge of 300 feet. I drove across its 4,173-foot crest, and listened to the low, smooth hum of 1,260,000 electric horsepower in one of its twin powerhouses. I stood in its clinically clean control rooms and walked through some of its eight-and-a-half miles of inspection tunnels.

Such comparisons as enough concrete to build three great Pyramids, or to pave a transcontinental highway, deal only with magnitude. The dam has other equally real but less tangible qualities. An American standing below the spillways of the Grand Coulee Dam cannot help being proud of the Nation which did this mighty job of engineering.

Nature Once Dammed the Columbia

Viewed from the air 24 hours later, man's dam-building efforts shared their glory with the natural setting where, during the Ice Age, Nature threw a glacial dam across the Columbia. Thus diverted, the raging waters of the swollen, glacier-fed river gouged out the 40-cubic-mile canyon that we saw stretching southward from the dam site. This canyon is Grand Coulee.

For some 25,000 years now, since the ice receded and allowed the Columbia to revert to its old, and present, channel, Grand Coulee has been high and dry. Its floor is about 200 feet above the surface of Roosevelt Lake, which was formed by Grand Coulee Dam. The coulee is 52 miles long, one and a half to five miles wide, and at places 1,000 feet deep.

As our plane completed its circling maneuver and leveled off toward the southwest, I could see earth-moving machines, which appeared like ants on an anthill. They were working on the second of two earth-fill dams that will turn the northern half of Grand Coulee into a high-level irrigation reservoir.

Pulling itself up by its electric bootstraps, the Columbia will, in summer, raise some seven percent of its volume through giant pumps driven by electricity produced by other waters of the Columbia as they pass through the generators of Grand Coulee Dam.

Water from this equalizing reservoir, as it is called, will be delivered by means of canals, siphons, tunnels, and prehistoric watercourses to more than 1,000,000 fertile but thirsty acres to the south, some as far south as Pasco, 100 miles distant.

25,000-year-old Dry Falls

Our plane followed Grand Coulee far enough to give us a look at Dry Falls—dry for about 25,000 years.

I tried to visualize 100 Niagara Rivers plunging over a three-mile brink for a sheer drop of 400 feet—two and a half times the drop of Niagara Falls. I couldn't do it. I tried to from the air, and I tried it in the hush of twilight as I stood beneath this ghost of what may have been the mightiest cataract of all time.

After brief stops at Wenatchee and Yakima† and a few minutes during which our jovial stewardess, Peggy Shaw, busied herself with a flight report, she picked up The Society's map of the Northwestern United States from the vacant seat at my side and began to talk.

From her home in Zenith, Washington, she had recently driven her station wagon through Snoqualmie Pass in the Cascade Range to Cle Elum, over the Wenatchee Mountains to Blewett and north to lovely Lake Chelan.

"That's the road over the mountains from Blewett," she said, pointing down to the range at our right. "And that must be the town of Cle Elum. Yes, there's Cle Elum Lake and Kachess Lake just beyond."

She looked back at the National Geographic map in her lap. "Why, the whole trip is right here! Everything but little Zenith."

I unfolded the map to the Puget Sound inset and there, as much to my delight as to Miss Shaw's, was "little Zenith." Later, as we were approaching the Seattle-Tacoma Airport, she was able with the map's help to find

* See "Columbia Turns on the Power," by Maynard Owen Williams, National Geographic Magazine, June, 1941.

† See "Washington, the Evergreen State," by Leo A. Borah, National Geographic Magazine, February, 1933.

723 J. P. Millard

Steel Mills Line the Smoky Cuyahoga; Ore Boats Feed Cleveland's Blast Furnaces

Before emptying into Lake Erie, the Cuyahoga cuts through the heart of Cleveland. Factories and warehouses cluster along its industrial flats. A docked ore carrier here replenishes Republic Steel's stock piles.

Zenith and point out her apartment house.

On another holiday Miss Shaw had driven to the rain forests of the Olympic Peninsula where, having seen my tickets, she knew I was bound.

"Be sure to drive as far as you can up the Hoh River Valley and then get out of your car and walk a mile. It's wonderful. Not many know about it. I really shouldn't tell you, because you'll put it in the NATIONAL GEOGRAPHIC. I don't want to find popcorn vendors there when I go back."

After a night in Seattle I took off from Boeing Field for Port Angeles.

Only a few of the flight's 35 minutes had slipped away when I was able to predict good weather. Basis for my prediction was a breath-taking view of the jagged, snow-capped Olympic Mountains on our left, the smooth, island-spotted and boat-specked waters of Puget Sound below, and on our far right a snow-capped peak which, my map told me, was Mount Baker.

Watching the distinctive shapes of islands, points, bays, and sounds pass beneath was like comparing The Society's Northwestern United States map with a beautifully colored large-scale chart with no place names on it.

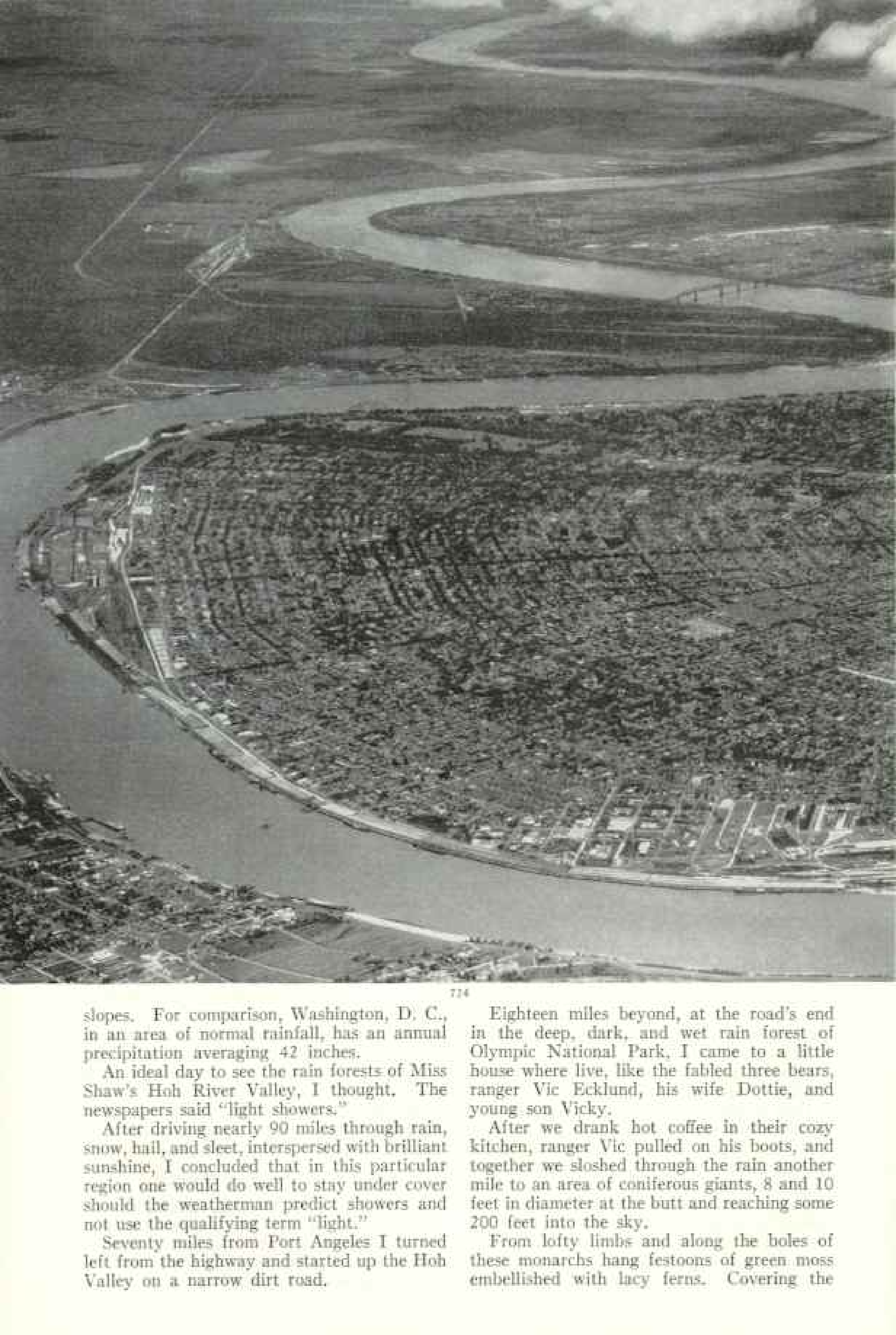
As we neared Port Townsend we veered westward, and I turned my map to keep it lined up with the scene below. Port Townsend lies at the northern end of Admiralty Inlet, which links the waters of Juan de Fuca with Puget Sound.

North of Sequim (the "e" is as silent as the "h" in Thomas) is Dungeness Spit, pointing like a bony finger in the direction of Mount Baker.

In the shelter of Ediz Hook, a similar natural breakwater some 12 miles to the west, lies Port Angeles, where we landed.

Trek to the Rain Forests

Next morning the Olympic Mountains were getting some of the 140 inches of annual precipitation which are responsible for the towering spruce, fir, cedar, and hemlock that grow in primeval splendor on their western



slopes. For comparison, Washington, D. C., in an area of normal rainfall, has an annual precipitation averaging 42 inches.

An ideal day to see the rain forests of Miss Shaw's Hoh River Valley, I thought. The newspapers said "light showers."

After driving nearly 90 miles through rain, snow, hail, and sleet, interspersed with brilliant sunshine, I concluded that in this particular region one would do well to stay under cover should the weatherman predict showers and not use the qualifying term "light."

Seventy miles from Port Angeles I turned left from the highway and started up the Hoh Valley on a narrow dirt road.

Eighteen miles beyond, at the road's end in the deep, dark, and wet rain forest of Olympic National Park, I came to a little house where live, like the fabled three bears, ranger Vic Ecklund, his wife Dottie, and young son Vicky.

After we drank hot coffee in their cozy kitchen, ranger Vic pulled on his boots, and together we sloshed through the rain another mile to an area of coniferous giants, 8 and 10 feet in diameter at the butt and reaching some 200 feet into the sky.

From lofty limbs and along the boles of these monarchs hang festoons of green moss embellished with lacy ferns. Covering the

Mississippi's Sweeping Curve Makes New Orleans the Crescent City

Dike-encircled New Orleans is kept free of drainage water by 11 pumping stations. Its mean elevation is a foot below that of the Gulf of Mexico, 107 miles downstream. Once the land was so soggy that the dead had to be buried in vaults above ground. Even today big buildings must rest on pilings. No longer does New Orleans fear floods; the Mississippi's surplus is diverted above the city. The main channel welcomes ships from the globe's far corners.

Travelers, envisioning old-time pirates, fur dealers, and rivermen, find the city irresistible. The Vieux Carré (French Quarter) shows narrow streets fringed with wrought-iron balconies. That old section, together with the business towers, stands out of view to the right. U. S. Highway 90 (Old Spanish Trail) crosses the $13,000,000 Huey P. Long Bridge.

Lee Cox, Industrial Aerial Photos 725

Fantastic? The enchanted woods in Walt Disney's *Snow White and the Seven Dwarfs* could well have been inspired by these rain forests.

In a mill on the way back to Port Angeles I stepped gingerly between buzz saws big and small, and around deft-fingered men who were making shingles out of fragrant red cedar. Awaiting their turn in the millpond were logs up to seven feet in diameter. Some of them, according to millowner H. E. Huling, would produce enough shingles to keep the rain out of five average-size homes.

Six Cabs Support Three Daughters

My cab driver to the Port Angeles airport next morning was Mrs. Bessie W. Malesky, a widow who, with six cabs, was supporting three daughters (one in college), four riding horses, and a neat little home that looks out on the Strait of Juan de Fuca.

Aboard the plane Capt. Max Christman marked the route we would follow over the Olympics to Seattle. To make sure I should get a satisfactory eyeful, he took me forward to ride in the cockpit.

Our course was up the wooded valley of the Elwha River, between Mount Deception and West Peak, and down to the Hood Canal via Duckabush River.

"That's Mount Olympus over there," shouted Shelby Tuttle, the copilot, above the motor noise. "It's really a group of peaks and only a little higher than the rest of the Olympics."

Later, on a detailed map I counted 50 peaks of more than 6,000 feet within a 30-mile radius of Mount Olympus, whose highest point is 7,954 feet.

The smooth sweeps of pure-white snow that lay about the peaks and the cloudless sky above them were eloquent of peace and cleanliness. Below, the conifers looked as if they had been shaken like doughnuts in a

forest floor is a thick, soggy upholstery of rotting vegetation, more moss, and more ferns. Moss-draped, too, is the undergrowth of bigleaf maples and vine maples. Wherever the vine maples' helter-skelter branches touch the ground, new roots go down and new trees come up.

In the contorted shapes of these trees my mind's eye was beginning to see weird creatures with long green hair when Vic broke the silence.

"You should be here when the moon is full," he suggested.

I nodded, but inwardly I shuddered at the thought.

Old Volcanoes Look on Wooded Vistas in the Cascades

Green ranges of the Cascades run from Canada to California. Heavy snows and rains stimulate the growth of timber on the western slopes (page 723).

Mount St. Helens (9,671 feet, left) and Mount Adams (12,307), a three-day hike apart, stand in southern Washington, overlooking the Gifford Pinchot National Forest wilderness.

These two peaks, like Hood, Rainier, and some others in the Cascades, are extinct or inactive volcanoes. Explorer John C. Fremont a century ago watched St. Helens's last eruption—a violent one—and collected ejected samples. Earlier eruptions dammed a stream and formed Spirit Lake (not shown) at the volcano's base. This lake is so deep that its bottom in places has never been plumbed.

Loose rocks make the north side of St. Helens difficult and dangerous to climb during summer.

Forest lookouts, on the alert for fire, man Elk Mountain Lookout Station (foreground).

This air view looks toward the east.

Fairchild Aerial Surveys, Inc.

A Flaming Projectile Gouged Meteor Crater in Arizona's Desert

Supersunlight, an earthquake thud, clouds of rock, and geysers of steam. Thus scientists reconstruct the moment when a visitor from interplanetary space struck the earth. Not unlike a crater on the moon, this pockmark appeared on the Painted Desert. It is 570 feet deep and nearly a mile wide.

Various people have conjectured that a meteorite lies embedded beneath the crater's floor. Drillers have searched for it in vain. A 1922 expedition bored 1,376 feet. Then the drill, striking a hard mass, presumably iron-nickel, was lost. One theory holds that the missile vaporized on contact and fell in fiery rain.

Weathering effects indicate the crater may be 5,000 years old. Rock fractures on the south side show the meteor (or meteor and satellite) angled in from the north. In a second it removed more than half as much material as the Panama Canal gave up.

In this air view huge boulders dislodged by the impact look like pebbles. Pulverized rock coats the rim. Hopi Indians, who believe a god lives in the crater, use the rock dust in religious ceremonies.

Fairchild Aerial Surveys, Inc.

bag of powdered sugar. This was the dapple effect of wet snow clinging to firry boughs.

On our left passed Mount Deception, its 7,772-foot peak a cluster of jagged crags too steep to hold snow. Off our right wing, seemingly near enough to touch, rose 7,350-foot West Peak.

One hundred miles ahead of us Mount Rainier, softened by the haze of distance, suggested a great conical scoop of ice cream, vanilla flavor (page 744).

"Which of those two rivers is the Duckabush?" I asked as we approached Hood Canal.

Christman consulted his aeronautical chart, which showed the rivers but omitted their names.

He finally settled the question with the Puget Sound inset of my map, which showed and named both the Duckabush and the Dosewallips Rivers.

"See that little T about five degrees to the right of our course?" asked copilot Tuttle. "That's a shipbuilding crane at Bremerton."

Little T Becomes Giant Crane

Slowly, as we neared Bremerton, the little T grew and grew, finally becoming the giant crane that dominates the Bremerton shipyards. I saw several aircraft carriers and numerous small craft tied up in these secluded waters of Port Orchard, an arm of Puget Sound.*

Seattle, with its buildings standing shoulder to shoulder on the hills above the dock-lined shore of Elliott Bay, passed in quick review as we approached Boeing Field to land.

A few hours later I was in the air again, Portland-bound in a "local" that touched briefly at Olympia, Washington's capital city, on the southernmost arm of Puget Sound; at Aberdeen and Hoquiam, twin cities born of and reared by lumber; and at the port of Astoria, where sawmills, flour mills, grain elevators, fishing boats, and ocean freighters vie for space along the Oregon shore of the Columbia's broad mouth. The distinctive shapes of islands, capes, headlands, bays, and river estuaries were a delight to this map-conscious air traveler.

Ghost of a Forest

From John Jacob Astor's trading post we headed like a crow for Portland. With the cathedrallike beauty of Olympic Peninsula's forests still fresh in mind, it was a sad experience to look down upon mile after mile of still-standing ghastly trunks of trees that died in the Tillamook burn of 1933. Enough timber, much of it virgin Douglas fir, to build 1,000,000 five-room homes was destroyed in this 11-day fire.

Further mute testimony to the strength of Nature on the rampage are the bare foundations of mushroom Vanport City. Once home for nearly 10,000 families of Henry Kaiser's World War II shipbuilders, the area was wiped off the map in 1948 by the raging floodwaters of the Columbia River. In the light of the setting sun, trees threw long shadows across its empty green acres as we landed, just beyond, at Portland.

Next morning, about eight minutes before flight time, I was introduced to Capt. Carl Recknagel, pilot of the Portland-San Francisco flight on which I held space.

To San Francisco—via Los Angeles

"For real scenery and plenty of it you should take the nonstop to Los Angeles," he said. "Wish I had that flight today. I'd show you Crater Lake and Shasta. I'd take you over Lake Tahoe and Yosemite Valley. You'd get a look at Mount Whitney, too."

When Recknagel's plane roared down the runway a few minutes later, I was buying a new ticket to San Francisco—via Los Angeles.

The plane had been aloft only a few minutes when two of my traveling companions in the lounge became actively interested in my maps.

I was trying to identify the three snow-capped peaks that dominated the view to the east and northward to our rear (page 726).

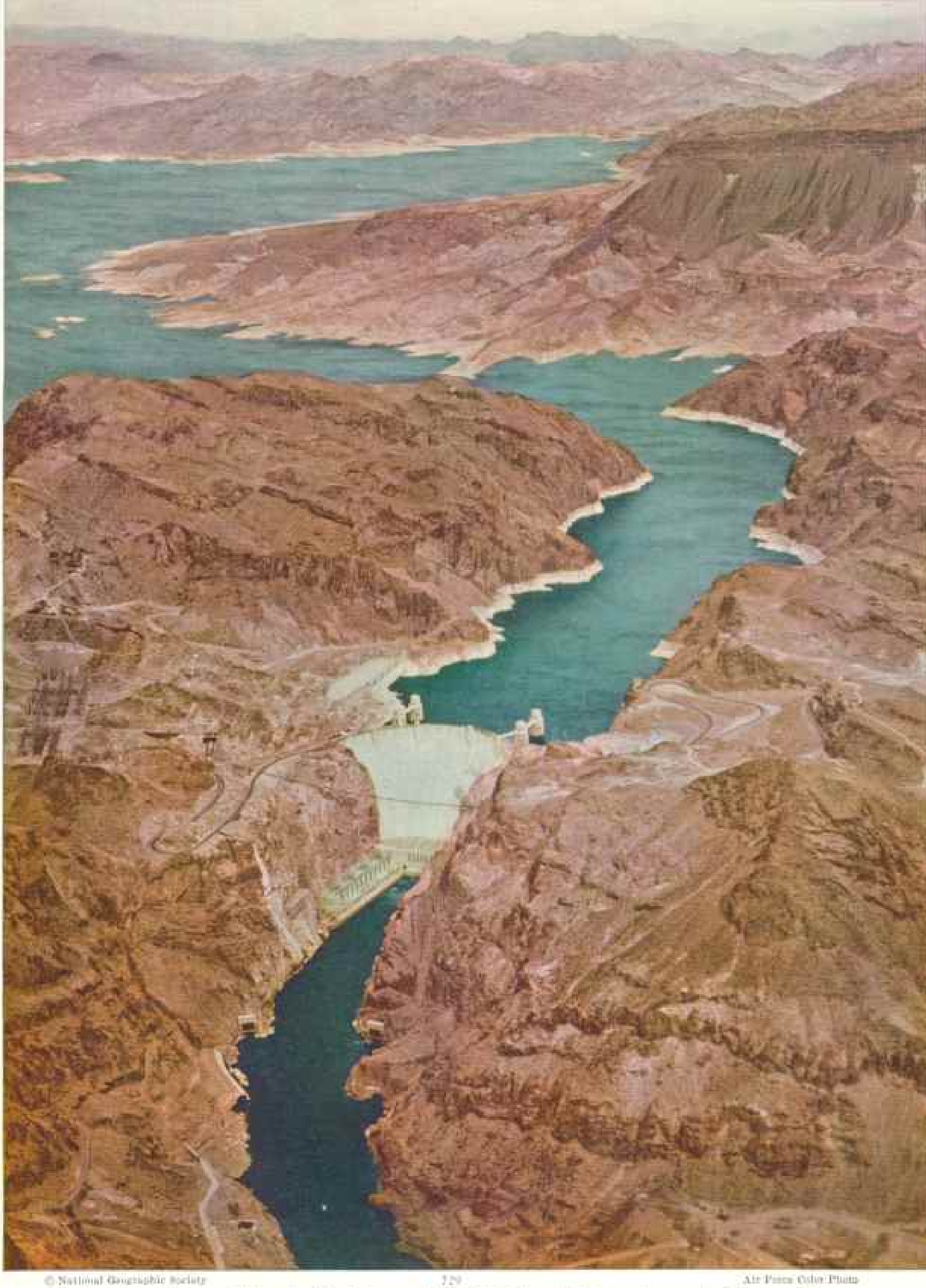
"H A S, the word 'has,' is the way I was taught to remember them as a boy in Portland," said one. "That's going from right to left: Mount Hood, Mount Adams, and Mount St. Helens."

To our right we looked down on lush Willamette Valley and read from our map the names of its centers of population as they slipped by: Oregon City, at the more than 3,000-foot-wide Willamette Falls; Salem, capital city of Oregon; Albany, trading and industrial center; Corvallis, which fittingly takes its name from Latin words meaning "heart of the valley"; and Eugene, snug against the Willamette at the valley's head.†

The map announced the snowy peaks of the Cascade Range on our left: Mount Wilson, Mount Jefferson, Three Fingered Jack, Mount Washington, and the Three Sisters. Mount Jefferson, advised our map, is highest of these peaks, with an elevation of 10,499 feet, and

*See "Wartime in the Pacific Northwest," by Frederick Simpich, National Geographic Magazine, October, 1942.

†See, in the National Geographic Magazine: "Oregon Finds New Riches," by Leo A. Borah, December, 1946; and "Native Son's Rambles in Oregon," by Amos Burg, February, 1934.



Lake Mead Twists Through Dark Lava Hills Behind a "Broken Teacup"—Hoover Dam

This 726-foot dam, world's tallest, barricades the Colorado at Black Canyon. Road across top links Nevada (left) and Arizona. "Tiny" powerhouse at base equals 20 stories. Gypsum deposits ribbon the lake.

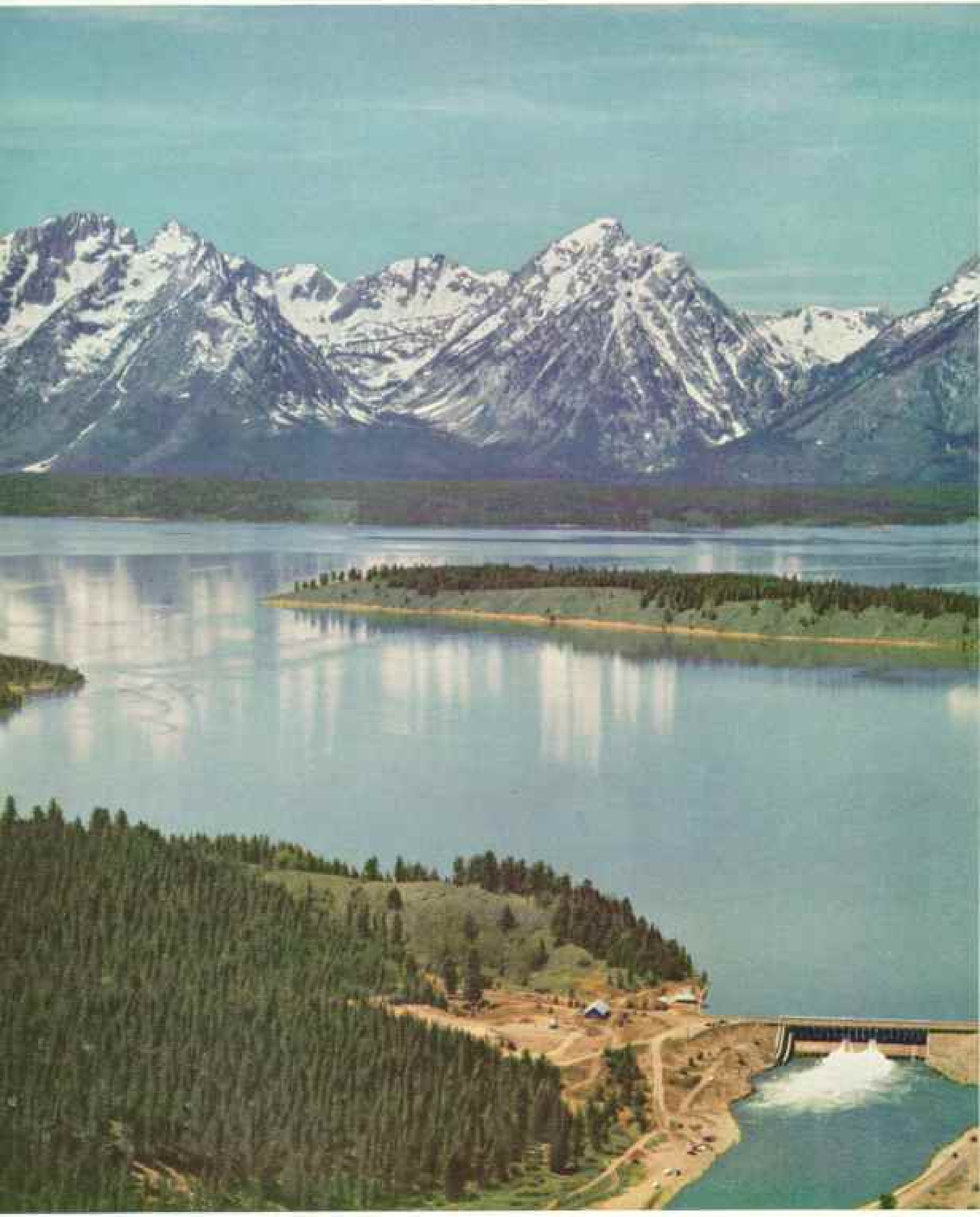
Chicago's Towers, Like Soldiers Abreast, Dress Their Line at Michigan Avenue

This year marks the 80th anniversary of Chicago's great fire, which swept the business district and destroyed 17,000 buildings. From the ashes rose the Nation's second largest city. Skyscrapers hide the Loop, the heart of the city, encircled by elevated lines. Michigan Avenue, faced by famous stores and hotels, is often called Chicago's front window. Downtown playground is Grant Park (foreground). Low-roofed park building houses the Art Institute. Shore-line highway is Lake Shore Drive.

731 Air Force Color Photo

Titan of the Midwest; World's Busiest Rail Center; Largest Meat and Grain Market

Chicago, home of 3,606,000 people, is relatively young. It was incorporated in 1833 with 550 inhabitants. Fort Dearborn, built 30 years earlier, gave the town its start. Chicago River (right) is the entrance to the Illinois Waterway, which links Lake Michigan to the Mississippi. Once the Chicago emptied into the lake, but engineers reversed the flow. Wrigley Building (right) exposes a gleaming white face. A breakwater (lower right) protects the yacht basin. A wider view to the right would show the Gold Coast, an exclusive apartment section.



Wrapped in Ermine, the Tetons Thrust Peaks Two Miles into the Wyoming Sky

Grand Teton National Park is named for 13,766-foot Grand Teton (not shown). Mount Moran, dominant on right, towers 12,594 feet. Ancient glaciers, like gem cutters, ground myriad facets on the mountains' faces.

733 Air Force Color Photo

Jackson Lake Mirrors Rivers of Snow Creeping down the Mountain Flanks

Construction of Jackson Lake Dam (*foreground*) in 1916 enlarged the lake and shaped the island, once a part of the mainland. Snake River waters, feeding the reservoir, irrigate Idaho farms.

Granite Walls Soar in Grandeur above California's Yosemite Valley

This seven-mile valley remained hidden from white men until 1851. One discoverer, stalking Indians, was so impressed he forgot his quest. Half Dome's bald top rears on the left. Right: Tenaya Canyon.

Air Force Color Photo

Forest Patches Cling Like Cockleburs to the Sierra Nevada

Indians in 40 villages used to people the valley. Yosemite takes its name from *Uzumati*, their word for grizzly bear. Glaciers and the Merced River scoured the valley 3,000 feet deep.

Air Force Color Photo

Golden Gate Bridge, 220 Feet above the Tide, Spans the Entrance to San Francisco Harbor. Twin Towers Soar 746 Feet

Geologists say the Golden Gate was once a river gorge. Erosion, scouring the channel, permitted the Pacific to back in, forming San Francisco Bay (right). Spanish explorers sailed past the narrows without suspecting the enormous harbor. Engineers, with earthquakes in mind, built the bridge so it could sway 21 feet in either direction. Its stretch between towers is 4,200 feet; approaches boost the length to 9,266 feet. Here Redwood Highway (to Oregon) enters Marin County.

Sinyala's Summit Is Known to Birds but Not to Men

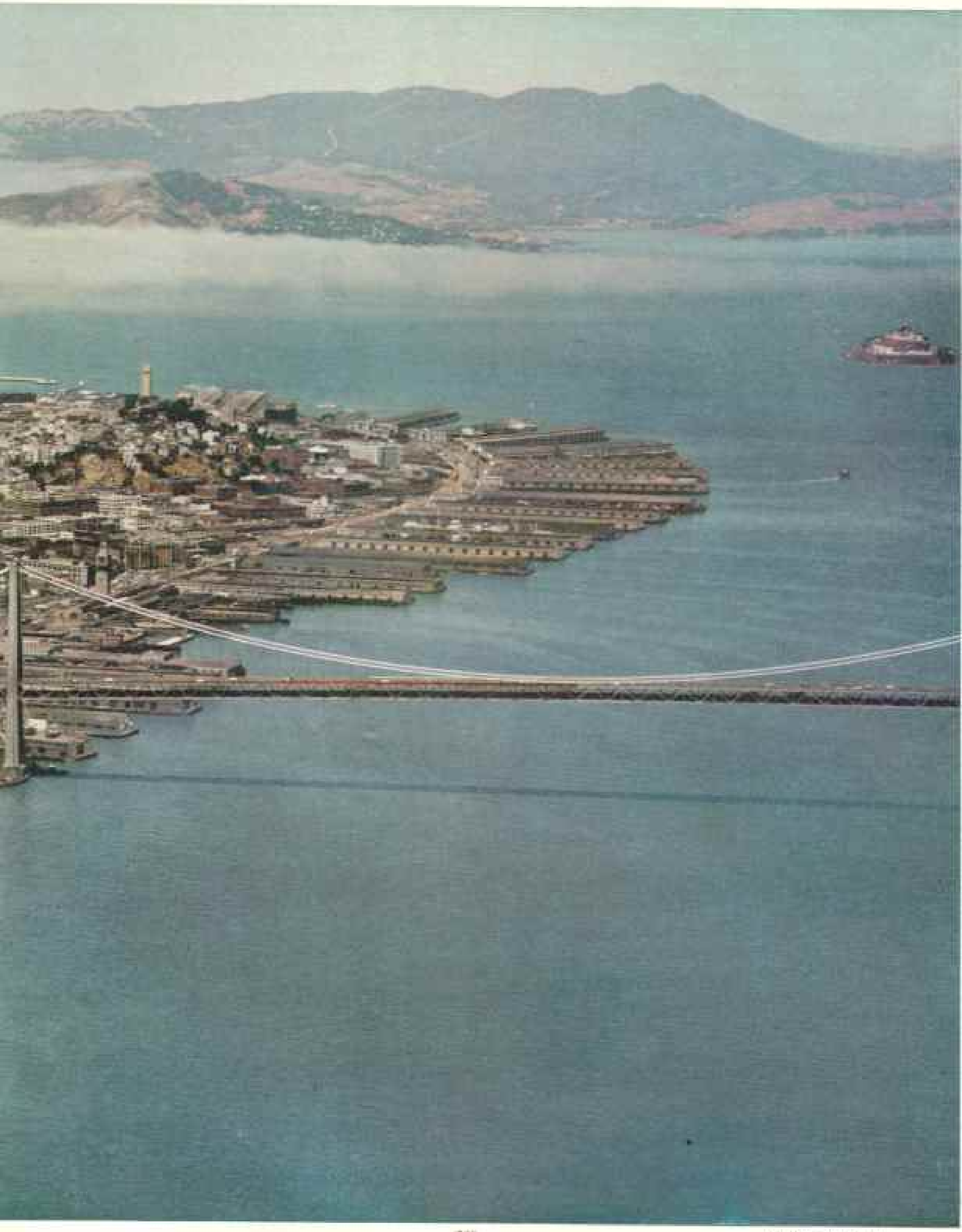
Mount Sinyala stands 1,200 feet above a shelf at the western end of Grand Canyon National Park, Arizona (page 740). When erosion gouged out the mile-deep gorge, a hard rock cap protected Sinyala's softer base from being washed away.

Many of the canyon's buttes, such as Vishnu, Brahma, and Shiva Temples, honor Hindu gods, but Sinyala bears the name of an old Havasupai family. The tribe's reservation lies in near-by Havasu Canyon.

"As far as we know," says H. C. Bryant, superintendent of the park, "no white man has climbed Sinyala. The Indians, who pasture their horses on the flats near its base, know no one who has made the ascent. Only one of our rangers has ridden around the base."

San Francisco, Hub of the Pacific: Its Wharves Stand Out Like Cogs on a Wheel

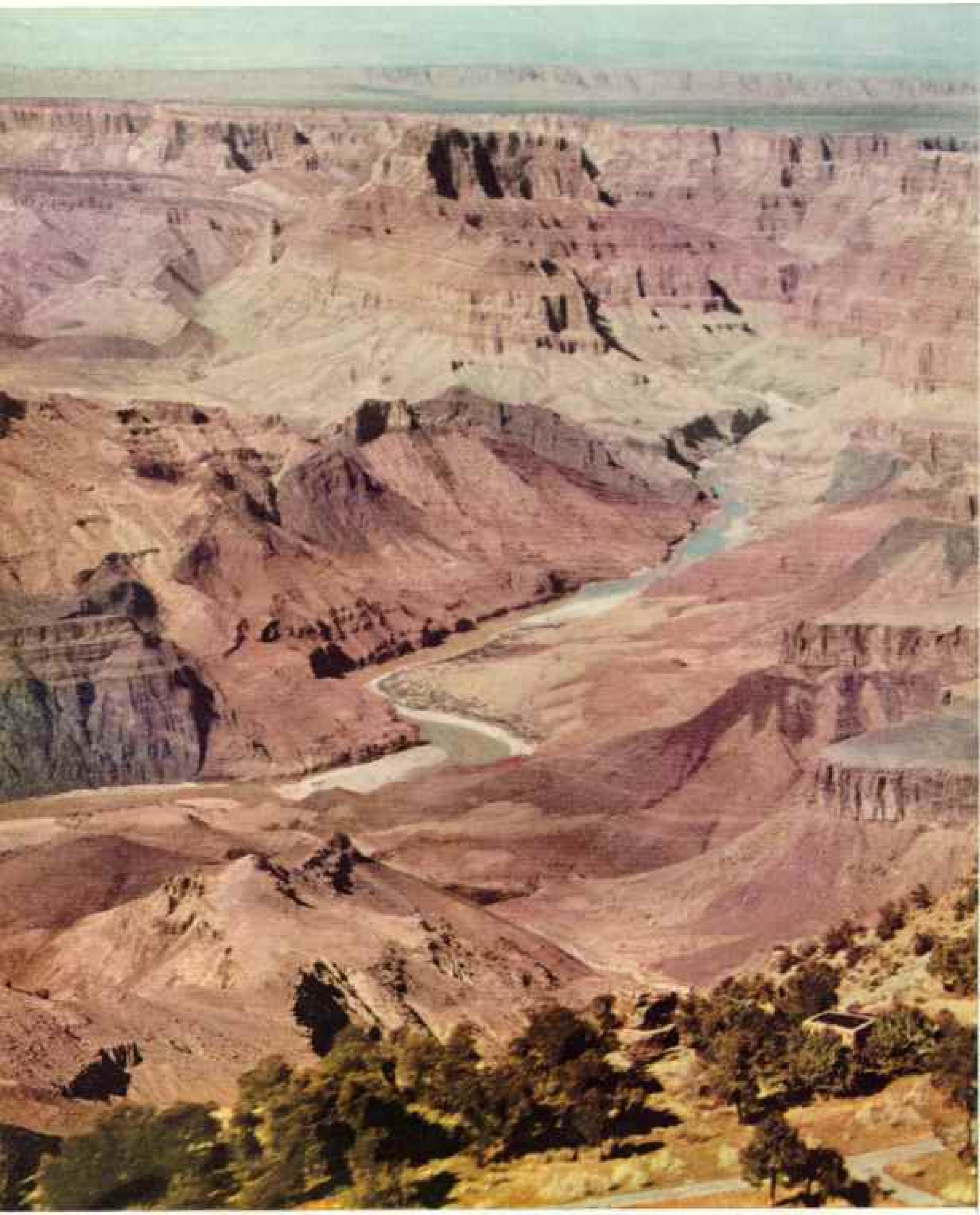
If these skyscrapers did not exist, men would immediately start building them, so vital is the harbor.



Air Force Color Photo

Fog Rolling In from the Ocean Shrouds the Golden Gate in a Milky Blanket

Golden Gate Bridge's north tower pierces the cottony ceiling. Bay Bridge (foreground) runs to Oakland.



Mile-deep Colorado River Has Cut Grand Canyon Down to Earth's Primitive Rock

The river, dredging a million tons of sand and gravel a day, has 2,000 vertical feet to go to sea level. Dark patches indicate old lava flows. The canyon's erosion-carved walls rise like upthrust mountains. Four separate life zones exist between plateau and river.

741 Air Force Color Photo

Earth Pigments, Surveyed from Desert View Watchtower, Spread a Pageant of Colors

First Spaniards to see the gorge (1540) were turned back by the hazardous descent. An American explorer (1857) described the canyon as a "profitless locality . . . there is nothing to do but leave." The tower, built like an Indian citadel, contains observatory, souvenir shop, and kiva (ceremonial chamber).

Tireless Winds, Firing Sand Bullets, Bore Stone-rimmed Eyes in Arches National Monument

"Nothing out there," old-time cowboys said; "just a lot of holes in rocks." Two fantastic formations they nicknamed Jug Handles and the Old Maid's Bloomers. Other wind sculptures picture battlements, chimneys, caves, and living forms. This reef of rocks, near Moab, Utah, is called the Windows.

▼ Legend Peoples Bryce Canyon with War-painted Indians Turned to Stone by an Angry God

Utah cattleman Ebenezer Bryce, for whom this national park is named, regarded it as "a hell of a place to lose a cow." Paiutes called it "red-rocks-standing-in-a-bowl-shaped-canyon." Inspiration Point (far left) looks out on forested ravines and Silent City (right).

Kodachrome Courtesy Northwest Airlines

Rainier's Fires Have Gone Out; 26 Glaciers Clamp the Volcano in an Icy Strait Jacket

Ages ago the mountain blew its top, losing 2,000 feet, but at 14,408 feet it remains the Nation's fourth highest. Rainier still shows off with hot springs and steam jets. Stratocruiser flies the Seattle-New York run.

"big" Sister is a close second with 10,354 feet.

We identified Diamond Lake and Mount Thielsen, Crater Lake's near neighbors to the north, and were anticipating the sight of Crater Lake itself when a voice on the loudspeaker confirmed the lounge "crew's" dead reckoning.

Slowly, very slowly at first, the plane's 50-foot wing dipped. We were circling incredibly blue Crater Lake! The voice on the loudspeaker continued ". . . was once a volcano. It blew its top. This is what's left."

A terse, moralistic summation, thought I, of the NATIONAL GEOGRAPHIC's account of ancient Mount Mazama's fate.*

Over Lonely Shasta

"Lonely as God and white as a winter moon," wrote Joaquin Miller of Mount Shasta. Spellbound, I watched the snow-mantled cone appear under the plane's wing, pass abreast, and slowly fall to our rear.

During the next 40 minutes and 200 miles we saw Shasta Dam ** and the crooked fingers of water it backs up into the valleys of the Sacramento, the McCloud, and the Pit Rivers; we passed mildly active Lassen Peak (it put on a display of violent spewing and belching between 1914 and 1917); and we picked up the first peaks of the Sierra Nevada, which we were to follow southward to Mount Whitney.

"I always think of my mother when I fly along here," said genial copilot Bowman, who had come back to visit in the lounge.

"How's that?" I queried.

"Mother remembers coming to California through Donner Pass down there with her feet dangling from the tail gate of a wagon," he answered.

Incredulous, I asked if she was still living.

"Yes, she lives in Nampa, Idaho."

Correspondence with Mrs. R. E. Bowman produced the following:

"We left Ely, Nevada, my birthplace, in the spring of 1890 with all our worldly possessions packed in one trunk . . . There were four children, the oldest 12 and a victim of infantile paralysis . . . paralyzed from the hips down . . .

"I am sure my feet did not dangle from the tail gate of the wagon, as I was too small, for one reason, and the wagon was securely closed at the back. Only the round peephole in the canvas was open, but mother said I would sit all day in the hot sun, up in the seat with my daddy."

Mrs. Bowman's son chatted with two or three of the 50 passengers as he returned to the cockpit. It was his turn to take the "reins."

We saw Reno and Carson City, Nevada, and Lake Tahoe, whose blue waters caused a revision of my superlative notes on the intense blue of Crater Lake.†

Another 85 miles along the Sierra brought us to the glacier-sculptured grandeur of Yosemite Valley (pages 734-35). Below us, flanked by El Capitan and 620-foot Bridalveil Fall, lay the pine-studded meadow into which Maj. John Savage's Mariposa Battalion pursued Chief Tenaya of the Yosemite Indians in March of 1851, and thus discovered the U-shaped granite trench that attracts some three-quarters of a million visitors a year.‡

We banked and turned left to come abreast of Yosemite Falls, which in two ponderous leaps and 675 feet of cascades plunge nearly half a mile from valley rim to valley floor. Another bank, this time to the right, and we had resumed our course toward the southern Sierra.

We found that the Nation's highest peak, Mount Whitney, is almost imperceptibly higher than its snow-topped neighbors. To spot Whitney took some careful looking and map reading, in spite of its 14,495 feet.

One member of the lounge crew commented cogently on the smooth, brown hills east of Tulare, "Like chamois—as if you had picked it up and dropped it."

With a 50-mile tail wind, our ground speed was 350 miles an hour as we passed Bakersfield at the southern end of California's Central Valley.

Los Angeles Battles Smog

"Where's the smog?" I asked as we approached Los Angeles.

With pardonable pride, one of my companions who lives in the area, described the steps that are being taken to rid this sprawling metropolis of its smoky pall.

In Los Angeles I changed planes and, during the course of dinner, 350 miles slipped by almost unnoticed to put me over San Francisco at dusk. Through the mist of evening, the lights from Frisco's hills and bridges twinkled as from a city in fairyland (pages 736, and 738-39).

Of the Golden Gate city I saw what can

* See "Crater Lake and Yosemite Through the Ages," by Wallace W. Atwood, Jr., NATIONAL GEOGRAPHIC MAGAZINE, March, 1937.

** See "More Water for California's Great Central Valley," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, November, 1946.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Mapping Our Changing Southwest," by Frederick Simpich, December, 1948; and "Nevada, Desert Treasure House," by W. Robert Moore, January, 1946.

‡ See "Yosemite National Park," 9 ills. in natural color, NATIONAL GEOGRAPHIC MAGAZINE, April, 1951.

Robert L. Browning

Shrines of the Lone Star State: Battleship *Texas* and San Jacinto Monument

On this field Texans won their independence. The 570-foot shaft commemorates Gen. Sam Houston's victory over Santa Anna's Mexican army on April 21, 1836. U.S.S. *Texas*, veteran of two world wars, was saved from the scrap heap and moored in Houston Ship Channel in 1948.

be seen from the ding-danging little cable cars. I rode them up to and down from my hotel on Nob Hill and to the end of the line at Fisherman's Wharf. On my next visit to San Francisco I'll see what lies beyond the cable cars.*

The local plane in which I returned to Los Angeles landed at Santa Maria to load several cartons of day-old chicks and two seals, mother in one crate and baby in another. A dog, already aboard, protested the seals' presence with vehement barking. The chicks peeped steadily and the seals gave forth with a schoolboy's "bird." Aloft, things quieted down, but my nose reminded me that seals eat fish.

Dogs, cats, tropical fish, chinchillas, and octopuses are common sights in the cargo compartments of this airline, I was told.

Map Depicts Sun-cooked Desert

I changed planes quickly in Los Angeles and in a few minutes was high above the naked, sun-cooked Mojave Desert on my way to Las Vegas. Here, more than elsewhere, I was struck with the similarity of map and terrain.

Little desert communities like Lenwood, Barstow, and Daggett appear only slightly wider than the combined width of the highway and railroad that link them in the parched landscape. More conspicuous are their ink counterparts on the map.

On the field at Las Vegas I met Captain Danielson and asked him about the possibilities of having a look at Hoover Dam on the way to Valle, Arizona, the Grand Canyon stop.

From the air Hoover Dam appears like a piece of a broken teacup that has been carefully fitted between the steep walls of Black Canyon. The original unbroken teacup would have been 1,005 feet in diameter at the rim and 726 feet high (page 729).

We leveled off over the clear water of Lake Mead. Below us, at the lake's eastern end, was the delta of silt deposited by the muddy Colorado. If unchecked, the Colorado's silt, at the rate of half a million tons a day, will have filled Lake Mead by the year 2380.

More than ten thousand centuries ago a ceaseless sculptor, the Colorado River, began a work known today as the Grand Canyon. This indescribable abyss is a symphony of varied color; of magnitude; of delicate castellation on massive buttes; of pinnacles; of amphitheaters; of the earth's story, eons old, told by strata in slopes that curve, drop vertically, and curve to drop again. It's not a sight; the Grand Canyon is an experience!** (pages 737 and 740-41).

At the bottom of a side canyon we saw the agricultural Indian community of Supai,† noted for remoteness and for waterfalls that plunge into pools of emerald green. As we circled, Captain Danielson pointed out an incongruous Quonset hut and explained that it was lowered into the canyon by helicopter. Donated by a construction firm of Phoenix, the building serves as church and community center.

Later the same day I stood on the rim at El Tovar while purple darkness, like mist from the ageless river, rose and slowly filled the mighty chasm. This, of the Grand Canyon's many moods, is my favorite.

Seated in a jump seat between Captain Sleeth and copilot Eads on the flight to Santa Fe, I watched intriguing names on my map come to life.

First were the snow-capped San Francisco Peaks which we, like gold-seeking Conquistadores four centuries earlier, used as a landmark.

A few miles eastward, in a setting of small volcanic cones and black cinders, we passed Sunset Crater, so named for the brilliant red and orange coloration in its rim.

Captain Sleeth pointed out the Painted Desert. "It's far more colorful in the early morning and late evening," he explained. "Fly westward over it in the clear air of early morning. As the sun rises behind you, the colors change from blood red to russet, to amethyst and blue."

We passed mile-wide Meteor Crater, which differs from its volcanic neighbors by being more in than above the ground (page 727).‡

Early American "Guest Book"

Early American "guest book" El Morro, or Inscription Rock, was easily recognized by its 200-foot sheer faces, one of which bears the inscription:

> Passed by here the officer Don Juan de Oñate to the discovery of the sea of the south on the 16th of April, 1605.

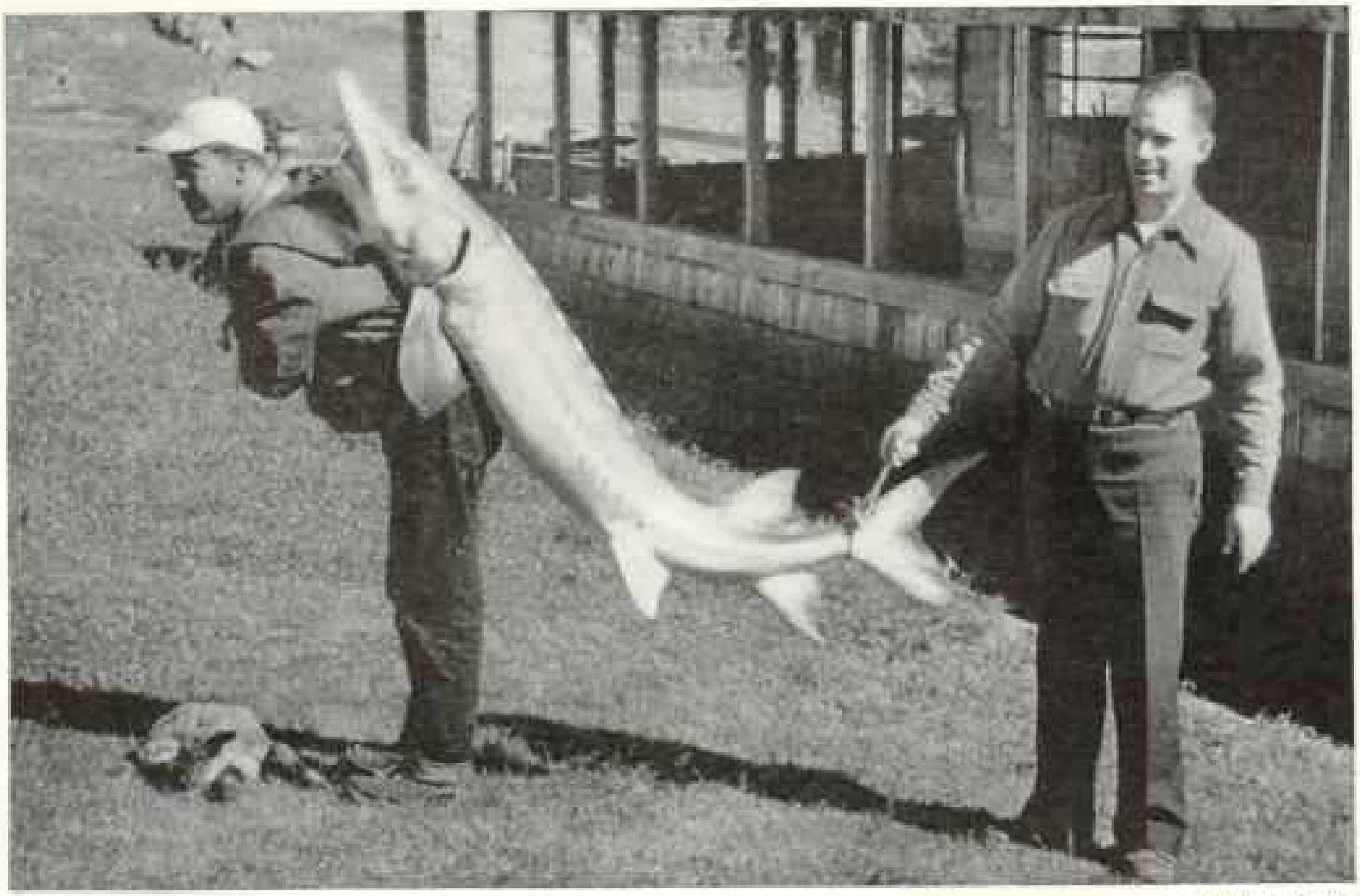
Our view of the fortress city Acoma was

* See, in the National Geographic Magazine: "California, Horn of Plenty," by Frederick Simpich, May, 1949; "San Francisco: Gibraltar of the West Coast," by La Verne Bradley, March, 1943; and "Out in San Francisco," by Frederick Simpich, April, 1932.

** See, in the National Geographic Magazine: "Scenic Glories of Western United States," 8 ills. in color, August, 1929; and "Surveying the Grand Canyon of the Colorado," by Lewis R. Freeman, May, 1924.

† See "Land of the Havasupai (Indians)," by Jack Breed, National Geographic Magazine, May, 1948.

‡ See "Mysterious Tomb of a Giant Meteorite (Meteor Crater)," by William D. Boutwell, National Geographic Magazine, June, 1928.



Maurice B. Lynch

Imagine the Amateur Fisherman's Surprise When He Caught a 125-pound Sturgeon

One night Kyle McGrady (left) and the author set eel-baited hooks in Hells Canyon of the Snake River. Next morning Mr. Bumstead pulled in the lines. With no warning tug, the sluggish sturgeon came to the surface, showing less fight than a half-pound trout. Its steaks made a tasty breakfast. A stray lamb (foreground) was rescued on the way back to camp (page 721).

interrupted by heavy showers stabbed by lightning. Of this pueblo-topped, steep-sided mesa one of Coronado's men wrote: "the strongest ever seen, because the city is built on a very high rock. The ascent was so difficult that we repented climbing to the top."

Next morning I left Santa Fe to visit San Ildefonso, an Indian pueblo 20 miles to the northwest. Suddenly from within the pueblo, as I stopped my car, came the staccato of rifle fire, flaming arrows arced overhead, black smoke belched up from one of the buildings, and on near-by hills I saw Indian warriors mounted on bareback ponies.

In a few moments the fighting subsided, and I entered San Ildefonso to find it taking the role of Fort Thorn in the 20th Century-Fox Civil War film *Two Flags West*. Dressed in homespun and seated in the shade of a Conestoga wagon, Linda Darnell was busy with a crossword puzzle.

I met Cornel Wilde, Jeff Chandler, Roy Gordon, and Arthur Hunnicutt, dust-covered Union officers.

Seated opposite me at lunch, Confederate officer Joseph Cotten conversed about maps in a manner that led to my nominating him to membership in the National Geographic Society.

I came home from Santa Fe in big jumps that took me south along the Nilelike, green-edged Rio Grande to El Paso, east over big, broad Texas (page 746), to New Orleans near the Mississippi's many-fingered mouth (pages 724-25), southeast to Florida's Key West and north past Miami* to Washington, D. C., over beautiful beach-banded littoral.

Maps Dog-eared at Journey's End

My maps deserved far better treatment than being stuffed into my pockets as I alighted at Washington's National Airport. Unfailingly, these now dog-eared companions had answered my questions: Where? What? Which direction? How high? How long?

* See, in the National Geographic Magazine: "Miami's Expanding Horizons," by William H. Nicholas, November, 1950; "You Can't Miss America by Bus," by Howell Walker, July, 1950; and "Florida—The Fountain of Youth," by John Oliver La Gorce, January, 1930.

For additional articles on the States and regions mentioned, see "National Geographic Magazine Cumulative Index, 1899–1950."

Occupied Austria, Outpost of Democracy

By George W. Long

With Illustrations by National Geographic Photographer Volkmar Wentzel

SMARTLY uniformed American MP's stopped our travel-stained automobile at the Enns River bridge, highway link between the United States and Soviet Zones in occupied Austria. Vienna-bound, we had reached the fringes of the Iron Curtain.

A burly sergeant examined our passports and military passes. Returning them, he warned, "Keep to the main road—it's well marked. Stop only if absolutely necessary, and check in with the MP at the Vienna city line. Good luck!"

In the middle of the bridge hung a life-size crucifix, typical of devout Austria. At the far end bemedaled Russian sentries glanced at our papers and waved us on.

Driving this American highway corridor through Soviet-occupied territory, we followed the not-so-blue Danube (Donau) to the Austrian capital. It was Whitmonday; all Vienna seemed to be returning from the long holiday week end. Local police, wearing swords, directed the avalanche of traffic through small, well-kept towns. Russian soldiers were conspicuous by their absence.

Austria First Nazi Victim

Ranked as a liberated nation, not a former enemy, Austria has its own Federal Government and exchanges diplomats with foreign countries as does any other sovereign State. But six years after V-E Day, caught in the East-West struggle, this first victim of Nazi aggression remains occupied and divided into British, French, United States, and Soviet Zones. Vienna (Wien), far inside the Russian Zone, is also occupied by the Four Powers (map, page 751).

As Americans we circulated freely in the three western zones, which are without internal barriers. But in the Russian Zone we were strictly confined to the Enns bridge-Vienna highway and to the capital itself.

Once the core of the autocratic Hapsburg Empire, this Alp-ribbed Republic thrusts a Maine-size segment of democracy deep into Central Europe. Soviet satellites Czechoslovakia and Hungary, and Communist Yugoslavia encircle its eastern borders. More than a third of its 7,000,000 people live in territory occupied by the Red Army.

Yet in two postwar general elections Austria has given Communist candidates a bare five percent of the votes. Last year even Soviet Zone Austrians, in their first free local elections since the war, voted to oust every mayor appointed by the Russians in 1945. And last October a Red-inspired, Soviet-backed general strike in Vienna fizzled when a vast majority of the city's workers refused to join it.

In the 16th and 17th centuries autocratic Austria stopped invading Turks at Vienna's walls and saved Europe from rising tides of Moslem expansion. Today its republican descendant is a staunch outpost of the West against another surge of eastern power.

From the balcony of his city hall office, Dr. Theodor Körner, Vienna's mayor, pointed out the city's landmarks to us. A former general in the armies of Emperor Franz Josef, Dr. Körner at 78 still walks and stands with military erectness.

"In the old days," he told us, "I had only one boss, the Emperor.

"Now, as mayor of this occupied city," he added with a chuckle, "I have four."

We found a spirit and solidarity in Vienna that is matched in few places today. Amid tidied-up scenes of war devastation men patiently restored the blasted monuments of a glorious past (page 755).* Despite a future that is uncertainty itself, municipal planners sketched the outline of a new city. And with almost careless courage Austria's Government, a coalition of once bitterly hostile parties, resists Soviet pressure.

Viennese Parade for Peace

Standing one night on a street corner of the inner city, we watched a candlelight peace parade led by Franciscan friars wind for miles through narrow medieval streets. Old and young, the halt, the hale, and the blind walked solemnly in the eerie, flickering light, their voices raised in fervent hymns.

But when Viennese pray, parade, and sing for peace, they don't mean peace at any price. All over the inner city posters showed a white dove in a Communist cage. "No peace without freedom," they warned.

Next day we looked down on the climax of the city's vast Corpus Christi procession. Student corporations, Boy Scout troops, girls' clubs, and thousands of sturdy burghers jammed the Graben and near-by St. Stephen's Square while Theodor Cardinal Innitzer celebrated Mass (page 764). Across from our vantage point Russian soldiers and workers

* See "Tale of Three Cities," by Thomas R. Henry, National Geographic Magazine, December, 1945.

730 Irving Levine, Pix

Innsbruck Wears an Old-time Look

Sitting on an age-old crossroads, Innsbruck grew rich on Brenner Pass traffic. It remains the capital of the Tyrol and is now the seat of French occupation forces (page 785). Traffic fails to disturb the peaceful air of Maria Theresien Strasse, the main street. The Rathaus, City Hall (left), overlooks a monument commemorating an Austrian victory in 1703.

Four Powers Quarter Austria

Britain, France, the United States, and Russia occupy separate zones in the Republic, as they do in Vienna, the capital. A third of the Austrians live in Red-occupied territory. Hungary and Czechoslovakia, two of their seven neighbors, are Soviet satellites. The Alps leave so little arable soil that the people never grow more than three-fourths of their food.

in a Soviet reading room silently watched this impressive display of Catholic Austria's religious devotion.

Allied bombing, bitter street fighting, and demolition by SS troops wreaked havoc in Vienna during the war's final weeks. Peace found the city one-sixth destroyed—its famed St. Stephen's Cathedral gutted, the Opera and Burg Theater in ruins, and many another well-known landmark badly damaged.

But since 1948, when the European Recovery Program began pumping new life into the nearly starving city, Vienna has staged a comeback. Brightly colored tiles picturing the Imperial Eagle again sheathe St. Stephen's roof (page 770), a new Opera rises from the ruins of the old, and countless painstaking restorations leave tourists ignorant that many a historic building was ever damaged.

Gaunt skeletons of blasted structures still dot the heart of Vienna. Bricks neatly stacked in window spaces hide their gutted interiors. Billboards conceal bomb-leveled lots while pick-and-shovel brigades clear away rubble. Scaffolding looms everywhere as the seemingly endless job of rebuilding goes on.

Kärtnerstrasse, Vienna's Fifth Avenue, looks impressive at street level. Smart shops, windows artfully displaying fine merchandise, line the sidewalks. Higher up, most of its buildings are hollow shells.

Characteristically, Viennese help rebuild their city by having a good time. Outdoor symphony programs (page 758), ballet, band concerts, and fashion shows—often combined in one big festival—fill the summer calendar. Proceeds go to reconstruction; funds swell to the lilting tunes of Strauss waltzes. For one festival merchants donated thousands of dollars' worth of goods as prizes for holders of

lucky tickets. For all of them, artists, musicians, dancers, and models gave time and talent.

"Did you see *The Third Man?*" a friend asked as we sat in the Café Mozart drinking coffee with whipped cream. When I said I had, he voiced a complaint I heard often in Vienna.

"An excellent movie," he said, "but not Vienna today. After the war, yes. Things were difficult then—little food, fantastic prices, black markets, unemployment, racketeers. But the Marshall Plan helped end all that. By recalling those times, we're afraid the film has given our city—how do you say?—a black eye."

By mid-1950 only the haunting *Third Man* melody, played everywhere, reminded Viennese of a time they wanted to forget. Shops bulged with luxuries and every common necessity. Artistic pastries, Vienna sausages, fine wines, and a dozen other specialties made mouth-watering displays in well-filled store windows (pages 767 and 768). We could discover no apparent shortages; rationing was virtually a thing of the past.

Austria's Prices Europe's Lowest

Visitors to Austria soon make a pleasant discovery; its prices are Europe's lowest. A U. S. tourist dollar buys 26 schillings, and 26 schillings buy a lot. Indicative of the country's recovery, the Vienna "gray market" in U. S. dollars went out of business while I was there, when its exchange rate—110 to 1 a few years ago—fell to the official 26.

My comfortable hotel room cost $1.16 a day. Five-course meals, cooked as only Viennese can cook, averaged around 30 cents; chef's special, 10 cents less. Even a gourmet has difficulty running his bill over a dollar. My notes record a hang-the-expense meal I had in one of Vienna's famous eating places: soup, juicy filet mignon, French fried potatoes, green salad, vintage wine, dessert, and Turkish coffee—$1.03, including service and tax.

Other prices fit the scale; only shoes and clothing seem relatively expensive. Male tourists especially enjoy ducking into a barbershop and getting "the works." Haircut, shave, shampoo, and tonic total about 28 cents.

Though visitors seem to be rolling in wealth, most Austrians have to struggle to make ends meet. Wages are rock-bottom low, the average in Vienna last summer being 730 schillings ($28) a month. Since then slight upward wage-price adjustments have occurred.

Heart of Vienna is the ancient inner city bounded by the wide, semicircular Ringstrasse and the Danube Canal. Today soldiers of four foreign nations stroll the famous Ring, built on foundations of the medieval city's walls. Each power occupies its own sector of metropolitan Vienna, but control of the inner city is rotated by the month.

In a misty drizzle I stood before the Palace of Justice and watched high-stepping British Tommies take over command from precision-drilled GI's. While Union Jack replaced Old Glory, the British band played *The Star-Spangled Banner*, and the Americans replied with *God Save the King*.

Spy Center of the Continent

For its size, this isolated Danube capital is probably the world's most policed city. Nearly 10,000 police patrol its streets (Detroit, somewhat larger, has less than half the number). In addition, there is a host of foreign MP's, including the unique International Patrol that cruises the city in reconnaissance cars (page 760).

Beneath its calm, baroque exterior Vienna seethes with intrigue. Strategically located at Europe's crossroads, it is the Continent's chief spy center. Kidnapings, assaults, and murders —once frequent—have declined sharply, but espionage continues round the clock. Estimates of the number of secret agents in the city run as high as 34,000.

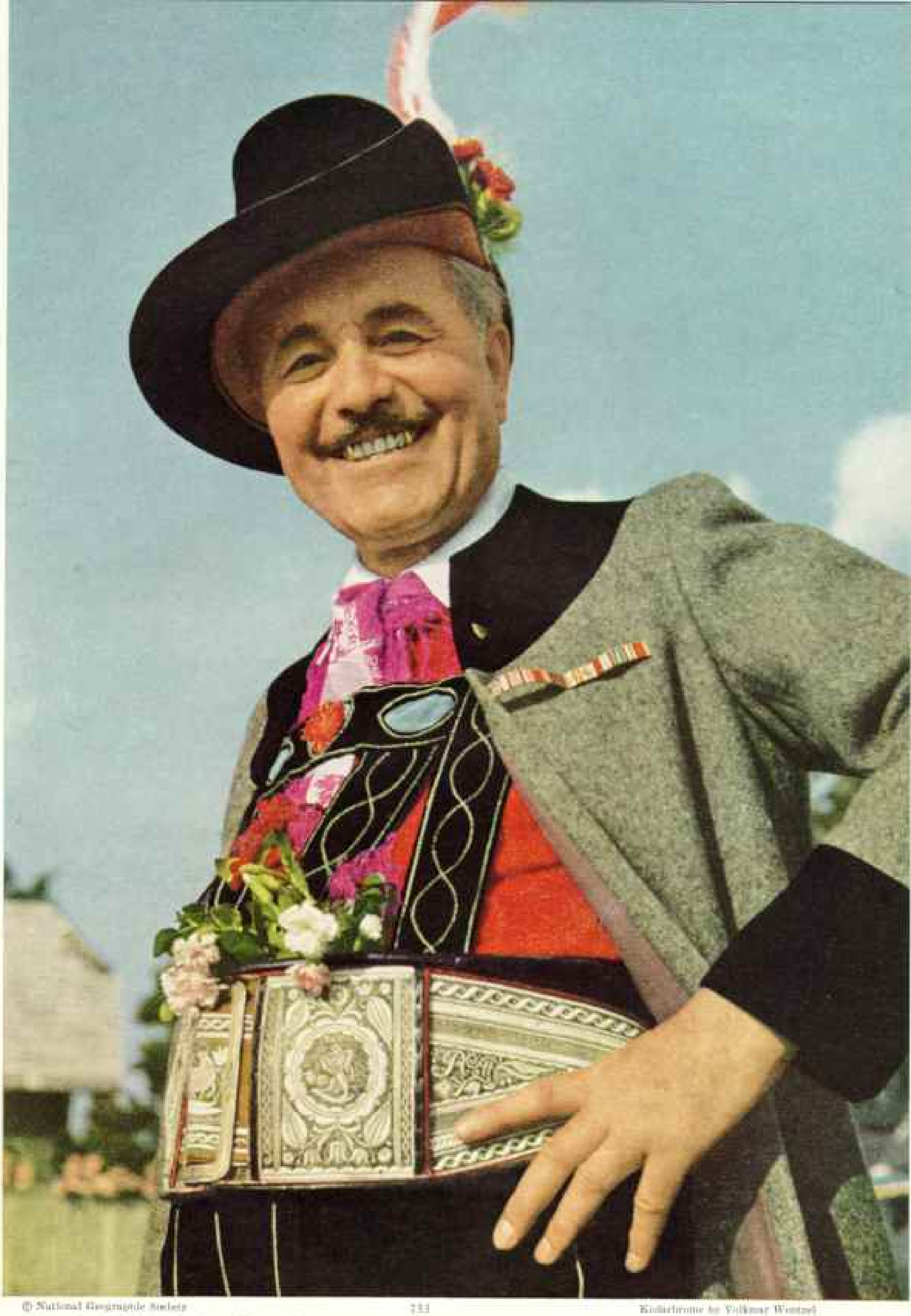
Europe's largest East-West trade, legal and illegal, flows through Vienna. In coffeehouses and wine cellars, businessmen from both sides of the Curtain make deals in guarded tones.

Outwardly, East and West cooperate in Vienna to a degree almost unknown elsewhere. Delicately balanced occupation machinery runs without serious difficulties. There have been no major flare-ups like Berlin's; relations at times seem almost cordial.

But on basic policy the cleavage is as sharp as anywhere. The Allied Council, top occupation board, meets every other week, as it has for five years, but it seldom reaches an agreement. One rare agreement it did make in 1946 gave Austria virtual "home rule." Laws passed by the Parliament, other than constitutional changes, would take effect unless unanimously vetoed by the Council. Thus Austrians run their own show with a minimum of formal interference.

Despite occupation, destruction, and some foreboding, we found Vienna gay. Opera, theater, and concert seasons rushed to a late-spring climax; kiosks advertised a rich musical fare. Almost every night in opera or concert we enjoyed the familiar classics of the great composers who made this city the world's undisputed capital of music.*

* See "Austrian August—and September," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, April, 1938.



Kodachrome by Volkmar Wentzel

Feathered Hat, Embroidered Suspenders, and Peacock-quill Belt Say This Is the Tyrol

Austrian *Schützenmeister*, or militia captain, celebrates the 1,700th anniversary of Matrei (page 782). Tyrolese militia in similar garb defeated Napoleon's troops and, a century later, held off those of Italy.

Snowy Stallions Dance Like Ballerinas

These Arab show horses take their name, Lipizzans, from the village of Lipizza, near Trieste, where the Hapsburgs founded a stud with imports from Spain. They belong to Vienna's centuries-old Spanish Riding School, which recently exhibited 14 of its snow-white mounts in New York.

Toward the close of World War II, the Spanish Riding School's stock was evacuated from Vienna as the Russian army approached. The late Gen. George S. Patton took the stallions under his protection and sent a tank column into Czechoslovakia to rescue the mares.

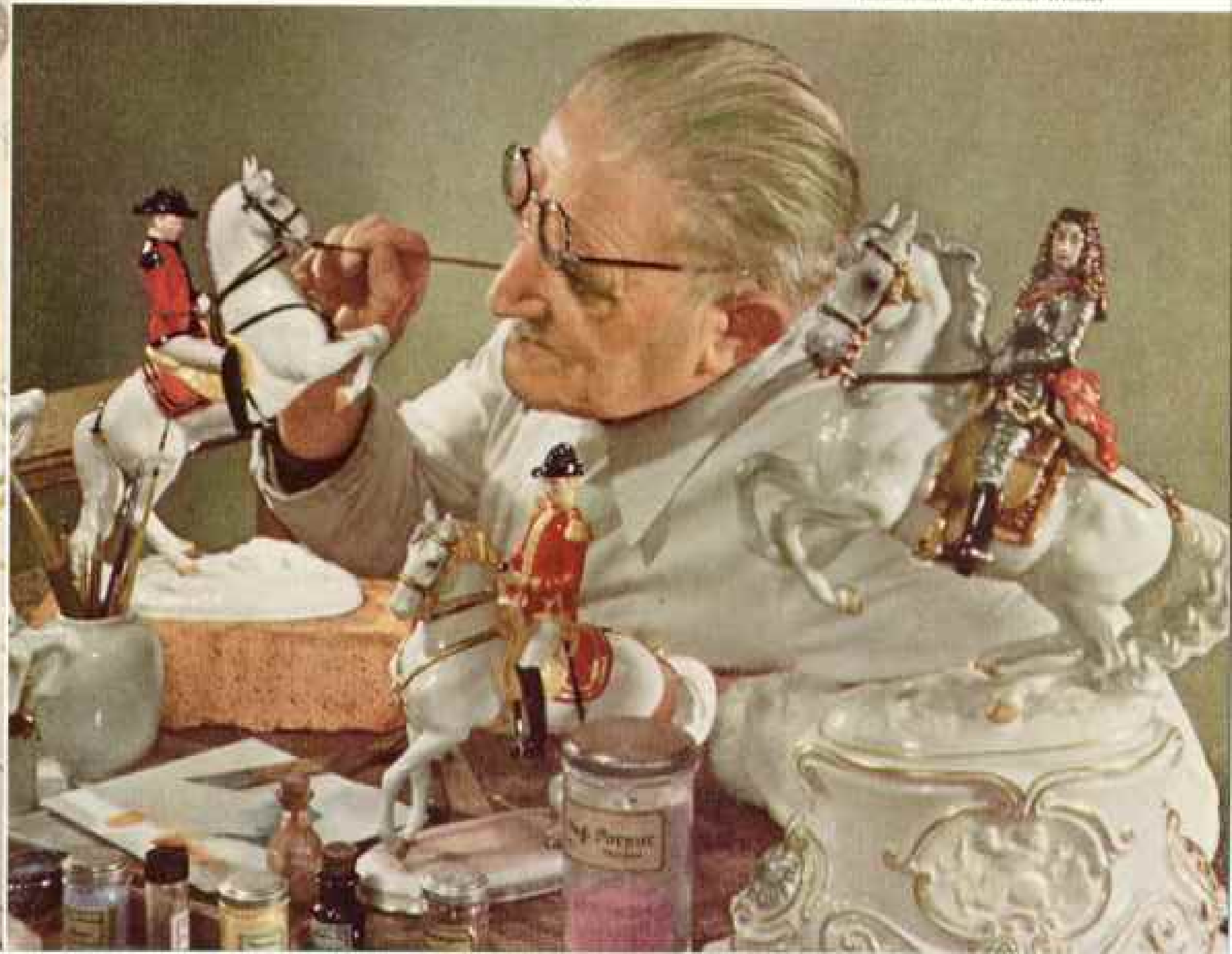
These horses, trained at Wels in the U. S. Occupation Zone, appear in Salzburg during the August Festival. Riders and mounts, moving to music, seem as one. Commands are silent—a shift in weight or pressure from a knee. Right: the four take turns executing the *levade*, a pose on hind legs. Below: a four-footed waltzer.

← Artists Repair Vienna's War Damage. ↓ Lipizzans Prance in Porcelain

Left: World War II damaged a sixth of Vienna; many famous landmarks were hard hit. Using painstaking care, the city undertook restoration of historic sites, in many cases from original plans. Only a handful of older artists had the skills required for elaborate baroque decoration. Young painters became their apprentices. These two restore a fresco in bombed Belvedere Palace. They overlook no detail. If work fails to pass inspection, they must do it over.

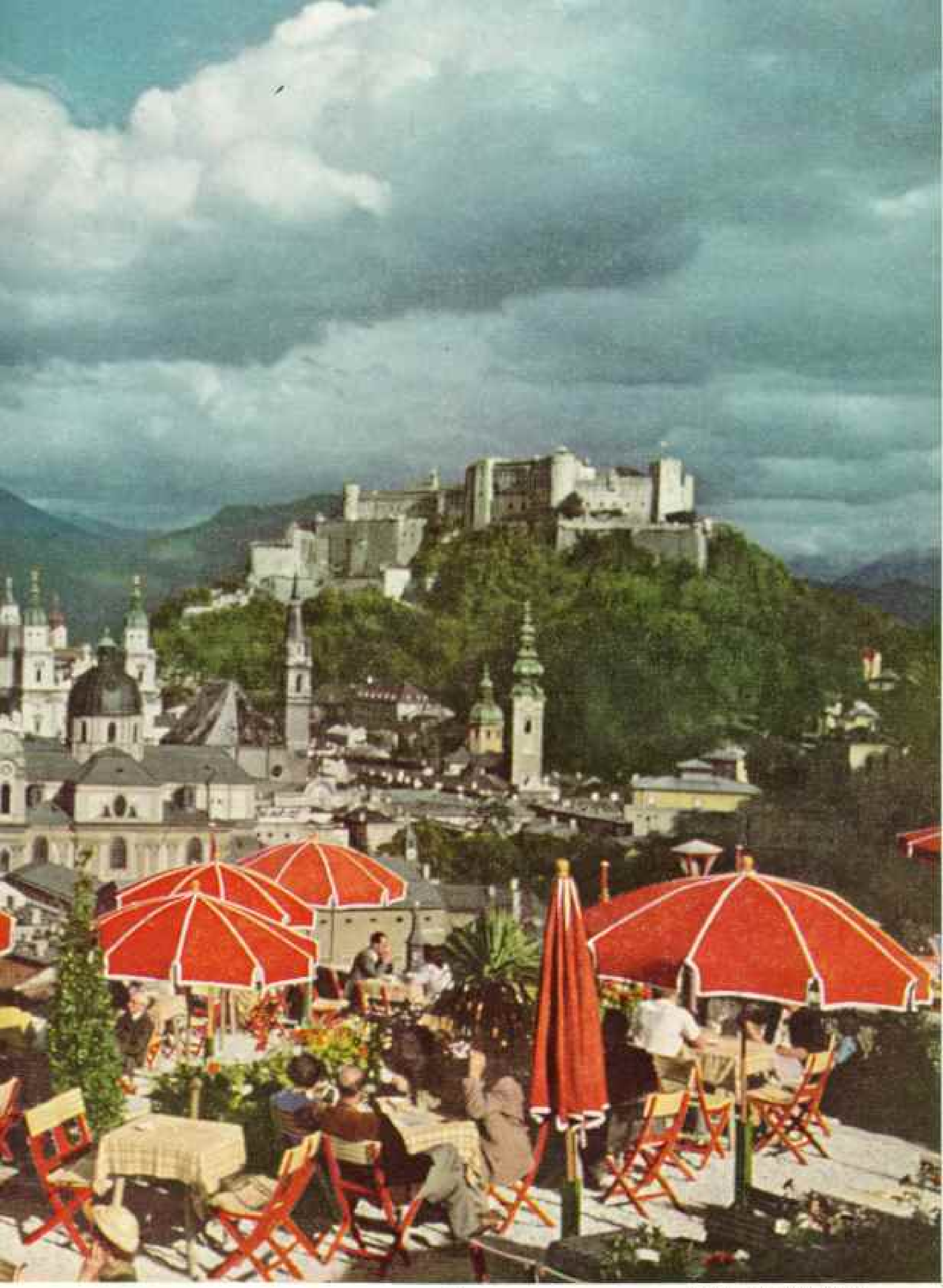
Below: Vienna for two centuries or more has been noted for its fine china. Its porcelain painters use techniques which conventional artists take years to master.

Augarten Porcelain Factory makes these white figurines, here retouched before refiring. Some are molded in as many as 70 pieces before assembly. Earlier models caper on many a European and American mantel.



Powerful Archbishops Made Salzburg the Germanic Rome; They Built in Baroque Style

Churches and palaces look up at the Alps' green foothills. Diners beneath the café's red umbrellas gaze down on the swift Salzach River as they sip coffee and eat pastries.



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Kodachrome by Volkmar Wentzel

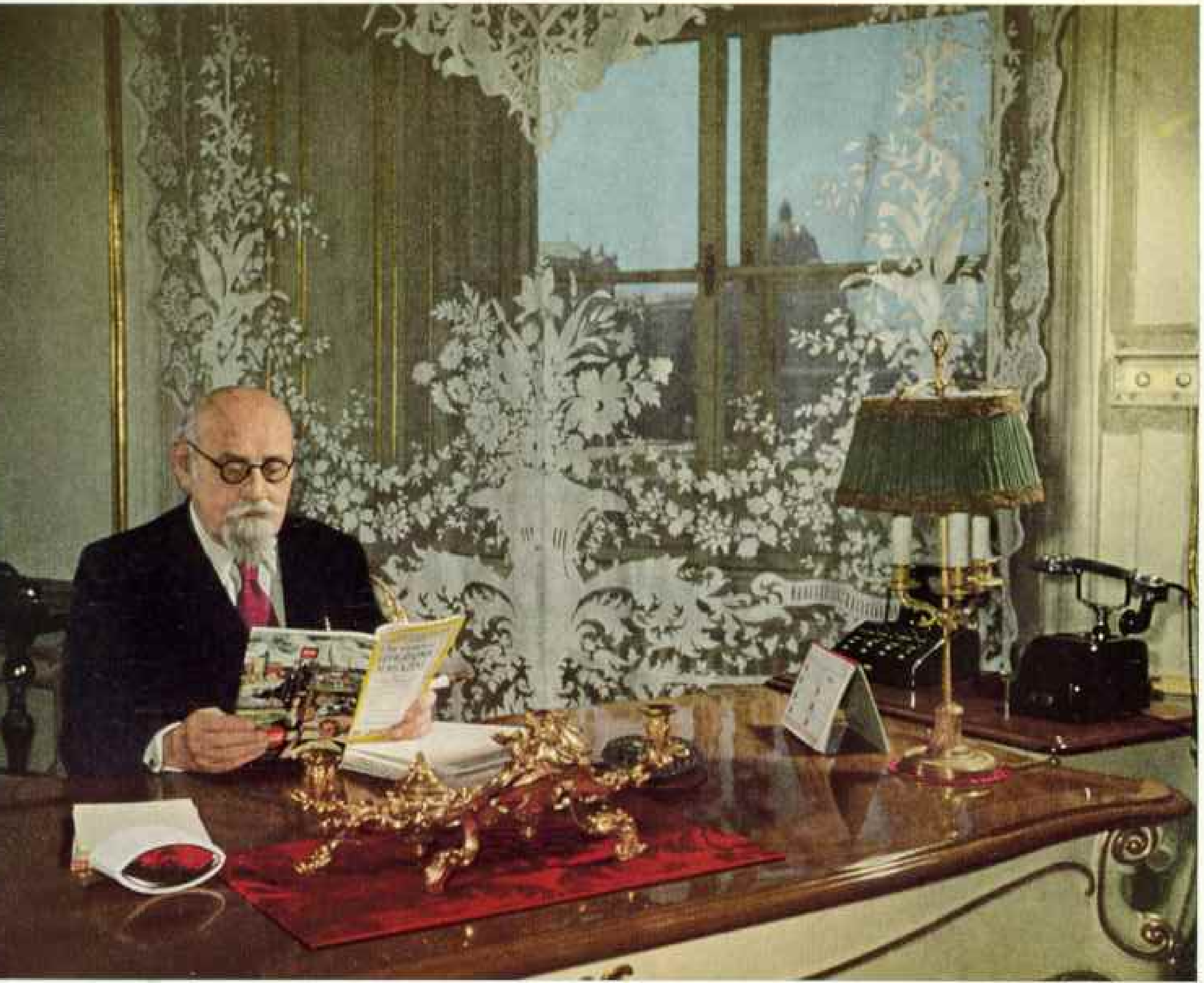
The City's World-famous Music Festivals Take Place in This Dramatic Setting

Music lovers every August jam Salzburg, the birthplace of Mozart (page 761). Their month-long fare includes opera, plays, and concerts. Centuries-old Fortress Hohensalzburg looks down from its dominating hilltop.

Kodachrome by Volkmar Wentzel

Vienna's Shirt-sleeved Musicians Play in Schönbrunn Gardens to Help Rebuild the "City of Music"

Benefit concerts crowd the city's summer schedule; building funds swell to the lilting strains of Strauss waltzes. Here, at a daylong festival, the Vienna Symphony Orchestra uses the grounds of Schönbrunn Palace (center), former summer residence of the Hapsburgs.



President Karl Renner: Founder and Restorer of Austria's Republic

A lifetime right-wing Socialist, Dr. Renner was a champion of democracy. Twice in his eventful career he assumed a major role in his country's history.

When the Austro-Hungarian Empire collapsed in 1918, Dr. Renner formed the government that ushered in the first Austrian Republic. In 1945, as defeated Germany relinquished control of Austria, he performed the function once again, and the Parliament unanimously elected him President.

A farmer's son, President Renner became the first commoner to occupy the Hofburg, city palace of the Hapsburgs. Here in Joseph II's study he reads the NATIONAL GEOGRAPHIC MAGAZINE, which he cherished as a friend. On the last day of 1950, soon after his 80th birthday, he died.

Dr. Renner's Austria, first victim of Nazi expansion (1938), ranks as a liberated, not as an enemy, nation. Enmeshed in the East-West struggle, it remains divided into French, British, American, and Soviet Zones, but its republican government makes laws for the entire country.

Kodachrome by Volkmar Wentzel

East and West Cooperate in Vienna: the Four-power International Patrol

Squads composed of one MP from each occupying power cruise the city. They take action only in cases involving Allied personnel. Four MP's, pistols in hand, are (l. to r.) British, French, Soviet, and American. By rotation's chance, the two inspectors are Yanks.

Austrians Learn about America in U. S. Information Centers

The United States Information Service maintains 10 centers in Austria. Reference books, fiction, magazines, and newspapers tell the American story. Window displays show news photographs; jeeps distribute documentary films. This is in the Vienna center.

Mozart as a Marionette Delights Maria Theresa's Court as He Did in Life

In Salzburg Prof. Hermann Aicher and his daughters pull the strings. Artists concealed in a pit read lines and play music. The composer is shown as a boy prodigy. His sister Maria plays the harpsichord.

Travelers Survey Pasterzen Glacier, the Living Ice Age

Like most European glaciers, crevassed Pasterzen is shrinking. A century ago it reached the level of the flag-decked parking lot. Now it is only six miles long, but it remains the largest ice river in the eastern Alps.

High above the creeping white valley stands a snowy peak, one in a range which culminates in the Gross Glockner (Big Bell Ringer), Austria's highest peak (12,461 feet).

These people arrived at the 7,750-foot overlook by motoring across the sky-scraping Hohe Tauern Alps. Following gigantic serpentines, they climbed Gross Glockner road, one of Europe's highest. Now they share an unforgettable experience, one usually reserved for mountain-climbers. They have left trees and grass behind; their lofty world is made of bare rock and eternal snow.

Flags, honoring visitors, represent Austria, the United States, Liechtenstein, Denmark, Egypt, and others. Similarly, some shrewd Austrian waiters please their customers by setting national flags on dining tables.

Idyllic Heiligenblut: Recently the Scene of a Deadly Avalanche

Tragedy struck unexpectedly at 4:20 on a quiet Sunday afternoon last January. Snow and ice, weakened by thaw, slipped down a mountain slope, crushed houses, power station, and school, and killed 16 residents. Survivors were isolated for days. Aid was flown in by United States Army helicopters from Zell am See.

Heiligenblut is a jumping-off-place for the Hohe Tauern peaks surrounding it. From September to June, when snow blocks the Gross Glockner road, the town sees few visitors. But summer's brief 12 weeks bring streams of buses, automobiles, and motorcycles loaded with sight-seers. Nearly everyone stops to eat lunch, explore the town, and buy a souvenir.

Heiligenblut (Holy Blood) takes its name from a vial of blood, supposedly the Saviour's, brought from Constantinople centuries ago. Today the vial is preserved in the Gothic church (center).

Brugge, Belgium, which has a similar tradition, parades its vial of holy blood once a year amid solemn scenes of veneration.

Kodachrome by Volkmar Wentzel

 764 Kodachrome by Volkmar Wentzel

Vienna, Worshiping in the Streets, Clings to Faith as a Bulwark Against Communism

Theodor Cardinal Innitzer here celebrates the Corpus Christi Mass. Crowds overflow the Graben, a former moat, now a shopping street. The monument commemorates the city's deliverance from a plague in 1679.

Kodachrome by Volkmar Wentzel

Giant Wheel and Horse Cab Move Customers in the Prater, Vienna's Amusement Park

In April, 1945, the park witnessed a savage artillery duel between Russians and Germans. The Riesenrad, 210-foot Ferris wheel, was damaged, later restored. Flowers deck the rubber-tired fiacre for a confirmation party.

New Wine and Old Songs Help Vienna Recapture Its Onetime Gayety

On the capital's rim stands Grinzing, a mecca for merrymakers. Here, for generations, crowds have drunk the new year's white wines and sung the past century's songs.

Now part of the city, Grinzing preserves its old-time village atmosphere. Pine boughs over doorways still advertise *Heuriger*, the new wine.

Here an American corporal (left) finds convivial company. Hostess Mizzi Enzl (center) joins the jollity. A balloon (right) advertises her tavern.

Vienna's Wiener, Daddy of U. S. Hot Dogs

In Austria, noted for its tasty sausages (*Würstel*), the word for Vienna is *Wien*, and for Viennese, *Wiener*. It is easy to see where "wiener" comes from.

Similarly, hamburger and frankfurter owe their names to Germany's Hamburg and Frankfurt.

Viennese often eat their *Wiener Würstel* with mustard and roll.

Kodachrome by Volkmar Wentzel


Wiener
Würstel
KEME

Vienna Pastry Cook Sculptures Edible Masterpieces

Tasty little boys and girls hold sugar candles on the cake mold. Gingerbread devils go to "bad" boys on St. Nicholas's Day. Chessboard and pieces are almond-flavored. Tall tiered cake was baked on a spit, the chef adding batter as it revolved.

Viennese, Yielding to Temptation, Forget Svelte Figures

A traditional midafternoon snack is *Jause* (coffee and rich pastries). The latter are called *Mehlspeisen* (flour dishes). Anyone especially fond of them is a *Zuckergoscherl* (sugar mouth). Many visitors to Vienna soon find themselves in that category.

On foot we made a pilgrimage to houses where Mozart, Beethoven, Schubert, Bach, Johann Strauss, Haydn, Brahms, and Wagner lived and worked. Most were little changed, some still occupied, and several preserved as museums. Few had suffered war damage. Places associated with Strauss had fared the worst; his birthplace was a pile of rubble, and the house where he composed the immortal *Blue Danube* had become a local Communist headquarters.

Strolling one night on Kärtnerstrasse, we saw a surging crowd in front of the Astoria Hotel. Expecting a political rally, we joined it. Instead we found people cheering and calling for Maria Jeritza, one-time darling of Vienna opera. Revisiting her beloved Vienna from America, she was singing again to help rebuild the Opera. Later we met her in the Mayor's office when a grateful city awarded her its coveted medal of honor.

Four weeks sped by all too quickly. In perfect weather we picnicked in the Vienna Woods and roamed the Prater, riding its Lilliput railroad and giant Ferris wheel (page 765). Atop the Kahlenberg, after a night of song in romantic Grinzing, we saw the rising sun tint the sleeping city a magical pink.

Magnificent baroque churches and splendid palaces are legacies of the Empire. In fabulous, 1,500-room Schönbrunn Palace (page 758) the Hapsburgs of history came to life again. Entering the Hofburg, their former in-town palace, we met the late Dr. Karl Renner, President and father of the Austrian Republic (page 759). Another time, in the palace chapel, we heard the angelic voices of the Vienna Choir Boys singing a Haydn Mass.

In the near-by Chancery I stood in the room where the glittering Congress of Vienna decided Europe's fate after Napoleon fell.

Crown Jewels Have "Disappeared"

Reverently a bearded monk showed us the awesome Hapsburg crypt beneath the Capuchin monastery on Newmarket Square, where 141 of the royal family, including 12 emperors and 15 empresses, lie in ornate sarcophagi.

"Where are the crown jewels?" I asked.

"The Nazis took them to Nürnberg," our guide said, "and your General Clark returned them."

Then, with a wink, he added, "With conditions so unsettled, no one knows just where they are now."

In the renowned Art History Museum I browsed among priceless treasures the Hapsburgs had collected during four centuries.*

War left the museum a wreck, its interior gutted and its great dome collapsed. When I was there, the foyer, dome, and 16 of its 80 rooms had been carefully restored from original plans. Its fabulous collections, pilfered by Nazis, were recovered by the United States Army and returned unharmed.†

Seated in the Albertina, home of one of the world's greatest collections of drawings and engravings, I handled original sketches by Raphael, Michelangelo, Brueghel, Rembrandt, and Albrecht Dürer. Many of its masterpieces I had seen in Paris a few weeks earlier, where they were on loan.

Vienna Fights Housing Shortage

With a city official I inspected acres of neat postwar housing developments. In the 1920's Socialist Vienna, building huge, fortresslike apartment buildings, led Central Europe in housing for the masses. Now the city struggles to relieve a desperate shortage of living space; World War II destroyed 87,000 of its flats.

Big neighborhood units of 3,000 apartments, complete with schools, pools, playgrounds, and recreation and shopping centers, are going up. But the emphasis is away from the colossal; instead, single, double, and cottage-type row houses in the suburbs, each with its garden, are being stressed.

Eager to see more of the country, I left Vienna in a rented English automobile, accompanied by an Austrian who "came with the car" and acted as driver and interpreter. Only 25, he was a veteran of three years on the Russian front. After the war he had worked in a United States Army garage in Vienna, where he learned to speak fluent but slang-sprinkled English.

Special Soviet military passes allowed us to travel from Vienna over Semmering Pass into Styria through the highway corridor reserved for the British. Apprehension gripped the city we left; North Koreans had just crossed the 38th parallel, and World War III seemed imminent.

"My home town," said Johann as we passed through Wiener Neustadt. "The Nazis had one of their biggest airplane factories here, and did the town take a pasting! Fifty-two thousand bombs fell on it."

Houses, I noted, had been largely rebuilt, but the huge Messerschmitt plant was a wilderness of rubble and twisted girders.

Through green, farm-dotted valleys we drove to Graz, Austria's second city. Straddling the swift Mur River, this provincial capital boasts imposing public buildings, extensive parks, a university, and museums

* See "The Vienna Treasures and Their Collectors," by John Walker, NATIONAL GEOGRAPHIC MAGAZINE, June, 1950.

† See "Europe's Looted Art," by John Walker, NATIONAL GEOGRAPHIC MAGAZINE, January, 1946.

Vienna's Crowning Glory: Medieval St. Stephen's

St. Stephen's Cathedral is a landmark of Vienna as the Eiffel Tower is of Paris. War spared the 500-year-old south tower, but smashed the base. Restoration proceeds. Bright fresh tiles again picture the Hapsburg eagle on the roof. A temporary silolike cap crowns the short north tower (right). It has remained unfinished since the architect fell to death from a scaffold, leaving no plans. Repairs spot war-damaged roofs near by.

bulging with rare treasures of Gothic art. Arcaded courtyards and pink-tile roofs capping ornamental stucco houses give the city a Mediterranean look. Its opera, concerts, and theater are second only to Vienna's—and no good Grazer would admit even that.

A pitiless sun pushed thermometers over the 100° mark; to escape the heat we fled to a hilltop *Gasthaus* beside the pilgrimage church in near-by Maria Trost. Next morning, guided by a local English professor, we began a perspiring, shirt-sleeve tour of Graz. Midafternoon found us resting atop the Schlossberg, the once castle-crowned hill around which the medieval city grew.

War Rumors Stir Graz

"Graz is full of wild rumors," the professor said as we rested. "There is talk of tanks massing in the Soviet Zone and an invasion from the east."

That night, in an open-air theater built into the castle's former dungeon, we watched the Richard Strauss opera *Friedenstag*, a story of the Thirty Years' War. While rockets burst overhead and sham battles raged, men armed with pike and halberd defended ramparts their ancestors watched 300 years ago. In the final act glorious peace came to a war-wracked Europe.

Participants in this stirring opera hadn't far to go for authentic costumes. The Graz arsenal, built in 1642, holds the Continent's largest cache of 17th-century arms and armor. Helmets, breastplates, arquebuses, blunderbusses—every then-known weapon to equip 26,000 men—hang row on shining row where victorious Styrian forces left them after the last Turkish onslaught.

When dawn's first glimmer stole across the Mur Valley next morning, ear-splitting explosions, reverberating in the hills, almost blew me out of bed. Wildly a bell began to peal. Dazed, I stumbled to a window, saw men on near-by knolls firing small cannon. This is it, I thought—World War III is here!

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Naked Rock, Swirling Mists, and Eternal Ice Fascinate Bus Travelers Atop the Alps

Gross Glockner Alpine Highway writhes 8,430 feet up the Hohe Tauern. The author's car crawled up in low gear. Other machines were stopped by boiling radiators. Some visitors pedaled and pushed bicycles to the summit. July temperature at this overlook was close to freezing (page 776).

Pulling on clothes, I ran downstairs. Mine host, fat and apron-swathed, stood in the courtyard. To my breathless queries in halting German he replied, "This is the day the bell is blessed."

Came a personal dawn when Johann arrived, as startled as I, and relayed an explanation. During the war Nazis took Maria Trost's big church bell. Five years its people saved to buy a new one. Now, on this long-awaited day, it would arrive, be blessed, and hoisted into place.

When I returned for breakfast, local families were already eating big platters of goulash, Wiener Schnitzels, and *Würstel* (page 766), and drinking tall steins of beer. Women set up booths displaying souvenirs, cakes, gingerbread, and balloons. The town band, in leather shorts and alpine hats, played lustily.

Up the hill climbed a long procession—monks, priests, altar boys, members of rifle clubs, and men and women in gay holiday costumes. On a flower-decked truck rode the bell, shiny and garlanded, amid more explosions, shouts, cheers, and music.

When we left, hours later, the bell was in its tower, but festivities showed no signs of letting up. This was Maria Trost's big day, and the town was making the most of it.

Through seldom visited eastern Styria we

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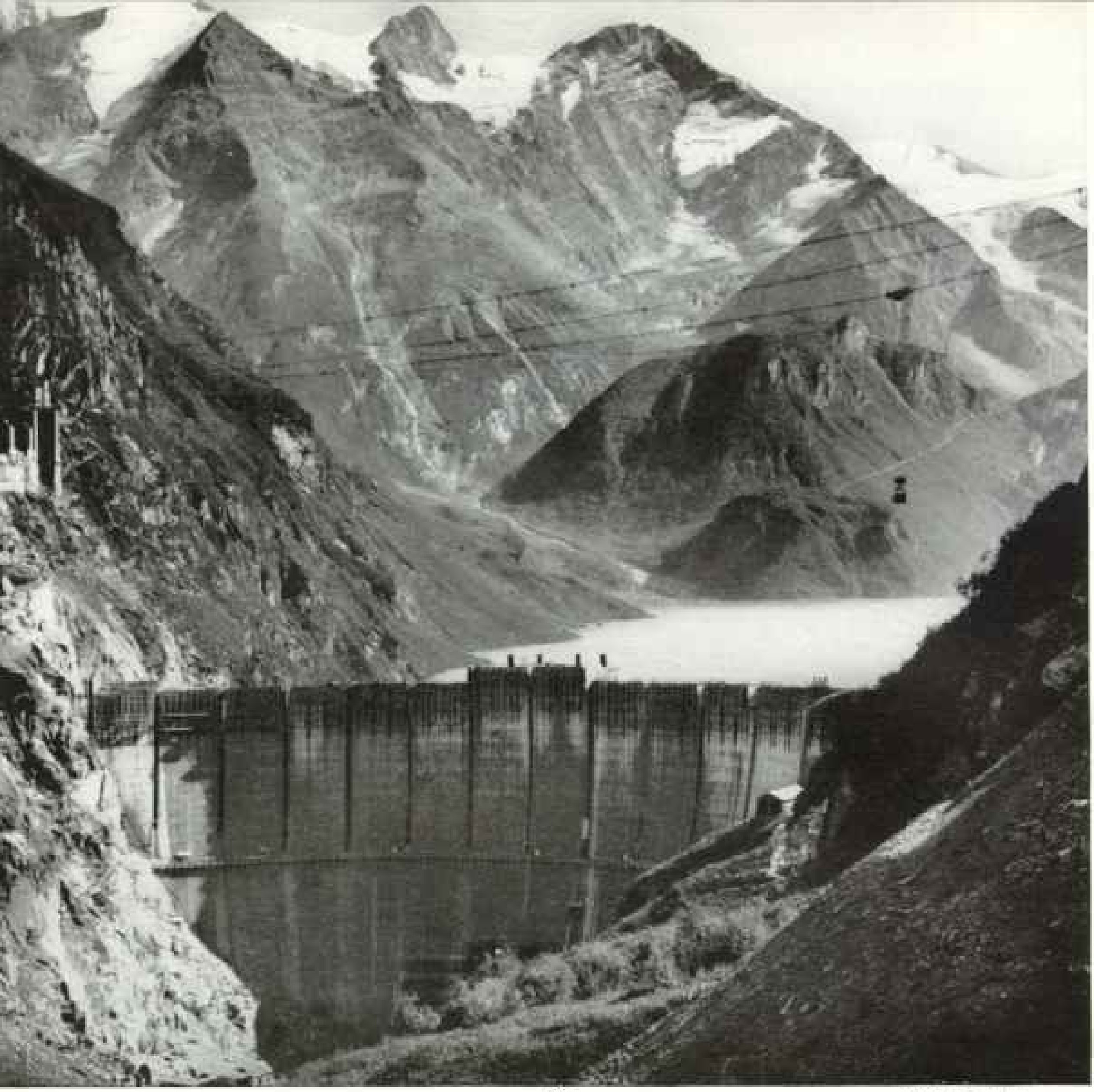
Austrian Legation

Iron Miners, Stair-stepping Ore Mountain (Erzberg) with Electric Shovels, Shaped It Like a Mayan Pyramid

The Tyrol in September: Corn Dries in Shocks, Hay Hangs in Barns, Inn Valley Parts the Alps



774 Austrian Legation

Kaprun Dam, Sealing a Canyon for Power, Shows the Marshall Plan at Work in the Alps

Signs all over the non-Soviet zones call attention to roads, bridges, and industries rebuilt with the aid of American funds. United States experts help modernize agriculture, industry, and forestry (page 785).

made a wide swing. For centuries this Germanic borderland bore the brunt of Slav and Turk invasions. It had an eastern look. Farmhouses were thatched cottages; barefooted, kerchiefed peasant women harvested wheat by hand in the broiling sun.

In Riegersburg we left our car and climbed to a storybook castle perched high on a dead volcano. Deep time-worn wagon ruts scored the steep, rocky road. Gates and drawbridges of seven stout encircling walls admitted us; once they defied all comers.

We caught our breath in the castle courtyard; cold, clear water from its moss-covered well slaked our thirst. Only silence answered our shouts. Through room after deserted room we wandered. From the big banquet hall we had a three-nation view reaching into forbidden Hungary and distant Yugoslavia.

On the windowpane old dates, noblemen's names, and odd notations were scratched. One entry recorded a record-making carousal. "On April 6, 1635," it boasted, "we began to drink and finished on April 26."

North we drove into Styria's high evergreen-clad mountains, land of hunter, logger, mountaineer. Stacked timber, wood-hauling cable cars, and trimmed logs spewed on steep slopes revealed the region's chief economic interest. Deep forests like these, covering 37 percent of the land, are the Republic's main resource. With ECA aid production is approaching prewar level.

At Seewiesen, where the road starts climb-

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Mustachioed Cyclist Depicts a Gay Era in Matrei's 1,700 Years

Matrei strides the Brenner road, barbarians' route to Rome. Some of history's great spectacles passed by. Parades last year re-enacted the town's history (pages 753, 782, and 787). Make-believe Roman soldiers and Teutonic warriors got no more applause than this clown.

ing the 4,114-foot Seeberg Pass, we tarried to watch a village dance. On a rustic barnyard dance floor overlooking a magnificent valley gay couples whirled to fast mountain music. During intermissions young blades danced the high-kicking, heel-and-thigh-slapping *Schuhplattler*, yodeled, or flirted with pink-cheeked girls in fetching dirndls.

After a crashing storm the town of Mariazell, crowning a hill, resembled an enchanted island in a sea of mist. Its 14th-century church, Austria's most revered shrine, draws thousands of pilgrims from all over the country. During our brief stay a group of 400 mothers arrived from Vienna to pray for the return of sons still prisoners in Russia.

In Mariazell I scaled my first mountain—by cable car. Each of a dozen later trips to heights in Austria's Alps had its own enchantment. I never tired of their sweeping, soul-lifting panoramas, of being transported swiftly to another world far above one's accustomed perspective. Hanging, swaying in space, I liked to remember that in more than 30 years of operation no serious accident has marred the safety record of Austria's cable cars.

In Mariazell, too, I bought *Lederhosen*—Austrian leather shorts—suspenders, and knee socks. Wearing them, I felt as self-conscious as a schoolboy in his first pair of long pants.

Dangling in a chair lift high above Prebichl

Pass, I had an eagle's-eye view of the Erzberg, Austria's mountain of iron (page 772). Surface-mining electric shovels scoop out giant steps on its bald, rust-brown slopes. Towering 5,033 feet, it resembles a Mayan pyramid.

Worked since the dawn of Europe's Iron Age, this fabulous mountain still has 360-odd million tons of rich ore left. From it comes 80 percent of Austria's crude iron, which goes to big steel mills at Donawitz, farther down the valley, and to industrial Linz in the U. S. Zone. Before Austria was zoned, Russians ran off with Erzberg's equipment and much equipment from Donawitz. ECA replaced both to get this basic industry going again.

Rare Treasure in Remote Abbey

Through the Gesäuse, a slitlike gorge of wild, majestic beauty, we reached quiet Admont. This remote village's 11th-century Benedictine Abbey houses one of Austria's great cultural treasures—120,000 rare books and 1,100 illuminated medieval manuscripts, the oldest dated 1180.

Crossing the Niedere Tauern Alps, we followed widening valleys to Klagenfurt, Carinthian capital and headquarters of British troops in Austria. This ageless north-south route is rich in old towns, romantic castles, and early Christian churches.

In walled and moated Friesach I walked ramparts that witnessed the capture of Richard the Lionheart as he returned from the Crusades. Near by I climbed 500 feet to visit well-preserved Hochosterwitz Castle, guarded by 14 fortified gates and four drawbridges. Capping an almost sheer cone-shaped hill, it looked like an illustration from the Grimms' fairy tales.

In off-the-road Gurk we found one of Europe's finest and least-known Romanesque cathedrals. Austria's best Romanesque frescoes illuminate its thick walls. Before its magnificent gilded altar, adorned with the life-size figures of 72 saints and 82 angelic heads carved in wood, we stood in utter amazement.

Built in the 12th century, the cathedral was the seat of a bishop for 700 years; then its mitered occupant moved to growing Klagenfurt. Today this by-passed gem of early medieval church architecture dominates a tiny crossroads hamlet of half a dozen houses.

Letters six feet high on Klagenfurt's provincial capitol proclaimed, "Carinthia Is Indivisible." Another huge sign on the city hall shouted "Carinthia—Free and Undivided."

Both referred to this border region's role as a European trouble spot. With a sizable Slav minority, southern Carinthia is coveted by Yugoslavia. Frontier war flared in 1918-19; the following year a plebiscite awarded the territory to Austria. After World War II, Yugoslavs, supported by Russia, renewed their claims, but since Tito's break with Stalin little has been heard on this score.*

Since earliest times this area has been a racial melting pot. Here Stone Age tribes warred for choice lake sites; Illyrians, Celts, Romans, Slavs, and Teutons had their day. Modern spade-and-shovel scientists find its subsoil rewarding. Today archeologists are excavating a near-by Roman city that promises to rival Pompeii in importance.

To find respite from the relentless heat, we settled by the breeze-swept Wörther See, largest of the scenic Carinthian lakes (page 778). Vacationists from a dozen western European countries thronged the fashionable resorts that line its shore. We joined them for a long, delightful week end of swimming and sailing.†

Moving again, we followed the deep Drau River Valley to bustling Villach. Between there and Spittal we passed the largest of the displaced persons camps scattered throughout Austria's western zones. Generally trim and tidy, they shelter only a fraction of some 300,000 nationless refugees, one of this small country's major postwar problems.

Turning our backs on the majestic Lienz Dolomites, we headed north up the narrow Möll Valley to Heiligenblut, jumping-off-place for the Gross Glockner Alpine Highway (pages 763 and 771). Climbing in giant serpentines to 8,430 feet, this boldly engineered road hurdles the mighty Hohe Tauern Alps, Austria's loftiest range. Driving this dramatic route is an unforgettable experience; its spectacular panoramas are usually reserved for hardy climbers with irons and ropes.

Beyond Heiligenblut we crawled in first gear; with increasing frequency we passed bigger, less patient cars cooling their boiling radiators. The temperature dropped steadily to near freezing. Scores of snow-capped peaks towered on all sides; cascades thundered hundreds of feet into unseen valleys. Forests gave way to pasture, pasture to naked rock.

Stretching our legs at the Franz Josefshöhe, we looked down on seamed and shrinking Pasterzen Glacier (page 762). Far above us the 12,461-foot Gross Glockner, monarch of the eastern Alps, thrust a white wedge into the blue sky. Continuing, we stopped at 8,000 feet to make snowballs in July. From Hochtor Tunnel, the road's crest, we emerged

* See "Yugoslavia, Between East and West," by George W. Long, NATIONAL GEOGRAPHIC MAGAZINE, February, 1951.

† See "Styria, a Favored Vacation Land of Central Europe," by Melville Bell Grosvenor, NATIONAL GEOGRAPHIC MAGAZINE, October, 1932.

Kodachrome by Volkmar Wentzel

Such a *Mädel* Stole the Heart of Archduke Johann, Who Renounced His Title for Her

Austria's favorite love story concerns Johann's operettalike romance of a century ago. Elvira Wallner, daughter of the pastry chef in St. Wolfgang, wears a dirndl dress and carries an heirloom handbag.

Landlocked Austria Loves Water Sports, Especially Sailing

Austria lost its Adriatic coastline to Italy and Yugoslavia at the end of World War I, but its Alpine regions abound in lakes. A fun-loving people have converted many of them into playgrounds.

This is the popular Wörther See. In summer small craft dot its blue expanse and swimmers paddle its warm waters, which sometimes reach 82° F. Freezing shore to shore in winter, the lake becomes a paradise for skaters.

Many visitors come from the British Isles, for the Wörther See lies in their occupation zone.

Here the village of Maria Wörth, crowned by its pilgrimage church, juts into the water.

The star-class yacht is the product of Swiss builders. Skipper (inset) is a university student from Klagenfurt. Two members of his crew are Vienna schoolgirls.

Traun See Folk, Costumed for a Water Pageant, Relive the Prosperous Days when Salt Boats Crammed the Lake

Centuries ago salt from the Salzkammergut (Salt Crownland) was freighted across the Traun See, some of it reaching the Black Sea. Gmunden, a shore town, grew rich on the traffic, which now goes by rail. These Gmunden women ride a fishing boat. The man in white portrays a salt carrier shouldering salt cakes.

Kodachrome by Charles J. Belden

↑ Austrian Cowgirl Leads Liesl, Her New Milker, Home Through the Alps

This young lady returns from Schruns, where her father bought the cow at a cattle fair. She lives in the scenic Montafon Valley, a part of Vorarlberg, Austria's westernmost Province. In many ways Vorarlbergers resemble their neighbors the Swiss.

Right: A pigtailed Tyrolese, seen at a celebration in Jochberg, carries a cask of Enzian schnapps, a liquor made from roots of the gentian, an Alpine wildflower. She sells the drink in eyecup-size glasses.

Two customers wear suits which, originating in Styria, have become popular all over Austria. Flannel-like material called *Loden* is trimmed in green; buttons are made from antlers.

Vorarlberg Girls, Working on Ball-and-socket Stand, Embroider Their Own Dress Materials with Gold Thread

Kodachrome by Volkmar Wentzel

Tyrolese Miner-Musicians Wear Plumes in Place of Lamps

Almost every Austrian village has its band. In mining towns, the miners' guild takes charge. Helmets' crossed hammers, a time-honored insignia, identify the trade of these coal diggers, here celebrating a holiday near Jochberg.

Steins Go Up in Toast to a Town; It's Matrei's 1,700th Birthday

Bandsmen and riflemen came from all over the Tyrol to help the town celebrate. Costumed Roman legionaries, Gothic invaders, and medieval knights stopped traffic on the historic Brenner Pass road with an hours-long parade. Here Matrei's own band relaxes (p. 753).

Kodachrome by Volkmar Wentzel

Devil Masks and Christmas-tree Shakos Announce a Witches' Sabbath in Badgastein

January festival's black-faced demons descend out of the pagan past. Team captains in tinsel hats shoo them back to the underworld. Only strong necks can long support such 50-pound burdens.

St. Wolfgang's Gold Caps Were Made Before America Was Discovered

Mothers for 500 years or more have handed down the fan-shaped headdresses to brides of their eldest sons. Paisley-type shawls complete the holiday ensemble. These women, en route to church (center), carry rosaries and prayer books.

Montafon Valley's High Hats Seem to Spring from Dickens's Novels

Starched shirtwaist, embroidered jacket, and bow tie dress up the young lady. Sixteen buttons trim the man's red waistcoat. The church's onion-shaped cupola reflects an Alpine baroque style inspired by Greek Byzantium, now Turkish Istanbul.

between high snowbanks into thick cloud mist for the long, eye-filling descent.

Near Zell am See we turned off to Kaprun, where Austrians, with the aid of ECA Counterpart Funds, are building the country's most dramatic hydroelectric project. To reach the secluded dam, I rode an open, boxlike cable car over a stomach-turning abyss and hiked a mountain path that left me panting. From a high, rocky ledge I surveyed the colossal wall, swarming with ant-sized men, that is sealing up the canyon (page 774). Impounding and taming the rushing torrents that pour from melting Hohe Tauern glaciers, Kaprun, when the entire project is completed, will produce annually 600 million kilowatt-hours of vital energy.

But Kaprun is only the most dramatic of a host of ECA projects in Austria. Signs all over the western zones call attention to highways, bridges, power plants, and industries built with Marshall Plan funds. Directly or indirectly, ECA has bolstered the nation's economic weaknesses and kept it a staunch democratic ally. American experts have helped revamp Austrian agriculture, industry, education, forestry, and power system.

Since April, 1948, total ECA aid to Austria has amounted to about 500 million dollars. From that month, graphs showing industrial and farm production, living standards, foreign trade, food supply, and employment climb sharply.

Despite steady progress, putting Austria on its feet is an uphill battle. Some 73 percent mountainous, the country has never supplied more than three-fourths of its food needs. Large supplies of fuel, food, and raw materials must be imported. Now the Iron Curtain largely shuts off natural eastern sources of food and outlets for manufactured goods.

While ECA struggles to lift Austria's economic level, Stalin weighs it down. Since 1945, Russia's occupation, dismantling of industries, and interference with production and trade have cost the nation well over a billion dollars. Russians took valuable modern equipment out of several hundred Austrian industrial plants. Another 300 in the Soviet Zone are operated by and for the Russians under a giant holding company. Russian-controlled Zistersdorf oil fields produce one million tons a year, the bulk of which is taken by the Soviets.

Under the circumstances, and because remaining in Austria gives the Russians a reason to keep supporting troops in near-by satellites, Stalin is in no hurry to leave. In more than 250 meetings of treaty deputies, East and West have failed to produce a treaty giving Austria its promised freedom.

Crossing into French-occupied Tyrol, we spent the night in Kitzbühel. After dinner we joined tourists, soldiers, and gaily costumed townspeople thronging the main street of this internationally known ski resort to hear a *Platzkonzert*. In a scene reminiscent of *The Student Prince*, the town band—in scarlet coats, leather knee breeches, and plumed hats—played lively tunes while its audience promenaded, visited, and threw paper streamers. Climaxing the concert, everyone followed the band in a spirited torchlight parade.

In Hitler's Mountain Eyrie

Driving to Salzburg for mail, we crossed that fateful little salient of Germany that pierces its neighbor's northern flank like an arrowhead. Detouring, we visited Hitler's bombed-out chalet above Berchtesgaden. Through the huge, glassless picture window of its rubble-strewn living room we had a superb view of the distant Festival City and the fallen Führer's Austrian homeland. Was this the view in Hitler's mind, I wondered, when he ordered his troops to invade Austria in 1938, setting off a train of events that plunged the world into war?

In Kufstein, near the Bavarian border, I watched craftsmen blowing three tons of molten glass into delicate goblets and glasses.

"Some of these workers learned their trade in a local glass factory that was founded by the Medici in the 16th century," the foreman told us, "but most of us are refugees. This plant was moved in 1946 from Czechoslovakia, where it was started 120 years ago, and most of its workers came with it. I myself used to own a big glass factory in Poland, but I had to flee to Czechoslovakia and from there to Austria.

"By the way," he added, "if you're in Chicago in September, be sure to see our exhibit at the International Trade Fair."

Gay tricolor bunting hung by French occupation forces in honor of Bastille Day decorated Innsbruck when we arrived in the Tyrolese capital. Tourists crowded the streets; we made half a dozen vain attempts before finding rooms.

Bridging the swift Inn River, this crossroads city rose and flourished with the tide of medieval traffic that ebbed and flowed across near-by Brenner Pass. Through Innsbruck the ages have marched; each has left its mark. The deepest was made at the time of Maximilian I, Holy Roman Emperor, who embellished the city with architectural treasures.

Modern changes—trolleys, traffic lights, recent buildings—seem unobtrusive here (page 750). After more than 400 years the Archduke would feel at home in the city's oldest section.

Eric M. Sanford

Wrought-iron Trademarks Overhang the Salzburg Street Where Mozart Was Born in 1756

Rosenmayer's bakery hangs out a pretzel. Just beyond, a fezzed, pantalooned figure identifies a café. It reminds us that in 1683 defeated Turkish invaders, by abandoning stores of coffee beans, introduced the drink into Austria. Mozart left Salzburg as a boy; he died impoverished in Vienna at 35 (page 788).

The Golden Dachl, the ornate gilt-roofed balcony from which his court watched strolling street players, still stands. The near-by Hofburg Church shelters his grandiose tomb, which he helped design, with its royal bronze figures that include King Arthur and Theodoric the Ostrogoth. The tomb itself is empty; quarreling with city fathers, Maximilian left Innsbruck, never to return, and was buried where he was born, in Wiener Neustadt.

Ageless inns, their guest books reading like a *Who's Who* of the Middle Ages, offer the same hospitality and strong Tyrolese wine as in the Archduke's day. Pointed arcades cover the same cramped streets lined with narrow Gothic houses. Old fountains bubble where they've quenched the thirst of generations. Theological students walking these streets speak medieval Latin.

French Armed Might Parades

There was nothing medieval, however, about the parade of French armed might I saw on July 14. Past the storied Hofburg rumbled every type of modern war machine. Old Andreas Hofer, I reflected, must be turning in his grave. Three times this heroic innkeeper gathered sturdy Tyrol men and drove out Napoleon's troops. Tyrolese still call 1809, the year of Hofer's exploits, simply "the year nine."

That evening, in a flower-strewn square outside the Hofburg, French, Austrians, and transient visitors danced till dawn to the modern music of two orchestras.

Using Innsbruck as our base, we explored the idyllic valleys that branch from the Inn River like the veins in a leaf (page 773). They took us into backwoods Tyrol, a remote world of changeless ways—of pagan legends, old customs, folk art, elaborate wayside shrines, yodeling, and country dances.

In this "land in the mountains" glacier-capped Alps dwarf hamlets of rustic half-timbered houses. Tipsy farms cling to high, steep slopes; cattle graze in highland pastures. Costumes, architecture, and even speech vary from one valley to another.

In some places Johann had a hard time understanding people when we asked directions, their speech was so different from his own Viennese dialect.

"These farmers," he'd say, "don't even speak good German. Some of their words I never heard before."

Flags of 11 nations flew in Mayrhofen, rural home of Innsbruck University's International Summer School. Strolling college students conversed in almost as many tongues (page 789). Staying over, we attended an evening discussion group that sounded like the UN in action as student interpreters translated speakers' remarks into half a dozen languages.

In Matrei, near Brenner Pass, we helped the town celebrate its 1,700th birthday (pages 753, 775, 782). For hours traffic on this historic route was halted while Roman legionaries, barbarian invaders, knights, and costumed rifle clubs paraded.

Up the Oetz Valley we drove to Obergurgl, Austria's highest town. At road's end, this remote cluster of dwellings nestles among snow-crowned mountain giants. Travelers reaching it feel they've left the world behind. Hikers, climbers, and those who like solitude seek it out in summer; under winter's deep white blanket it becomes, like most Tyrolese towns, a skier's heaven.

Car-high snow had flanked the recently plowed road over Arlberg Pass when we drove it in May en route to Vienna; our automobile was among the first to cross. Two months later, as I lunched in the famous ski resort of St. Anton, steady streams of summer traffic flowed in both directions over the divide. We joined the flow down into Vorarlberg, Austria's westernmost province.

A setting sun turned Lake of Constance (Boden See) into gold as we reached Bregenz, the provincial capital. Townspeople promenaded the water-front esplanade, small boys fished, and a paddle-wheel steamer disgorged visitors from Swiss and German lake ports. A lighted cable car, scaling the city's mountain backdrop, looked like a giant firefly.

In its limited area Vorarlberg encompasses flat Rhine valleyland, Bregenz Forest's rolling hills, and majestic alpine ranges. Vorarlberg life resembles Switzerland's. Like their Appenzell counterparts across the frontier, village herdsmen drive cattle to the hills in springtime and later to solitary pastures above tree line.* When high-altitude forage grows sparse in autumn, men and flower-decked beasts return amid gay scenes of rejoicing.

"Have you seen our industry?" asked the president of a big textile school in Dornbirn.

"What industry?" I countered.

"Vorarlberg is one of Europe's most important textile centers," he replied. "It has 10 large and 344 small textile factories that make all of the country's fine manufactured lace and a big share of its cotton, worsted, and silk goods. Vorarlberg and its neighbor Switzerland lead the world in the production of machine-made embroidery."

Under his guidance I found out why I hadn't noticed Vorarlberg industry. Factories

* See "Switzerland Guards the Roof of Europe," by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, August, 1950.

Christ Hangs Crucified from a Wayside Calvary

Roadside crucifixes are as prominent in rural Austria as direction signs. Pious countrymen adorn many with flowers. Copies of the Saviour's robe, the Roman soldier's spear, and the cock that crowed after Peter thrice denied Jesus hang on this cross in the Bregenz Forest. Other emblems of the Passion are chalice, lantern, torch, pillar and chain, sponge on spear, and purse that contained the 30 pieces of silver.

are smokeless, look like houses, and are often set in orchards. Machines hum with electric power coursing from dams high in the Montafon Valley. There are no crowded urban slums; even Dornbirn, one of the largest population centers, has only 17,000 inhabitants. Town workers alternate between airy factories and old, deep-eaved houses with large gardens that supply most of their food.

After two days in Vorarlberg we headed east again, bound for Salzburg to attend its famous music festival. The city was in holiday mood. Visitors filled every available room and overflowed into outlying towns, for during August this storied city, the birthplace of Mozart, becomes Europe's music center. Its festival, inaugurated almost before the guns of World War I were silent and revived before the debris of World War II was cleared away, attracts music lovers and top-flight artists from all over the world.

The dramatic setting for this month-long feast of opera, plays, and concerts is one of the world's most beautiful small cities. Built to suit the lavish taste of powerful archbishops who made it the "Germanic Rome," Salzburg is a city of princely palaces and magnificent churches. Straddling the turbulent Salzach River, it lies among green alpine foothills in the shadow of the castle-topped Mönchsberg (pages 756-757).

Exploring this fascinating city filled our days; every evening we attended a superb festival performance. We wandered narrow streets (page 786), browsed in old shops, traced a thousand years and more of history in Salzburg landmarks, and fell more deeply into the Austrian habit of *Jause*—having a late-afternoon snack in coffeehouse or sidewalk café. In the restau-

789

Mayrhofen, a Tyrolese Babel, Advertises a Circus in Three Tongues

Here the International Summer School enrolls boys and girls from a dozen nations. Lectures, translated into several tongues, suggest the United Nations in action (page 787). These hiking French students carry canes and dress in non-Alpine togs. They read appeals in German, English, and French.

rant of 1,200-year-old St. Peter's Abbey we sipped special wine made by the monks and topped off banquet-size meals with *Salzburger Nockerln*, a giant soufflélike dessert. After concert or opera we took an elevator to the popular Mönchsberg café that offers lilting music and a magical view of the city with its late-hour hospitality.

Headquarters of U. S. occupation forces in Austria, the city has a distinct American air. Signs in English are everywhere; so are GI's. Standing on any busy corner, one can hear in a few minutes the deep drawl of Dixie, the twang of western speech, and New England's clipped accents. Big American cars fill public squares and crawl through cramped streets meant for coaches. Above Mozart Platz the Stars and Stripes ripples in the breeze.

Behind the Mönchsberg I visited the Salzburg Seminar, a college summer school sponsored by Harvard University, in Leopoldskron, an 18th-century palace. Here student leaders from western European countries study American civilization and discuss freely and informally the world's problems.

Branching out, we made excursions into the near-by Salzkammergut, Austria's most popular summer vacationland. Its mountains vary from forest-clad hills to giants like the Dachstein. Countless turquoise lakes, large and small, fill its hollows; on their shores nestle quiet villages, like St. Wolfgang, that resemble settings for an operetta. Noted spas such as Bad Aussee and Bad Ischl, where Emperor Franz Josef had his summer court, offer ailing visitors mineral and thermal baths.*

Salt has flavored the life and been the chief wealth of this region since prehistoric

* See "Salzkammergut, a Playground of Austria," by Florence Polk Holding, National Geographic Magazine, April, 1937.

Fair "Ski Rabbits" (Amateurs) Hitch a Tow up Gentle Slope

Sixteen cable cars and 83 ski lifts make climbing easy in mountainous Austria. Snow is thick from Christmas through Easter. Skiing on the highest slopes continues through May. Room and board at the most expensive resorts cost no more than $6 a day.

times. Five Salzkammergut mines still produce more than 220,000 tons of it a year. Donning coveralls and carrying miners' lamps, we explored the biggest, in Hallstatt, which has been in constant operation since 1285 and was first worked some 3,000 years ago.

Deep inside the mountain our guide explained the mine's workings. Miners blast tunnels to big salt pockets and dig chambers in them. Water, pumped in, slowly dissolves the salt. Time and again the ever-growing chambers are drained and refilled, until the deposit is exhausted, which may take as long as 25 years.

A hundred finished caverns and 65 "live" workings honeycomb the mountain like holes in a Swiss cheese. From those still productive a river six times as briny as the ocean pours forth and is piped to Ebensee, 25 miles away, for evaporation.

On this mountain 2,000 graves of prehistoric lake dwellers have been discovered. They yielded such a wealth of salt-preserved early Iron Age artifacts that Hallstatt gave its name to that period of Europe's development, roughly from 1000 to 500 B.C.

Occasionally a Hallstatt miner will still find an object that belonged to an Iron Age predecessor. When he does, he merely shrugs and says it belongs to "the old man." Into the town museum it goes, for the enlightenment of Atomic Age visitors.

Returning to Salzburg, we picked up a young couple hiking along the road. Their idea of a vacation, we discovered, is to put on stout shoes and camping clothes, shoulder rucksacks, and see their native land on foot.

"Each year," the husband told us in English, "we take two weeks and explore some part of our country we're not acquainted with. On every trip we discover places that seem lovelier than those we saw the year before.

"Perhaps I shouldn't be the one to say so," he added, "but it's a very beautiful country."

Not only did I agree, but, after two months and 3,000 miles of travel in this Alpine republic, I thought his observation a modest understatement.

The Bird's Year

By Arthur A. Allen

Professor of Ornithology, Cornell University

With Illustrations from Photographs by the Author

THERE is a cardinal in our neighborhood that has caused mixed emotions. To a former mayor, Arthur N. Gibb, and his family he was a gift of color and cheer when he came to their feeding station at the window or sang from the top of the maple. To the Lloyds, who lived across the road, he was a troublemaker.

No sooner had the cardinal cracked a few sunflower seeds at the Gibbs' feeding station than he would dash across the road and fly headlong against one of the Lloyds' windows. He did this for nearly three years, and the Lloyds spent much of their time washing glass.

Shadowboxing His Own Reflection

Especially unpopular was the bird half an hour after sunrise, when he was known to fly against the window fifty times without stopping, or with just sufficient interval to permit the dreamer to drop off again.

To this particular cardinal the Lloyds' home was full of rivals. It never occurred to him that the intruders were only his own image reflected in the windowpanes. Going from one window to another, he would drive each bird back where it belonged, thus preserving the neighborhood for himself and his mate.

During the spring season, at least, the female was not averse to helping him, perhaps not in actual combat but with flattering whistles or even a complete song. The cardinal is one of the comparatively few species whose females can sing.

After the second year of window washing, the Lloyds sent me an ultimatum, threatening to trap the bird and carry him off into the country. As a pacifier I fastened a mirror outside the window of their guest room, where the cardinal could find an image really worthy of his prowess and where he could concentrate his attentions without being so objectionable.

The mirror was an immediate but temporary success (page 810). Eventually Sam Lloyd had to put up window screens long before the fly season, just to destroy the reflections that made the cardinal see red.

This is not the only cardinal with such antisocial behavior. As long ago as 1599, Ulissi Aldrovandi, the great Italian naturalist, told of one that had been transported from America to a garden at Pisa and spent most of its time fighting its reflection.

At my own home in Ithaca, New York, a female cardinal has taken the part of Don Quixote tilting with a nonexistent foe. The male aids her efforts by bringing her sunflower seeds already cracked, so that she need not cease her chivalrous defense of their chosen estate.

Cardinals along the northern limit of their range seem much more given to this "shadowboxing" than those farther south, where the species is much more numerous and therefore accustomed to having close neighbors.

Perhaps these northern pioneering individuals are endowed with a greater flow of hormones, as well as increased vitality. This has caused them to push onward into new country, just as our own ancestors did, and at the same time has made them intolerant of their kind.

Most Birds Defend Home Territory

This behavior of the cardinal is not at all exceptional in the bird world. I have known many robins, catbirds, wrens, song sparrows, orioles, and even indigo buntings to fight their own reflections when some offending window happened to be included in the area which the bird claimed as its nesting domain and which ornithologists have come to call the bird's "territory."

There are a few birds, such as the bank swallow, cliff swallow, and purple martin, that nest in colonies and seem to enjoy close neighbors. They do not appear to object to a friend even peering into the nest occasionally. But most birds are strictly "territorial" during the nesting season and will not allow another male of their own species to approach within a certain self-determined distance of their headquarters (page 813).

It is usually the male's job to defend the territory, but in some species the female will not permit another of her sex to enter the sacred precincts. My militant cardinal is a good example of these fighting females.

In cases where the females are not territorial, several may occasionally settle down in the territory of one aggressive male, and thus polygamy results in some normally monogamous species. House wrens, orioles, starlings, redwings, meadowlarks, and robins have been found fathering two or more families at the same time, although most indi-

viduals of their kind are strictly one-family males.

There are some records of two female robins having the same mate and occupying the same nest, or two nests touching each other, yet with the birds apparently on good terms. I have even heard of two female cardinals occupying the same nest; but this is most irregular, and the resulting confusion caused the eggs to get broken.

In one case of bigamy, where two robins built nests side by side, the eggs in one nest hatched the day the young in the other nest were about ready to leave. The stimulus of the wide-open mouths and insistent food calls of the clamoring large youngsters was so strong for both females that the small young were entirely neglected and therefore perished.

Two Keys to Bird Behavior

In general, a bird's behavior throughout the year is controlled by two major forces, and these allow little opportunity to use what we might call intelligence.

First, there is the physiological control from within the body. It tells birds when it is time to migrate, to stop migrating, to select a territory, to sing, to fight, to mate, to build a nest and lay eggs, to incubate the eggs, to feed the young, to assemble in flocks; and so on.

In a healthy bird these cycles of instincts follow one another with clocklike regularity. If there were no such things as weather or accidents, each species would probably leave its winter home on a definite date, pass through Washington or some other way station on the same day each year, and arrive on its nesting ground and lay its eggs with equal predictability.

Indeed, some birds that are not much affected by the weather—for example, the cliff swallows of San Juan Capistrano, in California, or the puffins of Labrador—do exactly this. One could plan his journeys years ahead so as to arrive at Capistrano with the swallows or on Perroquet Island in the Gulf of St. Lawrence on the same day as the puffins (page 815).* But if all bird behavior were so predictable, bird study would lose much of its zest and charm.

The other major force comes from without and is in the form of an intricate series of "releasers," as they were first called by that brilliant student of bird behavior, Konrad Z. Lorenz. Most of these are visual, but many are auditory and a few are tactual or perhaps even olfactory, though the sense of smell is very poorly developed in birds.†

For instance, a bird might fail to breed if its surroundings did not look, sound, feel, or possibly even smell right. Its normal behavior pattern would not be "released."

Glands May Turn Sissy into Bully

The physiological control is apparently governed by the activity of the pituitary gland and the secretion of certain hormones which in turn control the activity of other glands.

During the winter, for example, the reproductive glands are quiescent and all the activities connected with the breeding season are entirely suspended. Most species do not sing, or, if they do, they have a different song from that given on the nesting ground.

If they fight, it is entirely irrelevant to sex and merely for the purpose of establishing what has been called the "peck order"—determining which birds can peck and bully which others; and the dominant birds may be either male or female.

An established peck order is subject to many changes and even reversals as spring advances and a new cycle of behavior is ushered in.

In my flock of waterfowl, a few years ago, a snow goose lorded it over all the other fowls during the winter; but by April the mallards were passing into the breeding cycle while the snow goose was still quiescent sexually. As a result, one of the male mallards, which had submitted to the snow goose's brutality all winter, rose in the peck order to such an extent that he drove the snow goose off the pond and kept him away so successfully that he could hardly get a drink.

All the factors that control the pituitary gland are not understood, but it has been shown experimentally that the amount of sunlight or artificial light which the bird receives affects the activity of this gland and in turn the activity of the reproductive glands. It likewise affects all the secondary sex characters, such as color of bill, feet, and any "soft parts" that are normally subject to color change in the spring.

Sparrows, juncos, starlings, pheasants, grouse (page 811), crows, and other wild birds, as well as poultry, have been brought into breeding condition during fall or winter merely by giving the birds in cages increased allotments of light, corresponding roughly to the lengthening days of spring.

Hand-reared pheasants, grouse, and quail will actually produce eggs in the winter; but

* See "Sea Bird Cities Off Audubon's Labrador," by Arthur A. Allen, NATIONAL GEOGRAPHIC MAGAZINE, June, 1948.

† See "Sights and Sounds of the Winged World," by Arthur A. Allen, NATIONAL GEOGRAPHIC MAGAZINE, June, 1945.

Kodachrome by Arthur A. Allen

Black-crowned Night Heron, Dusk's Fearsome Fisher, Spends the Day Hatching Quadruplets

Nesting in colonies, night herons usually build homes in trees or, like this Utah mother, in marshes. Pity the frog or fish in spearing distance of her javelin bill! Three white plumes form a tiara worn for the mating season.

< Caught in the Act! Sneaky Mrs. Cowbird Jettisons an Egg in a Predawn Raid

Bigamist and social parasite—that's cowbird's shady reputation. Having lost her home-making instincts, she lays eggs in the nests of smaller birds. Foster parents hatch the interlopers, feed and raise them.

This extraordinary flashlight Kodachrome is believed to be the only color picture ever made of a cowbird parasitizing a nest. Finding mother warbler not at home, the daybreak visitor has deposited her own egg. Now she tosses out a warbler egg to make more room. Other eggs she foists upon different hosts.

Poultrymen play varieties of the cowbird trick on barnyard fowl—witness hens hatching ducklings.

Chestnut-sided Warbler Adopts the Bogus Egg >

Some warblers floor over foreign eggs by building second-story nests. More often they hatch the foundlings. Rightful heirs, usually smaller, fail in competition for food (opposite, and page 804).

Kodachromes by Hal H. Harrison

Mrs. Redstart Feeds the Destroyer of Her Children, a Greedy Cowbird Already Bigger than His Foster Mother

The young foundling, using his greater size to advantage, has grabbed most of the food and starved or smothered his nest mates. Now his prodigious appetite requires constant insect servings, and deluded guardians wait on him endlessly. Grown, he will live up to his name by associating with pastured cows.

Kodachrome by Arthur A. Allen

Kodachromes by Arthur A. Allen

Never a Housing Shortage Here. These Versatile Artisans Use Plant Fibers as Building Blocks

Avid insect hunters, these homemakers help preserve the balance of Nature. Phoebes (upper left) are named for their call, "Fee-bee! Fee-bee!" Oven-bird (upper right) sings, "Teacher! Teacher!"—hence the synonym, teacher bird. Mourning warbler (lower left) does not grieve; she's happy with her four beautiful eggs. Magnolia warbler (right) prefers spruce tree to magnolia.

Two Woodpeckers in Jaunty Bellhop Caps and a Purple Martin Make Their Homes in Cavities

Purple martin (female, left) prefers to live near man. In the East she may occupy a man-made box or a brightly painted gourd. Sparsely settled areas in the West find her nesting in hollow tree, cliff, or between rocks. Red-bellied woodpecker (center) shows more red on head than belly; it wears the Fish and Wildlife Service's numbered anklet. Gila woodpecker (right) shares the gila monster's arid domain in the Southwest. It may dig a nesting hole in a cactus.

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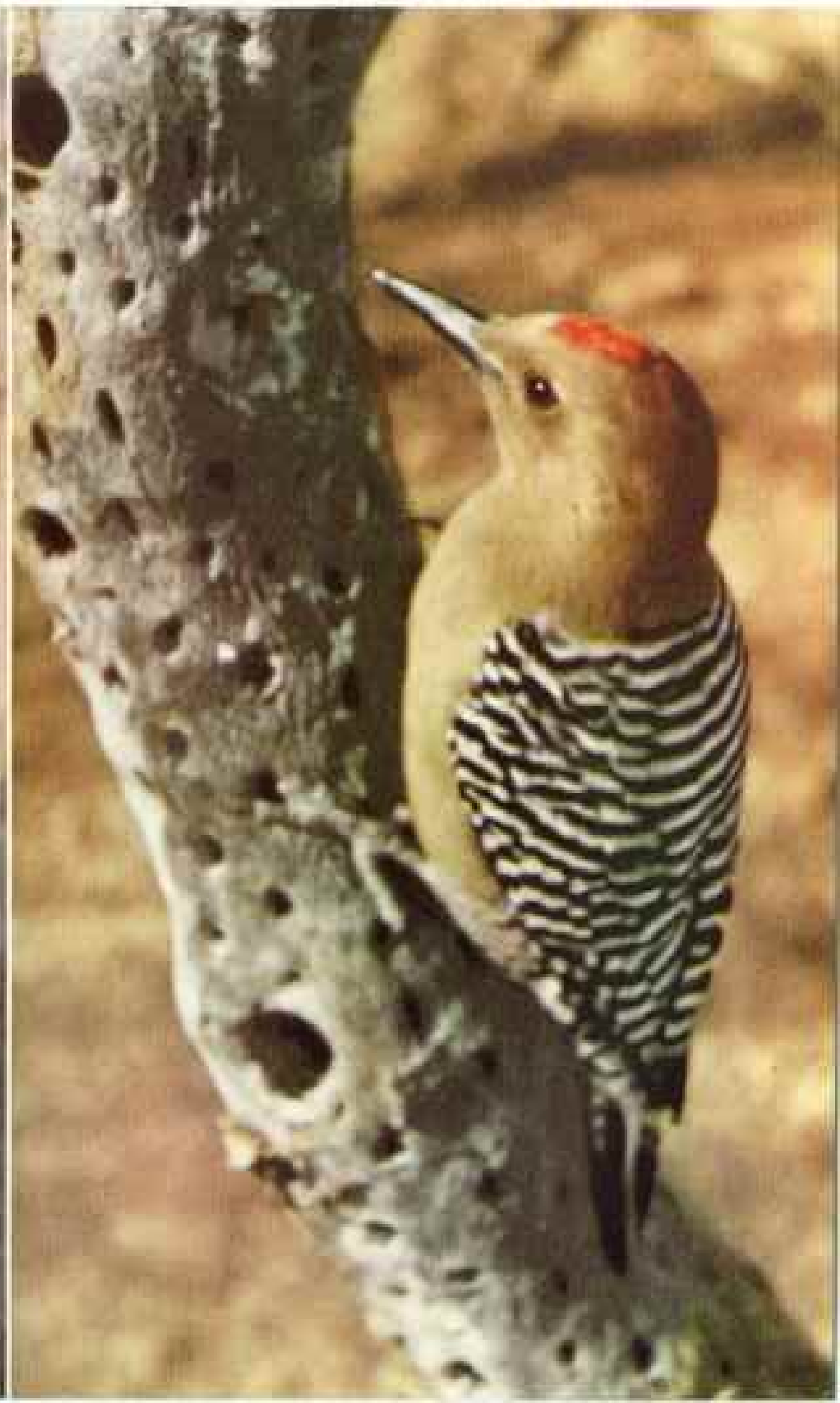
Kodachromes by B. A. Grimes

Kodachrome by B. J. and Florence Thornburg



Eared Grebe's Nest Is a Soggy Houseboat Moored to Rushes in North Dakota Marsh

Grebes build floating nests of decayed vegetation and usually bind them to aquatic plants. When disturbed, they cover eggs with strands from the nest and dive into the water. Though strong flyers, they seldom take wing. Lobed toes aid swimming; Nature waterproofs plumage.

As divers, grebes compete for the championship of the bird world, earning the nicknames "hell diver" and "water witch." Clumsy on land, they move on their bellies like seals or sit up like penguins.

Eared grebes, nesting in scattered colonies, range over wide areas of western North America. Usually they are found on inland fresh waters, but migrations may take them to sea. They feed chiefly on fish, larvae, crawfish, and other crustacea. Sometimes feathers are fed to the young.

Grebes' eggs, bluish white when laid, soon are stained a yellowish brown by the wet nest. Eggs sometimes are hatched when partly covered by water.

This raft dweller shared its marsh with a colony of Franklin's gulls.

Kodachrome by Arthur A. Allen

Disturbed, Least Bittern Freezes; American Bittern Angrily Fluffs Feathers

When an intruder approaches, bitterns may strike a statuelike pose, relying upon protective coloration to escape detection. Here the least bittern simulates a broken reed. Spread wings of the American bittern are eloquent of defiance. Its call, a liquid "Oohlee-oob, oohlee-oob," sounds like water gurgling from a jug. Clapping of the bill helps give the bird its alias, "stake-driver."

Kodachromes by Arthur A. Allen

Kodachromes by Arthur A. Allen

Relatives of This Wild Gobbler Journeyed to Spain in 1519

Bronze turkey is the New World's principal contribution to man's kept birds. Conquistadors, exploring Mexico, found captive turkeys and shipped them home. Europe falsely identified the bird with the turkey cock, a guinea fowl imported into Turkey from Africa.

About Face! Three Indian War Bonnets Flash Copper in a Texas Sunrise

In spring the tom turkey would rather strut than eat. Nature sustains him with a heavy pad of reserve fat over the breast. These chummy gobblers drove other males away from their 20 hens. They are Rio Grande turkeys, one of five wild races.

Kodachromes by Arthur A. Allen

↑ Frizzy-headed Young Coots Will Grow into Sportive Clowns

"Half duck, half chicken" describes the coot. In nesting season adults explode with cackles, clucks, and wails; they splash, wave wings, and chase one another. These newly hatched chicks wear hairlike orange feathers about partly bald heads. Black down covers bodies.

↓ "Hey, Dad, Wait for Me; I'm Tired." Baby Loon Aims to Hitch a Ride

Ever vigilant, the loon is difficult to approach. The bird dines on fish 7 days a week. Its cry suggests demoniacal laughter; hence the expression, "crazy as a loon." This youngster, swimming in an Adirondack lake, soon will clamber aboard for a pickaback cruise.

← Redstart, Nesting on Cornell Campus, Is Her Own Baby Sitter

This graceful bird packs boundless energy in a tiny frame. Gaily darting through the woodlands, she appears to be the spirit of motion.

She is one of the daintiest of the warblers, a family beloved for its cheery ways and usefulness in destroying insects.

Redstarts prefer the Eastern States, though some inhabit western areas. Olive-gray females have yellow patches; black males wear reddish-orange beauty marks.

Hoary Redpoll Likes → Northern Climes

Long Arctic days allow the bird plenty of time to hunt alder seeds, its favorite tidbit. The young are fed by regurgitation. Always hungry, they grow more rapidly than their southern cousins, the goldfinches.

Hoary redpolls in winter gather in flocks and wander southward, sometimes as far as the Northern States.

A lichen-covered alder in the Yukon Delta supported this Alaskan family.

Kodachromes by Arthur A. Allen

Forest Singers Tune Up in the Spring

Moist wood and shady ravine are favorite haunts of the Kentucky warbler (left). There its sweet song may be heard all day. It ranges from Hudson Valley westward to Nebraska. Winter may find it in Colombia.

White-throated sparrow (right) is called "Peabody bird" by New Englanders, who believe it sings "Old Sam Peabody." People north of the border insist it praises "Pure, sweet Canada." Its nest is hidden so cunningly that it virtually defies detection.

These Sentinels React Differently to Man

Remarkably fearless, blue-headed vireo (left) often permits stroking while on the nest. Vireo's name means "I am green."

Brown thrasher (right) defends his nest courageously, sometimes hurling himself at intruders. As a singer, he ranks a close second to the mockingbird. Not a true thrush, he is the "merry brown thrush" of children's books.

Kodachromes by Arthur A. Allen
Kodachrome by Hal H. Harrison

Kodachrome by Arthur A. Allen

Raucous Young Cowbird Demands Food from Devoted Foster Parent, an Indigo Bunting

This bird and his mate unwittingly hatched a voracious foundling. Most of our small songsters are victims of the cowbird's parasitic ways (pages 794, 795). In Europe the cuckoo plays a similar trick on neighbors.

Kodachromes by R. A. Grimes

Residents of the Lone Star State Lounge in Doorways

Texas is the only State frequented by these two. Male Sennett's oriole (left) dwells in a yucca. For the female, see "A Bag of Bird Portraits," NATIONAL GEOGRAPHIC MAGAZINE, June, 1946 (Plate III). Golden-fronted woodpecker (right) rooms in a huisache.

Home Are the Hunters Bearing Trophies of the Chase

Short-billed marsh wren (left) may build dummy nests to mark his territory in a damp meadow. Man seldom sees him, so rarely does he fly. His "Dee-dee-dee" sounds like two stones tapped together. Baltimore oriole, in orange vest, whistles, "Come right here, dear."

Kodachromes by Arthur A. Allen

Kodachromes by Arthur A. Allen

Kodachrome by S. A. Grimes

Evening Grosbeaks Prospect for Seeds . . . Sparrow Hawk Clings to a Fire Ruin Where He Lives in a Flicker's Dugout

Evening grosbeak is a misnomer, the bird having been mistakenly described as a twilight singer. Male (top) and female summer in Canada. Sparrow hawk, smallest of native hawks, sometimes occupies back-yard bird boxes. His alias, killy hawk, comes from the cry, "Killy, killy, killy."

Yellow-headed Blackbird Sings, "Our Cook Skedaddled, Our Cook She-e-e-e-e-e!" White-winged Dove Asks, "Who Cooks for You?"

Tattletale yellowhead, which seldom ventures east of Indiana, here perches in a Utah tule marsh.

Common in Mexico, white-winged doves are declining in the United States. Along the border they are shot as game. Certainly not the dove of peace was the cactus haunter on the right, which pugnaciously drove other birds away from the photographers' feeding station.

Kodachrome by Arthur A. Allen

Kodachrome by R. J. and Florence Thorndyke

Sabine's Gull Nests on Arctic Tundra

Named for its discoverer, Sir Edward Sabine, Arctic explorer, the gull is seen but rarely in Atlantic coastal areas. Preferring Alaska, it breeds in scattered colonies near the Bering Sea. In winter it migrates to the coast of Peru. Others inhabit northernmost sections of Europe and Asia.

This tonsorially correct specimen shared its Alaskan tundra with short-billed gulls, whistling swans, spectacled eiders, and little brown cranes. It may wander with arctic terns until its nesting season in late May or early June.

Avocet Rolls an Egg

Toothpick bill and beanpole legs make the avocet a clumsy egg roller and nest straddler. It lays large eggs, usually four, and centers the small ends like slices of a pie. Stilted limbs are designed for striding shallow marsh waters. The beak, swung like a scythe, scoops and sifts mosquito wrigglers for food. Avocets inhabit States west of the Mississippi.

Kodachromes by Arthur A. Allen

birds trapped in the wild do not proceed quite so far, since nest building and egg laying are controlled by "releasers" which are not so easily supplied.

Waterfowl Homesick for Some Unknown "Releaser"

For many years I tried to induce wild-trapped canvasbacks, redheads, and other waterfowl to breed in captivity. They were pinioned and placed on fenced ponds where there was plenty of natural food and nesting cover in addition to the stimulating laying mash which I supplied.

Each spring these wildfowl went through the regular cycle of fighting, courtship, and mating, but there the cycle stopped; no nests were built and no eggs were laid. There was something in the environment I had supplied which did not release the proper nesting behavior.

After several years of this, I obtained some eggs from wild nests in Canada and hatched them under domestic hens. The redheads hatched well enough to give me a breeding stock, and when they were placed on the same ponds with the wild-trapped birds, they had no inhibitions whatsoever about building nests and laying eggs the very first season.

These hen-raised ducks could never have seen or experienced a normal home or a redhead mother's attentions; yet the selection of the nesting site, building of the nests, the plucking of down from the breast of the incubating bird—in fact, their entire behavior—seemed perfectly normal for the species.

This experience has led me to believe that each species of bird has a normal annual cycle of behavior which it follows in detail when uninhibited, but which is often governed or modified by outside releasers, many of which are learned through the experience of the individual.

Thus the wild-trapped waterfowl were perfectly satisfied with my ponds for winter and mating quarters, but the ponds were found lacking in some detail when it came time to release the nesting behavior—a detail which they had acquired from their previous lives in the wild and which the hand-reared birds had never experienced.

Back to Scenes of Youth in Spring

When the birds come back to us in the spring, some continue on to the spruce forests of Canada and some to the Barren Grounds of the far north before their nesting behavior is released. Local birds scatter to wood, field, or marsh, according to the experiences of their youth.

So insistent is Nature on having exactly the right combination of releasers that one seldom finds a nesting bird "out of place." True, the little clumps of spruce forest on the tops of the Appalachians may induce some Canadian birds to stop and nest as far south as Georgia; but, more often, wandering birds that stray from the established breeding range of the species, even though they find mates, do not breed because they do not find the proper releasers to nesting behavior. Through the ages the summer ranges of most birds show little change.

Local populations of wide-ranging species, like song sparrows or yellow warblers, may gradually develop slight variations. These may tend to be preserved until we eventually recognize a race or subspecies, dependent for its preservation on some releaser of breeding behavior which our crude powers of observation are unable to recognize.

In like manner, slight differences in songs and courtship displays may develop in different parts of a bird's range and help segregate the populations. But the remarkable thing is that there is such regularity in the behavior patterns of the thousands of individuals that make up bird species, and such blind insistence on the details of the releasers, that normally two species are automatically prevented from interbreeding.

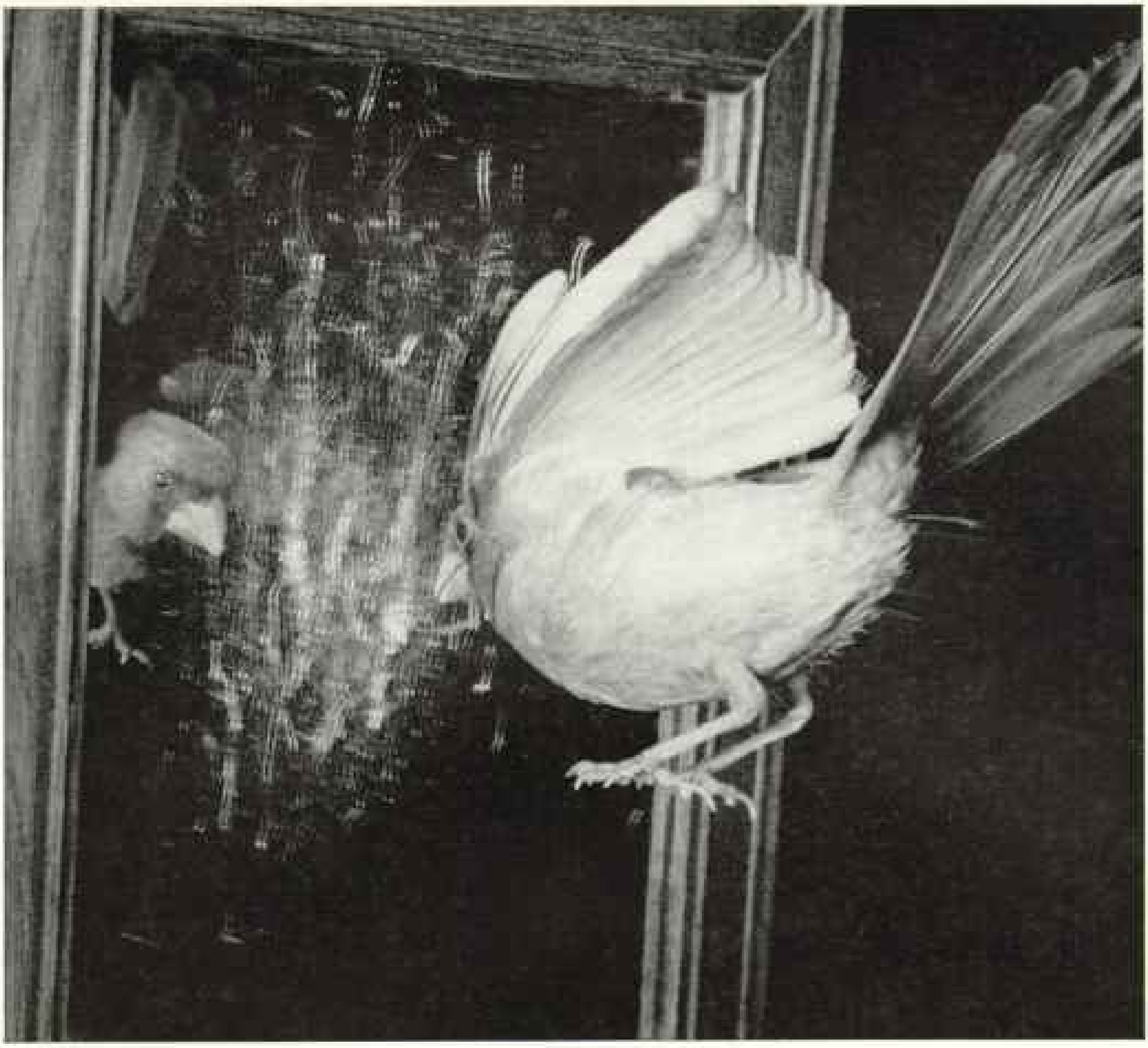
Hybrids are not uncommon in captivity-reared waterfowl, and in pheasants or even songbirds that have not experienced the releasers of their respective species; but in normal wild birds hybrids are most uncommon. They occur principally along the borders of overlapping ranges, where apparently the sex ratio of both species is likely to be upset.

Staking a Claim and Choosing a Mate

When a male bird sets up a territory, therefore, he is responding to a series of releasers that indicate to him that the particular area where he is located is suitable for his species. If he is strong enough to defend it against other males of his kind, eventually a female will arrive that is similarly affected, and she will try to settle in the same territory.

At first the male may try to drive her away, for he may still be in the aggressive cycle of his behavior and may not be desirous or capable of mating.

The mating period in most wild birds is short, both in the male and in the female, and the entire pattern of their behavior in the spring is designed to bring together birds that are in exactly the same stage of the cycle, so that fertile eggs will ensue.



Love-blind Cardinal Brooks No Rivals. He Fights His Own Image in a Mirror

The author's scarlet neighbor announces by singing that he has claimed a territory. He stakes out its limits with a series of song perches. Now a glandular stimulus robs him of reasoning power. He ignores birds of other species, but another male cardinal makes him see red. Nature may have intended his brilliant color to lure marauders from the nest. The incubating female needs to be less conspicuous (page 791).

Domestic birds have been bred away from this weak link in the chain of high productivity, so we are likely to overlook its importance in the wild.

Probably every territorial male drives away many females, as well as males, before a female that is in the proper stage, or approximately so, comes along. In many cases the song alone of the male is sufficient to cause other males to move on. If they persist, he flies at them and gives an intimidation display.

In the case of the red-winged blackbird, the chip-on-shoulder act consists of puffing out his feathers and raising his scarlet epaulets every time he sings. This is sufficient to show his near neighbors that he is ready to defend his territory.

In the white-breasted nuthatch, the black and white underwing and tail markings are usually not very conspicuous until he approaches an aggressor. Then he spreads his wings and tail so as to flash them in the intruder's face.

The ruffed grouse droops his wings and raises his tail like a turkey cock, then spreads his ruff in true Elizabethan fashion and shakes his head rapidly from side to side, at the same time producing a sound like a miniature freight train.

Prairie chickens stamp and boom; sharp-tailed grouse spread their wings, lift their tails, and give a stiff-legged dance, their feet making quick, stamping sounds; flickers bow and twitch and display the golden linings of their wings and tails; and so on.

In fact, every bird has some method for appearing bigger and better than he really is at this stage of the breeding cycle. It serves to intimidate all rivals and, with slight variations, to stimulate the female that is trying to settle in his territory.

Male's Song Raises Female's Pulse

Just what the stimulation amounts to is difficult to measure. But when the late Samuel Prentiss Baldwin and S. Charles Kendeigh were studying house wrens, they put a cardiometer in the bird's nest and discovered that each time the male sang the pulse rate of the female increased.

The various displays of plumage and the cavortings of the males, of which the females pretend to be oblivious, undoubtedly have a similar effect. Eventually the two birds find themselves in exactly the same stage of the mating cycle, and fertile eggs result.

The Author's Triumph: Ruffed Grouse Raised in Captivity

It was long considered impossible to rear captive grouse. Dr. Allen found the trouble lay in lack of sanitation, chicks infecting one another with their droppings. Chicken-wire flooring solved the problem, saving 85 percent. Birds were friendly toward their keeper, but the mating season started vicious fights among males. Hand-reared, they bred freely, where wild-trapped birds refused.

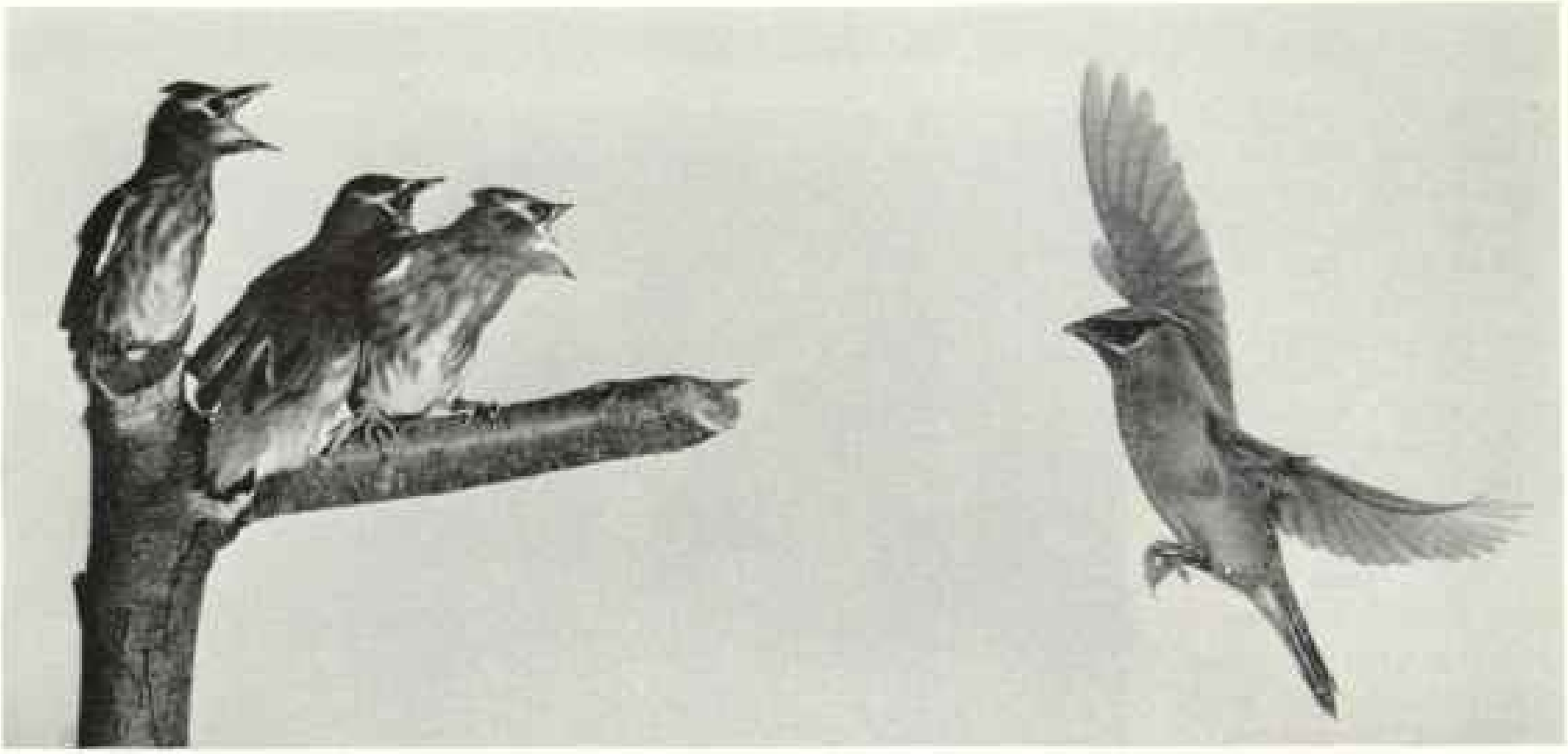
In the meantime, the female bird has not only accepted the male's territory but has felt the urge to build a nest, which must be completed in time for the first egg. It takes about six days for an egg to be formed and laid after the first yellow yolk is deposited about the ovum. Most birds spend about six days building their nests, so from this fact we infer that the instinct to build usually starts with the formation of the first yellow yolk in the ovary. However, there are undoubtedly many exceptions to this rule.

Henpecked Male Phalaropes Keep House

It is usually the female's job to build the nest without any help from the male, though here again are many exceptions. The male of the common house sparrow, for example, is much more active in nest building than the female. So are male woodpeckers.

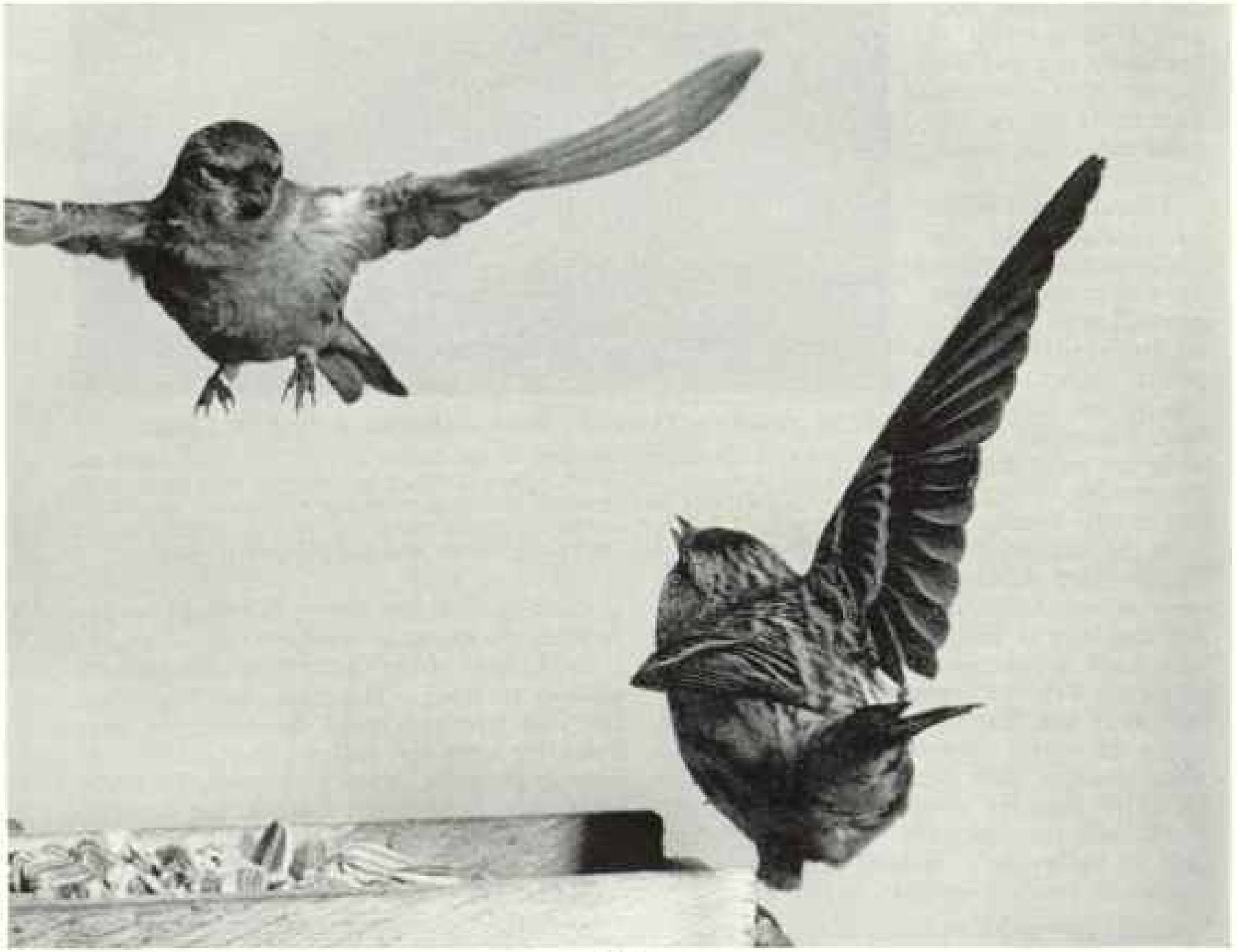
In the case of the phalaropes, the sexes are entirely reversed. The males not only select the nest site and build the nest, but they hatch the eggs and rear the young while the females go off in flocks by themselves. These gadabouts do, however, deign to lay the eggs. Incidentally, they wear the brighter colors and are larger than their henpecked mates.

Males and females of many birds share equally the duties of incubation and care of the young. This is especially true of species in which the sexes are colored alike. Even among the plainly colored song sparrows, however, if the species is abundant and territories small, a male may feel that he should spend



Dinner Is Served, but the Menu Is Hidden in Cedar Waxwing's Throat

Regurgitated fruits, with insects for desert, await mother's three star boarders. Using her esophagus as a basket, she carries enough for all. The speedlight's stroboscopic flash, freezing motion, analyzes the wingspread.



812

Wing Outthrust Like a Clenched Fist, One Redpoll Bluffs Another from the Chow Line

The two follow the flock's peck order, a feeding arrangement established by intimidation or combat (page 792). First bite goes to the prime bully, but if he loses his pep he will drop low in the queue. Winter visitors to Ithaca, New York, the redpolls flew out of the far north (page 802).

813

Louisiana's Snowy Herons Submit to Crowding, but Each Defends His Small Apartment

Nests may almost touch; but let one bird step an inch across an imaginary line and a sharp peck puts him in his place. Territorial trespass is avoided by exact flight routes back to nests. On their feeding grounds the birds may post large territories against fishing by other herons.

814

Mother's Nesting Impulse Is So Strong that It Overcomes the Fear of Man

Ruby-throated hummingbird makes her nest of pussy-willow down, fastens it with cobwebs, and trims it with lichens. She curves the rim inward so the two bean-size eggs will not spill out in high winds. Other birds she drives away. Her carefree mate never comes home; he retires to his one-man club, or territory.

all his time singing and defending the territory rather than sitting on eggs.

In birds like the indigo bunting, the goldfinch, and most warblers, whose males are brightly colored and the females plain, the males do not sit on the eggs at all, though they do help feed the young. The male rose-breasted grosbeak is one brightly colored male that does sit on eggs, but the ruby-throated hummingbird not only passes up egg sitting but disdains all household duties as well.

Every bird species lays eggs of definite size, shape, color, and markings. There is, likewise, a rather definite clutch number for each species, from which they seldom depart. Auks and murres lay but a single egg; hummingbirds, 2; robins, 3 to 5; chickadees, 5 to 8; grouse, 8 to 15; and so forth. The number is probably an adaptation to the dangers to which the eggs and young are subjected.

Each egg has a definite incubation period, or time required for hatching. This ranges from the 10 days of a cowbird to the 78 days of a royal albatross, with the average around 12 or 14 days for small birds like robins and sparrows.

Some species, like most of the shore birds, the grackles, and warblers, regularly have only one brood in a season; others, like the doves, sparrows, and thrushes, may have two or three. Most birds, if the nest is broken up, will attempt to nest again.

Chiselers of the Bird World

There are a few birds, like the Old World cuckoos, the African honey guides, certain weaverbirds, and the New World cowbirds, that have lost entirely their parental instincts and have become social parasites. Laying their eggs in other birds' nests, they let the foster parent hatch the eggs and rear the young.

Some of the birds, like the wrens, catbirds, and robins, respond by throwing out the cowbirds' eggs. Others, like the yellow warblers, frequently bury the cowbirds' eggs in the bottom of the nest. But the majority of small birds just accept and hatch the eggs and rear the young cowbirds (pages 795, 804). Often this costs them their own young, which are smaller, grow more slowly, and are eventually smothered or crowded out of the nest.

Madam Puffin Keeps a Clocklike Schedule

At a definite time each spring, puffins give up their carefree lives at sea and nest on islands from Maine to Greenland and from Portugal to Norway. They dig burrows, carpet them with straw pallets, and lay single large eggs. On certain English islands they invade rabbit warrens, driving out the rightful tenants or living with them. This moon-faced mother dug her home beneath a Labrador boulder.

Mrs. Starling Is Wife Number 3

Female starlings, normally monogamous, may dwell in harems if they exceed the sex ratio or if a lone male controls a very desirable territory. This bird shared her mate with two other tenants in the author's bird boxes.

The Old World's starlings were introduced into New York in 1890. For 20 years they remained close by. Then they spread rapidly, settling as far away as Hudson Bay, the Pacific, and Mexico. Though they devour wireworms and Japanese beetles, they remain unpopular with cherry growers. Cities dislike their chatter and dirt; the National Capital tried in vain to evict them.

Sometimes the cowbird removes one of the foster parent's eggs from the nest to make room for her own (page 794); but usually she lays her egg when there are only one or two of the rightful eggs in the nest. Always she lays the foundling egg before incubation has started.

Own Brother May Swallow a Runt

Birds do not usually commence incubating their eggs until the full complement has been laid, because otherwise the resulting young would be of different ages and sizes. This would have obvious disadvantages, as the larger ones would get all the food.

In the few exceptions to this rule among the hawks and owls, there is sometimes a resulting runt in the family, and the luckless mite gets swallowed by one of its big brothers or sisters when they all make a dive for the same piece of food.

Young birds are of two general types. We ornithologists call them precocial and altricial.

The former are like ducklings and chickens —covered with down, eyes open, and able to run around soon after hatching (page 801). Many of these, like young grouse and shore birds, have to find their own food from the start. They are dependent on their parents only for brooding and then only until their juvenile feathers retain sufficient heat so that they won't get chilled.

Altricial young, on the other hand, may be hatched entirely naked, like young woodpeckers and bluejays; but the majority have a little downy fluff on their upper parts (page 802), and the juvenile feathers grow so rapidly that the nestlings are completely covered in ten days. All of their food, however, has to be supplied by their parents, and many and varied are the ways of transferring it to the youngsters.

Most small birds carry the insects or fruit for their young in their bills, where one can see it; others swallow the food and later cough it up. Hummingbirds have tubular tongues and inject their youngsters with nectar, while cormorants and pelicans merely open their mouths and let the children help themselves, cafeteria fashion. It's not so bad for the first course, but they sometimes almost entirely disappear in reaching for the dessert.

The amount of food young birds require is almost unbelievable and gives an entirely different connotation to the expression, "appetite like a bird's." During their period of maximum growth they consume more than their own weight in food every day.

We once raised a black tern from his first day out of the egg until he finally flew away. When he weighed 31 grams one morning, he consumed 48 grams of earthworms during the day.

If Boys Ate Like Young Birds!

If a growing boy ate like that, he could gobble daily two or three lambs or a whole calf.

When young birds outgrow the nest, at from 12 days of age in red-winged blackbirds to six months in the case of albatrosses and condors, they practice using their wings on the edge of the nest before they flutter out into the near-by vegetation. There again they are cared for by their parents for variable periods, depending on the species. Sometimes the male takes care of the first brood while the female builds a new nest for a second brood.

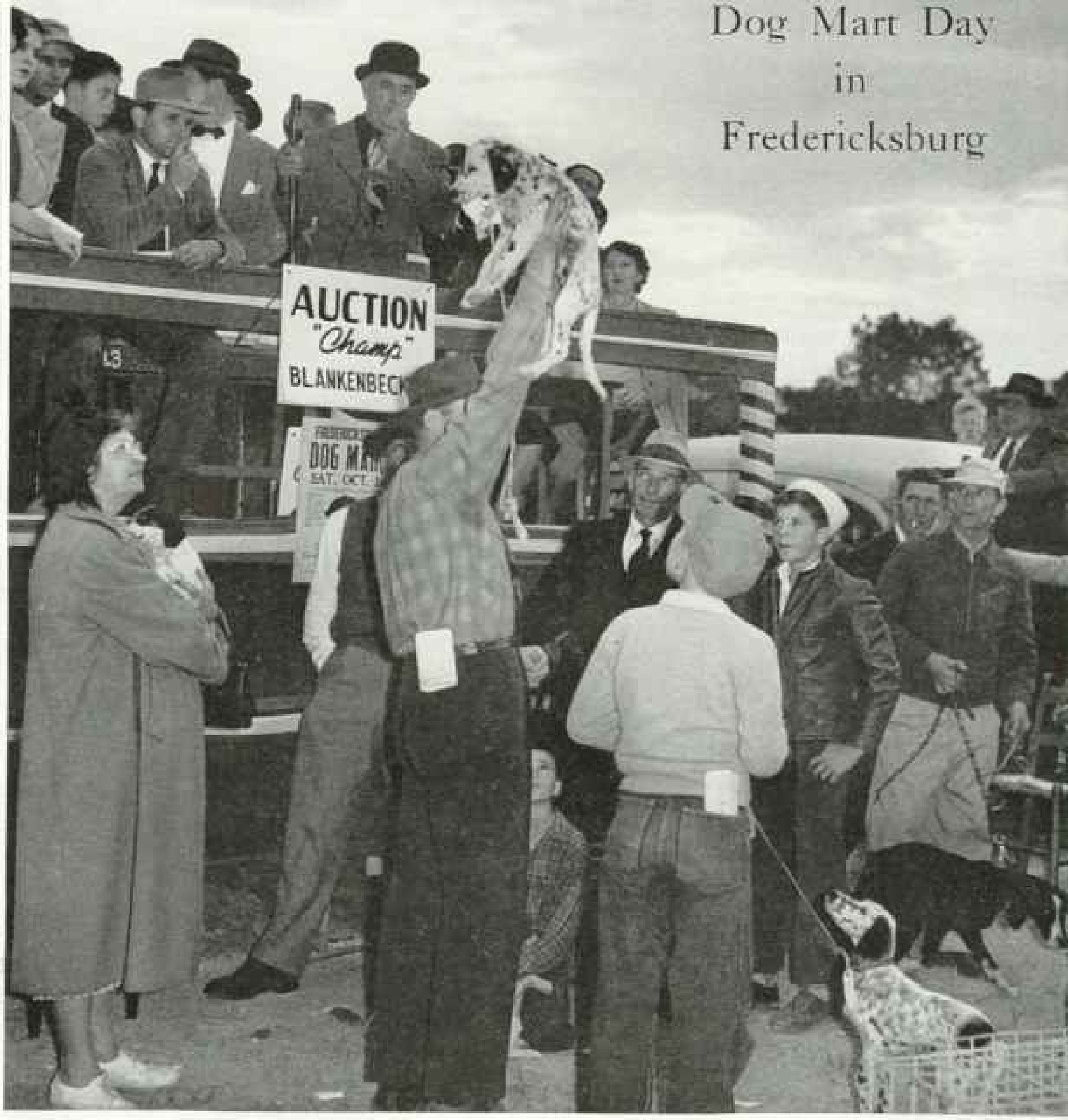
Eventually the youngsters join others of their kind and form roaming flocks that start off in almost any direction in their search for food. Families thus become separated and dispersed long before it is time to migrate. Although some individuals may remain near where they were hatched, others of the same family may show up hundreds of miles away.

So it is that the following year a few of the young may return to the area where they were reared, while the rest will be scattered, with little chance for inbreeding. The majority will find suitable areas for setting up territories, acquiring mates, and rearing young of their own the first year, although some species require longer periods to become mature.

In general, the bird's year measures a generation. If the bird lives for three years, it has grandchildren and has accomplished as much biologically as the average human being in his allotted threescore and ten.*

* For other articles by Dr. Allen and on various aspects of bird life, see "National Geographic Magazine Cumulative Index, 1899–1950."

Dog Mart Day in Fredericksburg



By Frederick G. Vosburgh

Illustrations by Staff Photographers B. A. Stewart, J. B. Roberts, J. E. Fletcher

"WE ARE going to the dogs," said big-lettered signs in Fredericksburg, Virginia.

It sounded grim, but all it meant was that the historic city on the Rappahannock was holding its annual Dog Mart, older than the Nation itself.

"Come, bring all the family and all the dogs. Spend the day," concluded the announcement.

Four of us from the National Geographic accepted. On a bright October day punctuated with barks, bays, and the sonorous notes of hunters' horns, we saw a unique intermingling of historic sites and hounds, of puppies and patriot shrines.

Traffic on U. S. Highway No. 1 halted as hundreds of dogs and their masters paraded streets paved with history. Virginians vied in

818

Most Precious Dogs in the World Are Theirs. Money Can't Buy Them

These participants in the Fredericksburg, Virginia, dog parade relax on the brick walk of Kenmore, where George Washington's sister lived. One of them, a 9-year-old girl, announced, "I wouldn't sell my Dookie for $20,000,000."

Mart-bound Foxhounds Accept the Scent of Gasoline

Trailers full of barks and bays haul in dogs from miles around. A pre-sale show awards a prize for the largest hound pack. Two dogged sit-down strikers (left) prefer to stay and hunt.

"Be Sure to Wash Behind the Ears!" It's a Dog's Life for the Terrier

Youngsters primp their pet to march in the parade of hundreds of dogs that opens Dog Mart Day (page 826). Many then compete for a blue ribbon in the informal show. Prizes include one for the Ugliest Mutt.

870

When Every Dog Has His Day, Fredericksburg Is a Mixture of Hounds and History, Pooches and Patriotic Shrines

Mary Washington, the first President's mother, lived in this house during her last 17 years. If George ever chopped down a cherry tree, the scene probably was near-by Ferry Farm, on the other side of the Rappahannock. There the family made its home when he was about the age of these boys and girls.

"Haven't I Met You Somewhere Before?" Asks a "Wolf" on the Old Slave Block

"Really! We haven't been introduced," reacts the party of the second part. On this cylinder of sandstone, slaves once were auctioned off like dogs.

Below: The biggest boy or man often owns the smallest dog.

"Over, Stormy!" $6,000 Worth of Dog Hits a New High

Mrs. Helms Crutchfield, of Richmond, and her husband wouldn't take $6,000 for their rare Weimaraner, Champion Helmanhof's Storm Cloud, C.D., C.D.X., U.D. His obedience trial "degrees" stand for Companion Dog, Companion Dog Excellent, Utility Dog.

Judges, as Intent as Bird Dogs, Survey a Setter

Equally serious are the owners parading their prides before judicial eyes. Spectators standing form only a small part of the crowd; hundreds watch from seats in the bleachers. Everything is free but refreshments, which appropriately include hot dogs.

↑ Drum Majorettes Put On the Dog Before the Big Parade

These high-stepping, baton-swinging girls represented James Monroe High School. Others came from Mary Washington College, a University of Virginia unit in Fredericksburg. Both institutions were named for famous Fredericksburg residents.

↓ Young Palefaces Have a Pamunkey Indian Chief Surrounded

Feigning hostility, a jovial subchief brandishes his personal "hatrack" symbol of authority. To lend color, tribesmen come from their reservation in King William County. Dwindling of Virginia's Indians long ago cost the Dog Mart its best customers.

824

Football Takes a Back Seat When All Fredericksburg Goes to the Dogs

Thousands pack the stands and throng the gridiron at James Monroe High School to watch obedience trials, dog show, auction, Indian dances, foxhorn blowing, hog calling, fiddling contests, and a pageant.

125

Hunt-minded Virginians Crowd Close as Judges Choose the Best Hunting Dog

Champion of the 1950 show was a big female "blue tick" hound named Tidewater (farthest left). After winning in the hunting-dog class, she nosed out the best pet dog, a beribboned little French poodle.

↑ City Scents Bewilder Hounds in the Traffic-stopping Dog Parade

Some 350 dogs marched in last year's parade. Lean, businesslike hounds still wearing the stains of field and thicket predominated. "Never bathe a hound," owners say. "Soap and water kill the power of scent."

Below: Mary Washington College students introduce their friend to higher education, but the collegiate canine shows little taste for this kind of boning. One of the small fry rests pavement-weary paws in a basket.

Hark to the Horn! Each Hound Pack Knows Its Master's Call

Fourteen contestants in last year's foxhorn-blowing contest included a fair-haired 6-year-old girl who "can outblow her maw," but a 6-foot male whooped off with the prize. Haunting, resonant notes of the steer horns carry far.

Right: A trade is in the making. Tall are the tales when hunters meet. Hereabouts, men follow the hounds by automobile and foot (page 832).

Who Can Resist a Beagle Puppy's Mournful Eye? Not the National Geographic Photographer

J. Baylor Roberts (right) went to Fredericksburg to get pictures, just pictures. But he fell at first sight of a fellow Virginian, 3-month-old Byrd Mill Bonnie King. Now, for $35 of the photographer's money, the pedigreed beagle owns *him*. Left: If the kids are along, you're lost.

Reward for Merit: a Tidbit and a Place Before the Fire

Kerry blue terrier and Irish setter share Ed Gibson's ante-bellum home. As a Fredericksburg pillar of the Izaak Walton League of America, "Defender of Woods, Waters, and Wildlife," he helps preserve the Dog Mart tradition.

foxhorn blowing, country fiddling, and hog calling, and put on a pageant, "Patriot's Dream." Pamunkey Indians danced. Dogs demonstrated their education in obedience trials and show. A derby-hatted auctioneer boomed forth in trombone tones. Enough dog to delight any small boy could be bought for as little as a dollar.

By the end of the day, everybody's puppies were dog-tired (page 832).

George Washington Bathed Here

Many a Virginian leading a dog was about the age of George Washington when he lived as a lad at Ferry Farm across the river and, according to some sources, went to school in Fredericksburg. Even after young George's family moved to Mount Vernon, he was wont to return.

Once two local damsels were arrested for "robbing the cloathes" of 19-year-old George while he was bathing in the near-by Rappahannock. Whether the clothes themselves or only the valuables they contained were stolen, Spotsylvania County court records do not state. They do show that Ann Carroll was acquitted and that in the case of Mary McDaniel the court ordered "that the sheriff carry her to the whipping post and inflict fifteen lashes on her bare back."

The future Father of His Country had no hand in the punishment decreed for luckless Mary, having sailed for the West Indies.

Fredericksburg's dog-going custom dates from even earlier than this painful incident. In fact, Fredericksburgers say, it is 29 years older than the city's name.

"In 1698 a truce was declared between settlers and Indians of eastern Virginia," explained Ira Grinnan, general chairman of the 1950 Mart. "This cease-fire afforded opportunity of trading the white men's superior hunting dogs for the red men's furs, gold, and handicraft articles at the Leaseland settlement, later named for Frederick, father of King George III."

Thus was born the Fredericksburg Dog Mart, today a 253-year-old tradition.

611

The Dog Mart Was 88 Years Old When James Monroe Hung Out His Shingle in 1786

In this story-and-a-half brick building, the man who became the fifth President practiced law until 1790. Furniture includes the White House desk on which he signed the message to Congress containing the Monroe Doctrine.

832

Dog-tired near the End of the Big Day, Pals Slumber in a Baby Buggy

Jostling crowds, yapping dogs, and clarion-voiced announcer failed to disturb silky-haired, 2-year-old Joanne Suchon, of Fredericksburg, and her 2-month-old cocker, Silver. "She was sleeping," said her mother, "and the little dog was tired, so I put him in the carriage and he went to sleep too."

As in Indian days, this is still hunting country, and the hounds, setters, and pointers rank as the elite of the show.

Old-timers in hunting caps looked a bit worried last year when a much barbered little powder-blue French poodle, owned by a woman, emerged as a strong contender for best in show. They relaxed when the be-ribboned essence of canine elegance was beaten out for the blue ribbon by a big competent-looking "blue tick" hound bitch named Tidewater.

Hunters hereabouts follow their foxhounds with automobiles.

"We head them off with cars, then get as close as we can on foot," explained the mayor, C. M. Cowan. "Too many barbed wire fences for horses."

Careening over country roads, autos do about everything but take fences. They enable these latter-day hunters to keep at least within hearing distance of the melodious chase.

Not the Dollars but the Scents

These Virginia hunters are great yarn spinners.

"Once I had a bird dog that was jumpin' a fence when he caught the scent of a wild turkey," said a hunter from the Wilderness. "He came down astraddle the fence and hung there, pointin' that turkey."

In the obedience trials some of the feats rivaled even such tall tales. Outstanding star was Stormy, one of two talented Weimaraners—a rare German breed—owned by Mr. and Mrs. Helms Crutchfield, of Richmond, Virginia (page 822). When paper money was spread on the grass and he was told to pick out the note that would buy him the most meat, he unerringly chose a $20 bill, disdaining the ones.

It wasn't the dollars; it was the scents. His nose knew the bill his mistress had touched.

More people than Fredericksburg's whole population—more than 12,000—usually turn out for this canine convention, held annually when autumn paints Virginia's woods and coverts. This year the big day is October 13, or a week later in case of rain.

Outsiders are drawn both by the dogs and by the city's historic sites, including the old homes of Washington's mother and sister (pages 820 and 818); the law office of James Monroe (page 831); the house where John Paul Jones once lived with his brother, a Fredericksburg tailor; and scenes of some of the bloodiest battles between the Blue and the Gray.

National Geographic's New Map Shows United States 150,697,000 Strong

EVER-CHANGING United States of America, with 19 million more people than ten years ago, more mighty works of engineers, more cities, and fewer open spaces, reveals itself in the National Geographic Society's current 10-color map.

Veined with highways, sown with cities, dotted with dams and resulting lakes, the map, "The United States of America," shows how greatly Americans have altered their thick, rich slice of a continent.

This mid-century portrait of the Republic is based on the 1950 census and reflects the greatest 10-year population growth in the country's history. It gives a "sea to shining sea" picture of a nation of more than 150½ million Americans.

Colorful, decorative, and packed with up-to-date information, the 41-by-26½-inch wall map goes to the National Geographic Society's 1,965,000 members with this June, 1951, issue of their Magazine. It is one of four large supplement maps sent each year to members throughout the world.*

More Place Names than Ever Before

This sheet bears 11,025 place names—more than have ever before appeared on a National Geographic map. Members will find it particularly suited to framing. Staff cartographer Charles E. Riddiford designed it to match The Society's 1943 World Map.

Red lines bearing highway numbers show main roads in the United States and neighboring areas of Canada and Mexico. Cities having airports with regularly scheduled commercial service are starred in red.

At the right is a key to 105 United States national parks and monuments, and 24 Canadian parks. Every man, woman, and child in the United States has a 1½-acre stake in the national park and forest reserves.

Inset in the lower right-hand corner are the Canadian Maritime Provinces of Nova Scotia, New Brunswick, and Prince Edward Island, plus the Gaspé Peninsula. This "East of Maine" area, far-famed as a summer haven, is shown on the same scale as the main map, 78.91 miles to the inch.

On a much larger scale, 16 miles to the inch, another inset shows the crowded New York area. In this metropolitan beehive live about 12½ million people, approximately the population of the entire Dominion of Canada's 3,845,144 square miles.

The map calls to mind the words of Walt Whitman:

> Mighty Manhattan, with spires, and
> The sparkling and hurrying tides, and the ships;
> The varied and ample land,—the South
> And the North in the light—Ohio's shores, and flashing Missouri,
> And ever the far-spreading prairies, covered with grass and corn.

Without adding an inch of territory, the 48 States and the District of Columbia grew in population from 131,669,275 in 1940 to 150,697,361 last year, an increase of 19,028,086. The gain exceeds the combined population of Belgium and the Netherlands, or all the people in the United States in 1840.

Although immigration contributed some, the increase resulted largely from the bumper crop of wartime and postwar babies and from the lifesaving effects of new medical knowledge. No decade has ever added so many Americans, although in percentage the gains were much greater in the Republic's youth when population was doubling every 25 years.

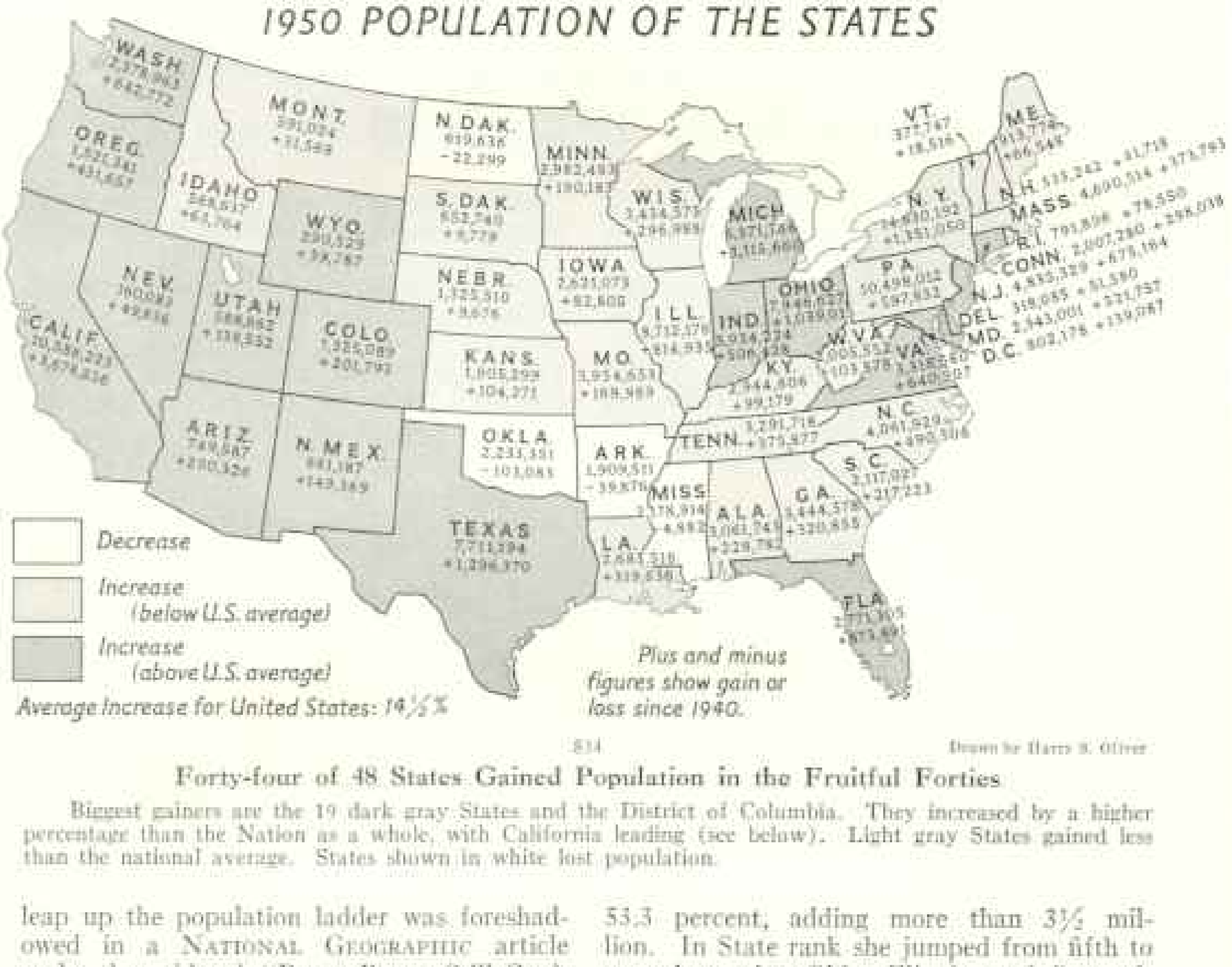
In the first half of the 20th century the number of Americans again nearly doubled. Members of the National Geographic Society will note that in the same period the print order for their monthly Magazine and maps has grown from a few hundred to approximately 2,000,000. When the present Editor began his duties in 1899, he could carry the entire monthly edition on his back. Now the Magazine each month fills 25 railroad cars.

While the population of the United States grew by 14½ percent in 1940-50, membership in The Society rose from 1,162,296 to 1,965,000, an increase of 69 percent. In these years of greater participation by the United States in world affairs, interest in living geography continues to grow apace.

Since the 1940 National Geographic map of the United States, 115 cities or towns have won more conspicuous type by growing up into a higher population category. Only five slipped back into less prominent type.

Outstanding among expanding cities is Baton Rouge, Louisiana, whose phenomenal

* Members may obtain additional copies of the new map of the United States (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices in United States and Possessions, 50¢ each on paper; $1 on linen; Index, 25¢. Elsewhere, 75¢ on paper; $1.25 on linen; Index, 50¢. All remittances payable in U. S. funds. Postpaid. GREATLY ENLARGED EDITIONS of this United States map (measuring 67 x 43½ inches) and of The Society's recent map of Asia and Adjacent Areas (enlarged to 62½ x 49 inches) are also available. Prices in U. S. and Poss., $2 each; Index, 25¢. Elsewhere, $2.25; Index, 50¢.



814 Drawn by Harry S. Oliver

Forty-four of 48 States Gained Population in the Fruitful Forties

Biggest gainers are the 19 dark gray States and the District of Columbia. They increased by a higher percentage than the Nation as a whole, with California leading (see below). Light gray States gained less than the national average. States shown in white lost population.

leap up the population ladder was foreshadowed in a NATIONAL GEOGRAPHIC article under the subhead, "Baton Rouge Still Can't Believe It!" *

Huge plants turn out synthetic rubber, aviation gasoline, and a host of other petroleum products. They boosted the Baton Rouge population by 257.03 percent in ten years. Growing from 34,719 to 123,957, the Louisiana capital shot up from 288th to 84th place.

Effects of war and defense preparations are dramatically shown by the mushroom growth of little Windham, Ohio, near Ravenna. It grew by 1149.1 percent, from 316 inhabitants to 3,947, because of the location of the big Ravenna Arsenal near by.

Even this growth is overshadowed by the new "atomic cities"—Oak Ridge, Tennessee; Richland, Washington; and Los Alamos, New Mexico. They boomed from virtually nothing to 30,236, 21,793, and 9,927 respectively.

Most of the 2,187 place names added since the 1940 U. S. map appear in the western States, again the region of greatest percentage growth. So do most of the giant dams built during this dynamic decade when hydroelectric capacity increased by 57½ percent. Among them are eight of the world's ten highest, notably Grand Coulee in Washington, Shasta in California, and Hungry Horse, the newest, in Montana, for power, irrigation, and flood control. The program is still in full swing.†

Between 1940 and 1950, California grew by 53.3 percent, adding more than 3½ million. In State rank she jumped from fifth to second, passing Ohio, Illinois, and Pennsylvania. Second and third honors for rate of growth went to two other sunny States—Arizona, with a gain of 50.1 percent, and Florida, with 46.1 percent.

Population shifts will be reflected in Congress, for census figures form the basis for representation in the House of Representatives. If the membership of the House is kept at 435, nine States will lose Congressmen to seven other States. Those that will gain are California, Florida, Maryland, Michigan, Texas, Virginia, and Washington. Those that will lose: Arkansas, Illinois, Kentucky, Mississippi, Missouri, New York, Oklahoma, Pennsylvania, and Tennessee.

Largest U. S. cities (over 500,000) are: New York, 7,835,099; Chicago, 3,606,436; Philadelphia, 2,064,794; Los Angeles, 1,957,692; Detroit, 1,838,517; Baltimore, 940,205; Cleveland, 905,636; St. Louis, 852,623; Washington, D. C., 802,178; Boston, 790,863; San Francisco, 760,753; Pittsburgh, 673,763; Milwaukee, 632,651; Houston, 594,321; Buffalo, 577,393; New Orleans, 567,257; Minneapolis, 517,277; and Cincinnati, 500,510.

* See "Louisiana Trades with the World," by Frederick Simpich, in the December, 1947, NATIONAL GEOGRAPHIC MAGAZINE, page 724.

† See "A Map Maker Looks at the United States," by Newman Bumstead, page 705 in this issue of the NATIONAL GEOGRAPHIC MAGAZINE.

Alaska's Automatic Lake Drains Itself

835

Don C. Moulton from Frederic Lewis

Summer Pulls Winter's Icy Plug; Lake George Carves a Channel Through Knik Glacier

Strange quirks of geography still lie hidden within Alaska's remote ranges, a surviving stronghold of the ice age. Lake George, one of these wonders, discharges its contents automatically, as if Nature had equipped it with a safety valve.

Crevassed Knik Glacier (left), creeping toward the Knik River, dams the lake's outlet most of the time (page 838). Each year the lake traps enough rain, melted snow, and glacial seepage to fill a depression 15 miles long and 5 miles wide to a depth of some 200 feet.

In July and August, when the lake grows brimful, a trickle of water seeps across the ice barricade. Quickly, the flow scours out a 7½-mile-long channel through a glacier 250 feet deep. Racing down the gorge, floodwaters swell the Knik Valley to a width of 2 miles. Eventually they reach Cook Inlet (map, page 840).

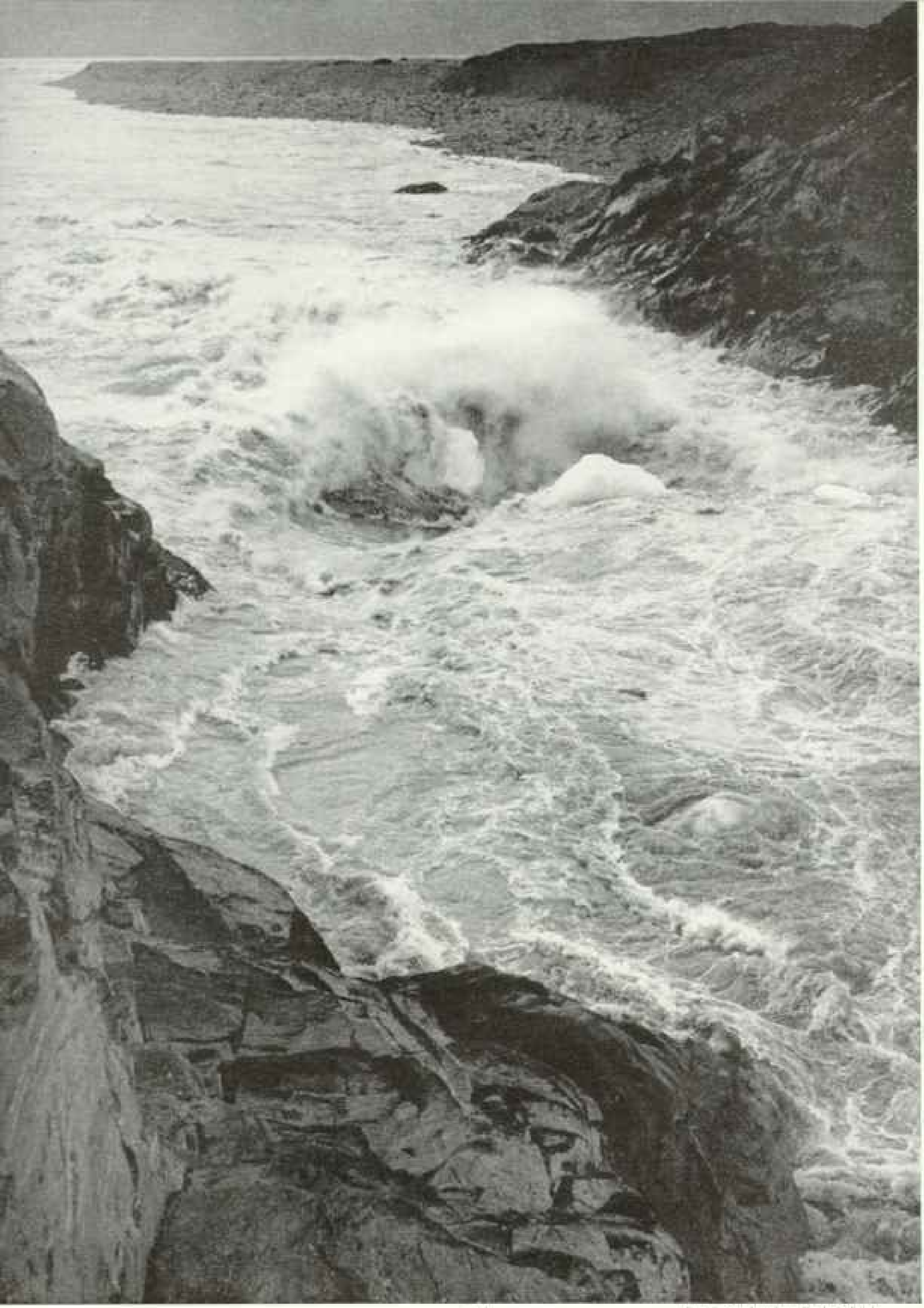
This annual flood continues a week or more, until the lake bed becomes a mudhole filled with stranded icebergs. When cold weather returns, the glacier again seals the lake. Summer sees the hollow refilled and the washbowl effect repeated.

Alaska enthusiasts, boosting the lake as a natural wonder rivaling Niagara Falls and the Yellowstone geysers, foresee the day when it will attract summer visitors by the thousands, but thus far few eyes have witnessed the spectacle. No highways, only treacherous, almost impassable trails, lead to the lake. A light plane offers the easiest transportation.

Lake George lies within 25 miles of the fertile Matanuska Valley. Anchorage, the Territory's largest city (population 11,000) is 45 miles distant.

This picture shows the ever-widening channel, here some 70 feet deep, squeezed between impervious mountain and yielding glacier. Undermined, enormous blocks of ice regularly break off and crash resoundingly into the torrent. When the water recedes, the glacier moves up snug against the mountain.

The following pages show other sights pictured by a party of Anchorage men who flew in to record sound effects of the ice dam's breakup.



536 Dan C. Knudsen from Frederic Lewis

Dam Is Broken! Baby Icebergs Swirl from the Raging Channel into Knik River

Don C. Knudsen from Frederic Lewis

▲ **Food and Equipment Drop out of the Sky**

For days, members of the ground party were trapped by the Knik River's flood. Their rubber boat was useless; the swift, ice-clogged current would have punctured it in a twinkling. Even with the aid of the plane, the expedition required 33 days.

▼ **Packs Grow Heavier Every Step Through the Wilderness**

Shouldering the Piper Cub's deliveries, the four men head for the glacier. Frank Brink and John Gore (left) represent radio station KENI, Anchorage. Don Knudsen (third) is the photographer. Pilot Skip Utter, wary of bears, carries a covered rifle.

Don C. Knudsen from Frederic Lewis

U. S. Air Force, Official

Knik Glacier Squeezes Through Chugach Mountains' Rocky Fist. Can Antarctica Be Any More Forbidding?

Ice from Surprise Glacier, moving toward Knik, covers much of Lake George (right). Only a narrow strip of open water can be seen.

Rippling Bull's-eye Rings a Browsing Bull Moose

Alaskan moose, some weighing 1,500 pounds, are the largest of their kind.

Stamping forefeet, armed with bayonets of horn, protect these mighty deer against wolves. Antlers, spreading six feet or more, can brush aside unwary hunters with bulldozer force. Ill-tempered bulls have treed men for hours.

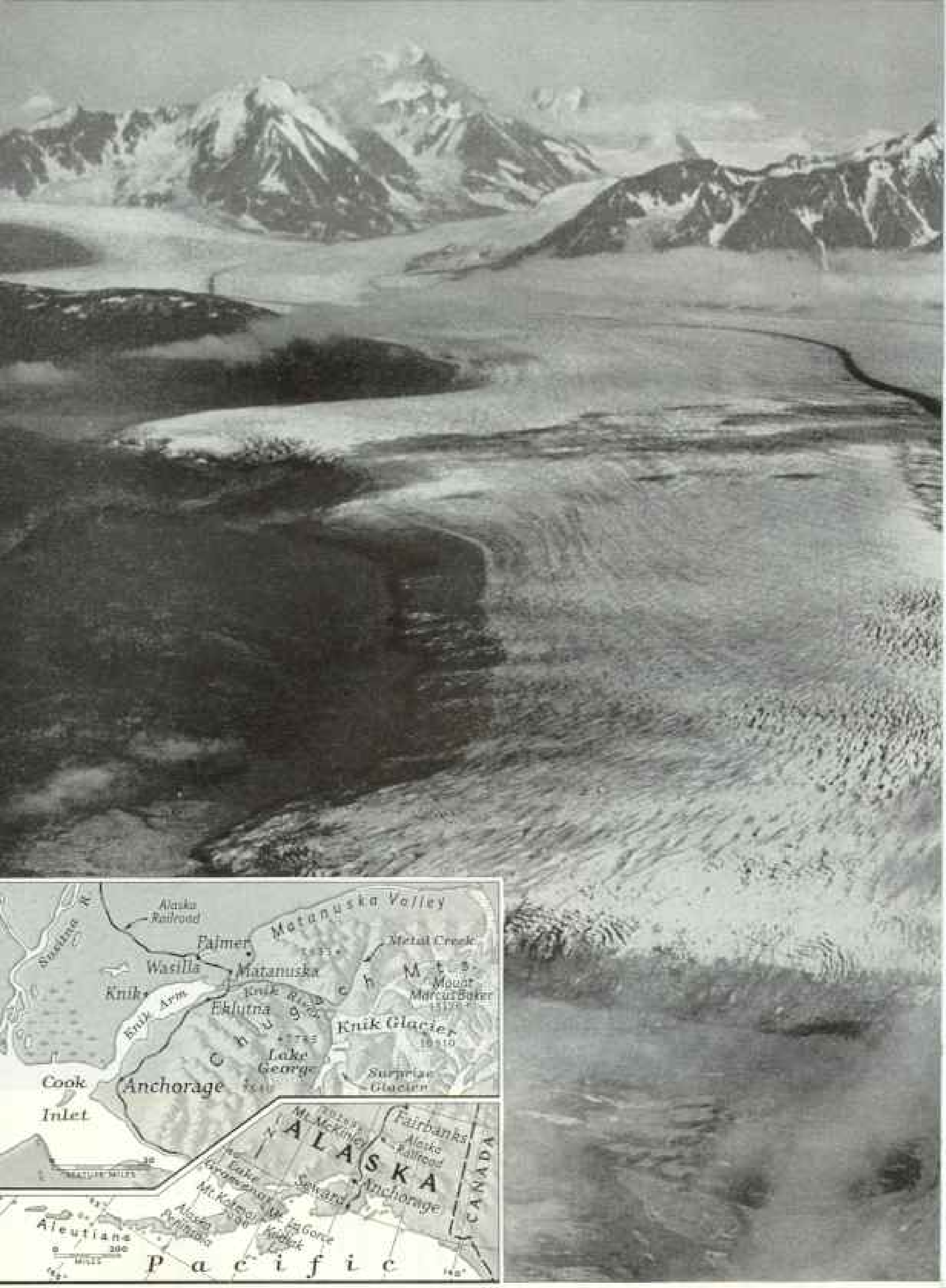
In warm weather moose love to wade shallow lakes for vegetable salads cropped under water. Rumps high in the air, they sometimes slither across the mud on folded front legs, as if on skis. At other times they submerge completely, coming up noisily for air.

Freezing weather compels moose to feed on shrubs and trees. Chisellike front teeth strip bark from saplings.

Antlers are shed after the rutting season; new sets sprout in spring.

Ducks are common in the Knik marshland. Trout, disliking silt, are rare in the glacial streams.

Don C. Rinehart from Frederic Lewis



$40

Knik's Brittle Surface Cracks; Its Plastic Bulk Creeps under Pressure Like a River

Imperceptibly, inch by inch, the glacier advances in answer to gravity's tug. As in a river, the center moves faster than the edges. Map shows how Lake George's waters find their way into the Pacific.

841 Don C. Knudsen from Frederic Lewis

Miles-long Streams of Debris Paint the Ice with Dark, Pavementlike Stripes

These accumulations of rock waste are called moraines. Because they shade their icy foundations, they stand higher than melting white borders. Deposited on land when the ice melts, they become heaps of rubble.

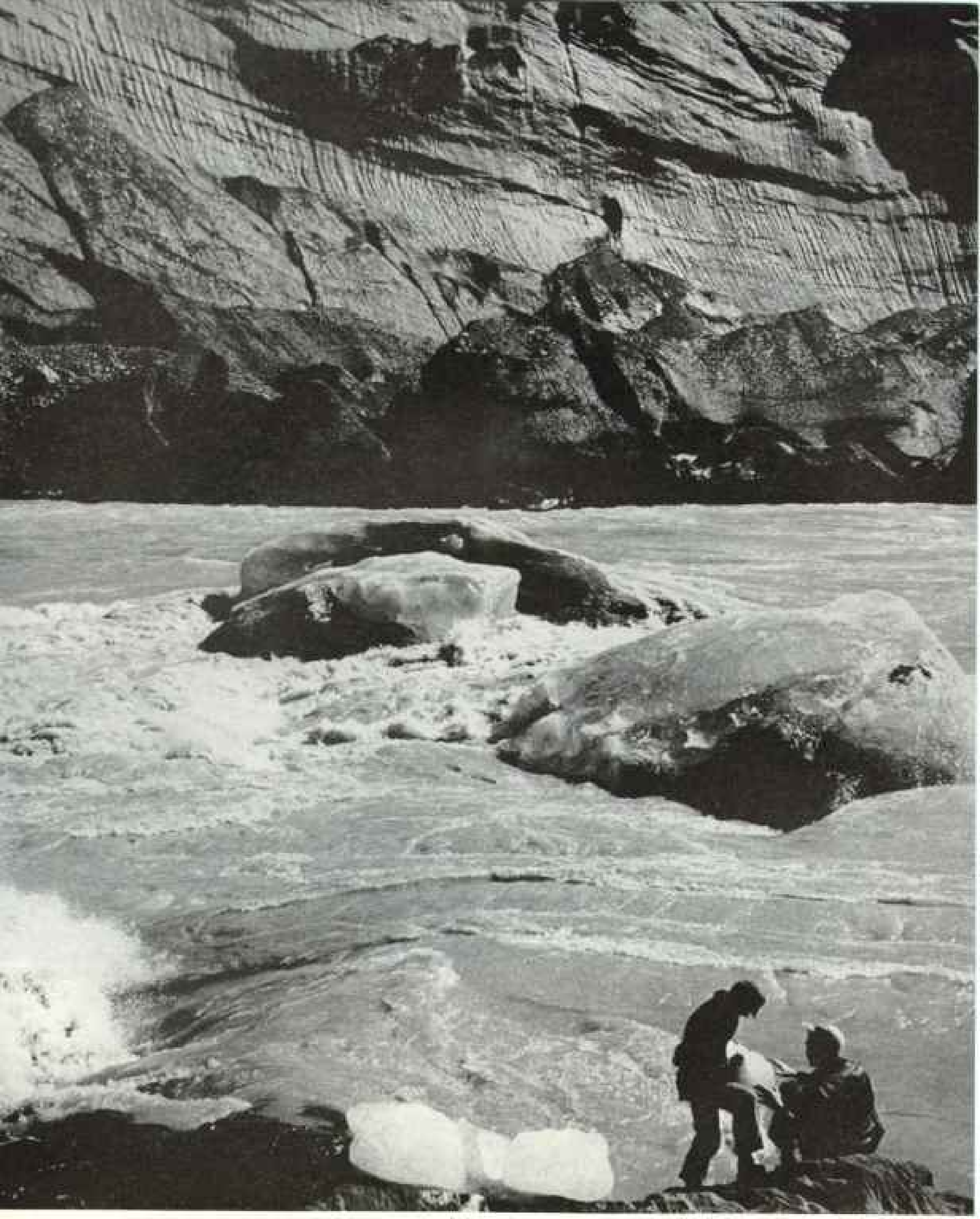
842 Drawn by Rhoades from Frederic Lewis

A Tape Recorder Captures the Breakup's Roar for Radio Audiences

Seen on the far shore, the glacier's face reveals a deep notch cut by the channel. When the overhang becomes top-heavy, building-size fragments sheer off with huge showers of spray. A salvo from a battleship's big guns sounds no more ominous.

"One night," writes Carl H. Thomsen, spectator at a previous breakup, "I was awakened by a terrific noise and thought we were having a thunderstorm. Raising my tent flap, I was surprised to see the sky filled with stars."

This sound equipment was flown to the glacier's edge and packed in. Mr. Brink, station KENI's program director, holds the microphone. Mr. Gore heaves the gasoline generator's pull cord. Mr. Utter assists.



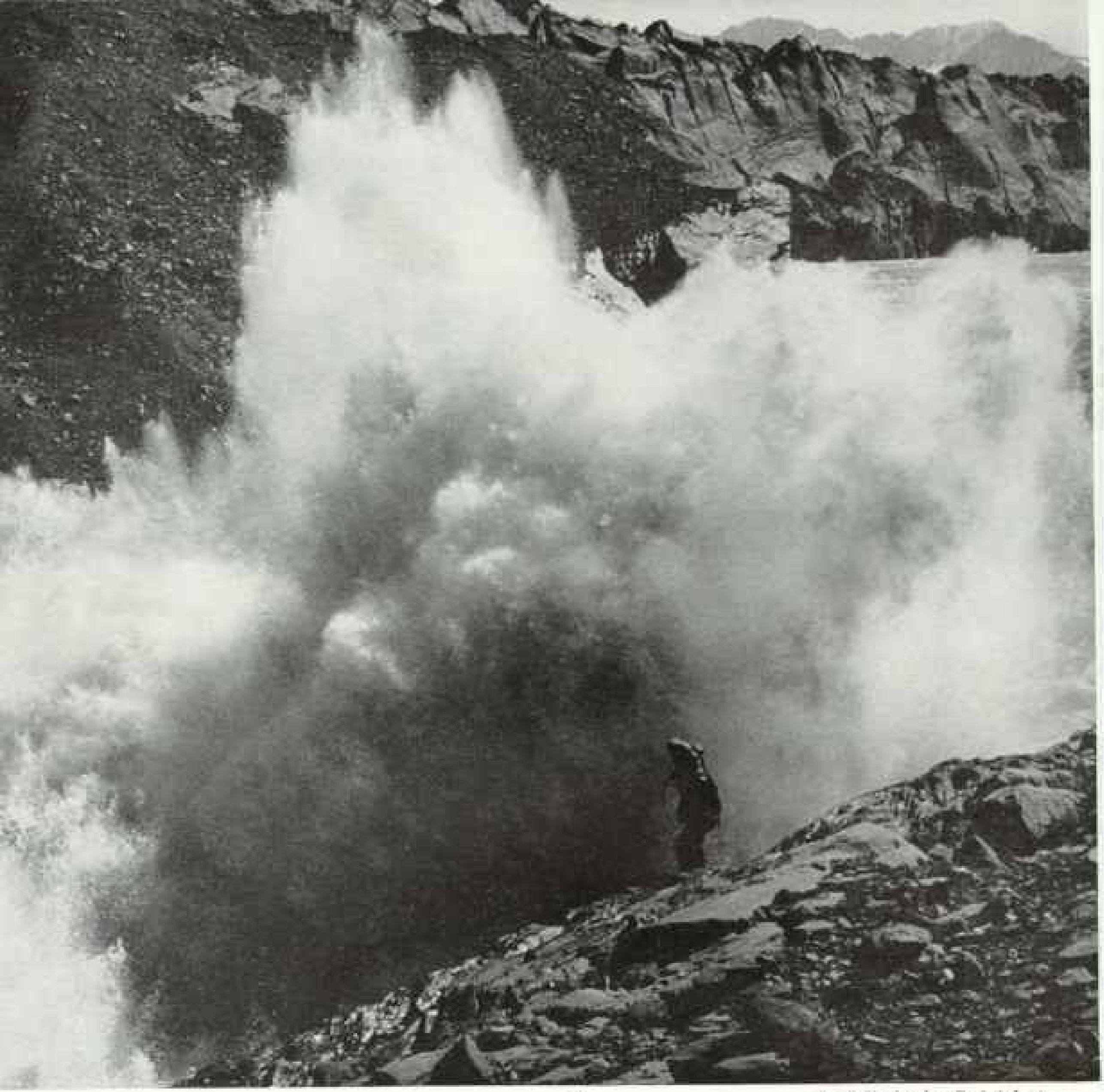
§43 Don C. Knutson from Frederic Lewis

Grinding, Bobbing Ice Rafts Speed Past the Glacier's Grooved Face

Gore and Brink, at the bottom of the gorge, examine ice laid down perhaps thousands of years ago. Geologists consider glacial ice, formed by re-crystallization of snow, akin to metamorphic rock, such as marble, the outgrowth of limestone. Unformed ice, if subjected to pressure in a laboratory, develops a similar structure.

Floods from Lake George's 1915 breakup surprised some 1,500 men camping near Knik River. Building the Alaska Railroad's 470-mile line from Seward to Fairbanks, they were using equipment left over from the Panama Canal job. Engineers and surveyors had to swim and wade the icy waters.

Loose gold is worked in near-by Metal Creek, but production is small.



844 Dan C. Knudsen from Frederic Lewis

Ice and Water Shooting the Outlet's Rapids Erupt in Spray and Shower a Spectator

Glaciers half a mile high stripped this area of soil, talus, and stream gravel during the ice age. Today retreating glaciers, Knik among them, leave amazing changes in the landscape. Lakes appear and disappear; rivers change courses. Debris-veneered valleys emerge where a quarter of a century ago ice may have stood a thousand feet thick.

Shrinking glaciers are not confined to Alaska; they seem to be retreating all over the world, suggesting increasing warmth or decreasing snowfall.

Glacier-dammed lakes are rare; drainage seldom is blocked. Greenland, where the ice age remains supreme, contains a few such phenomena. Some of its barricaded lakes stand at different levels on the same ice field. One lake drains through ice to a reservoir 300 feet below.

No one knows when Lake George's annual refill began. The late Raymond S. Patton, director of the United States Coast and Geodetic Survey and trustee of the National Geographic Society, made the first written mention in a 1914-15 survey. He quoted one Palmer, an eyewitness in 1910 to the Knik River flood. Mr. Palmer in turn credited a prospector with having stumbled across the outpouring lake while searching for gold.

Rock debris, ground by sliding ice until it resembles powdered coal, here covers the opposite bank of the gorge. Jagged walls of bluish-green ice rise above the channel (right). For a week or so the lake level drops about one foot an hour.

A huge block of ice, having dropped down the rocky chute, fractures into a thousand fragments, and these, mixed with water, swirl around Mr. Brink as he records sounds.

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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 researchers solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas 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 209 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.

A notable undertaking in the history of astronomy was launched in 1939 by The Society in cooperation with the Palomar Observatory of the California Institute of Technology. This project will require four years to photomap the vast reaches of space, and will provide the first sky atlas for observatories all over the world.

In 1948 The Society sent out seven expeditions to study the eclipse of the sun along a 5,320-mile arc from Burma to the Aleutians. The fruitful results helped link geodetic surveys of North America and Asia.

The Society granted $25,000, and in addition $15,000 was contributed by individual members, to help preserve for the American people the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

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.

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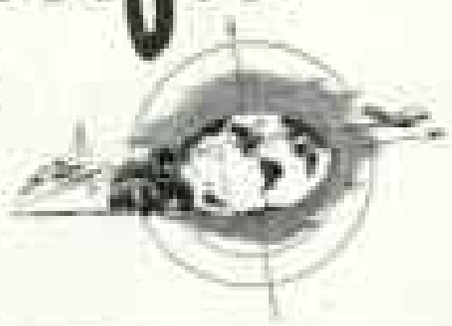

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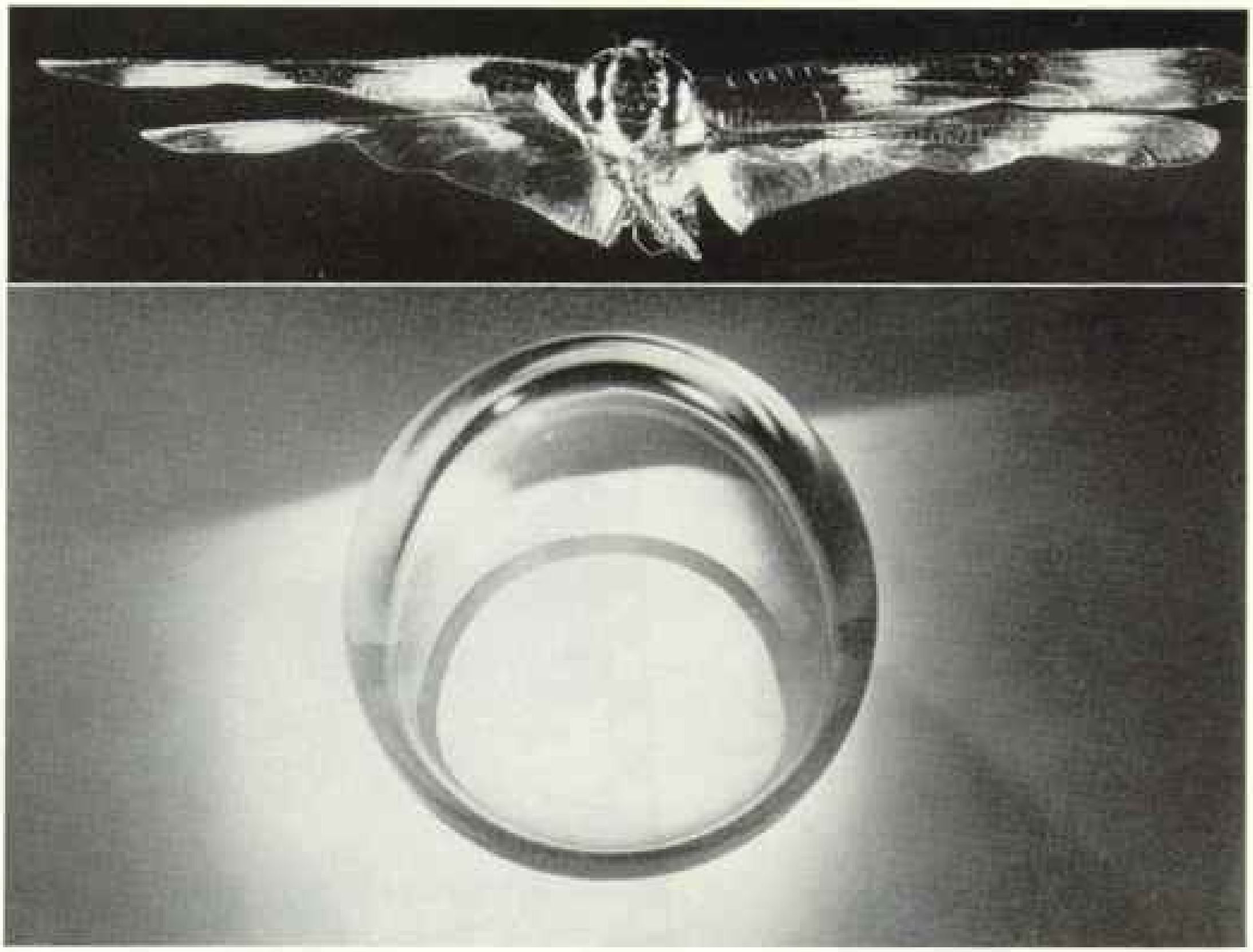

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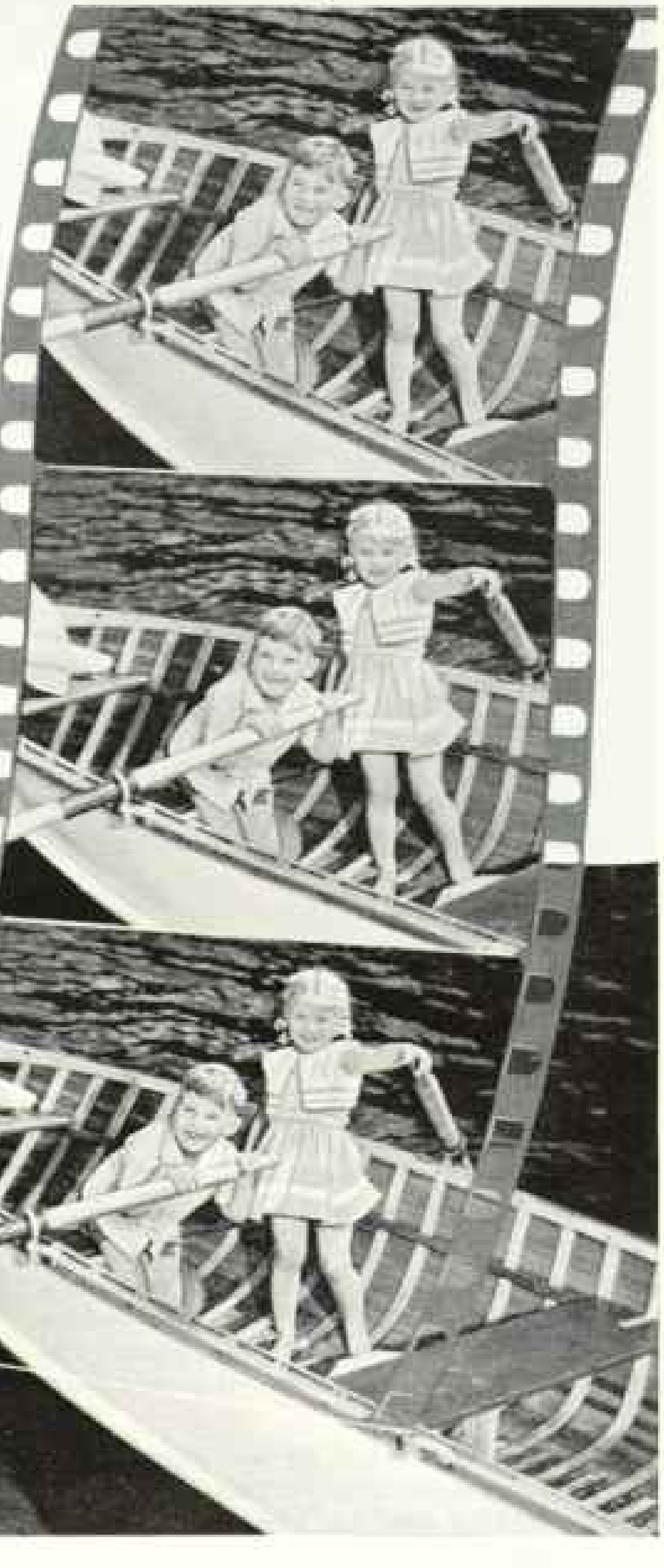

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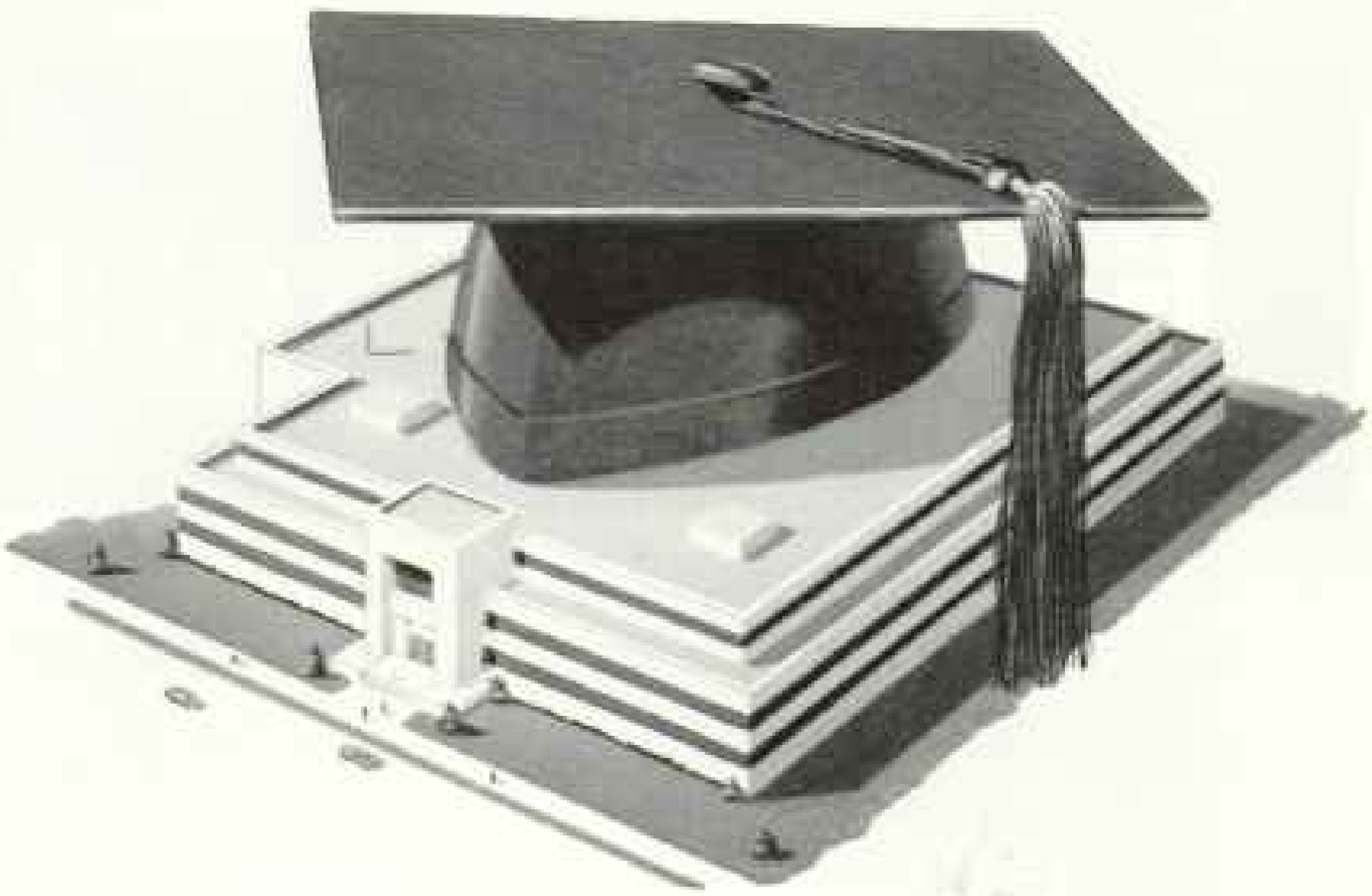

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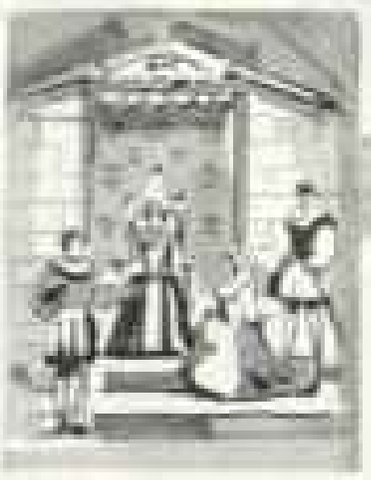

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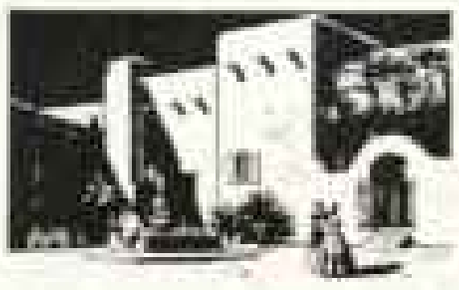

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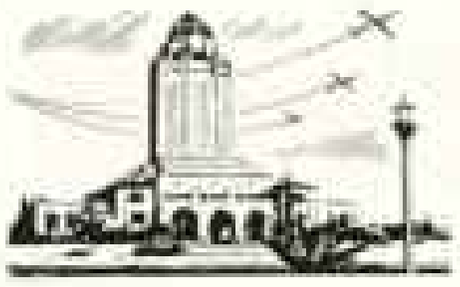

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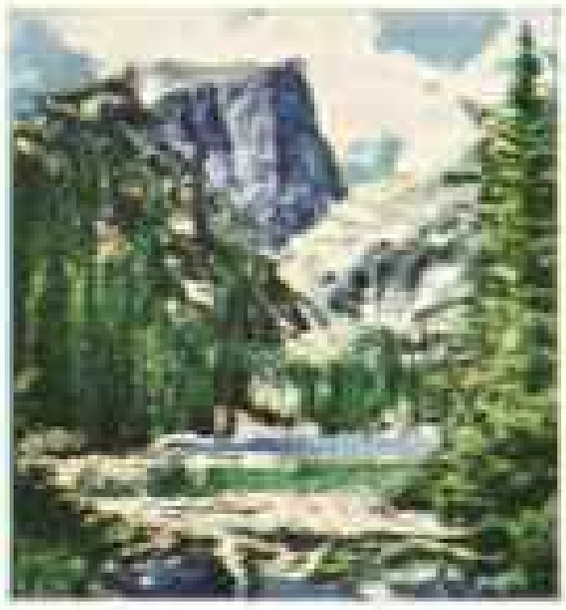

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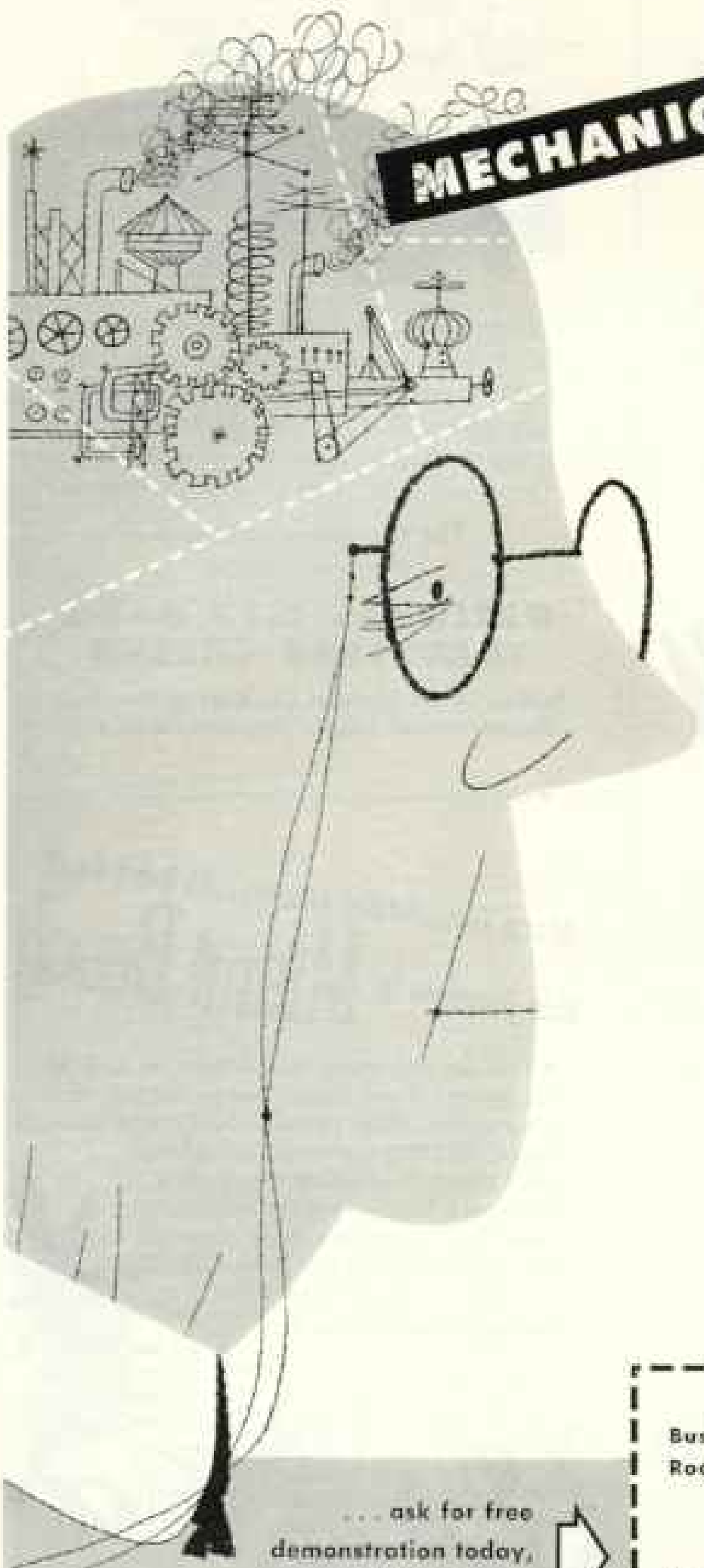

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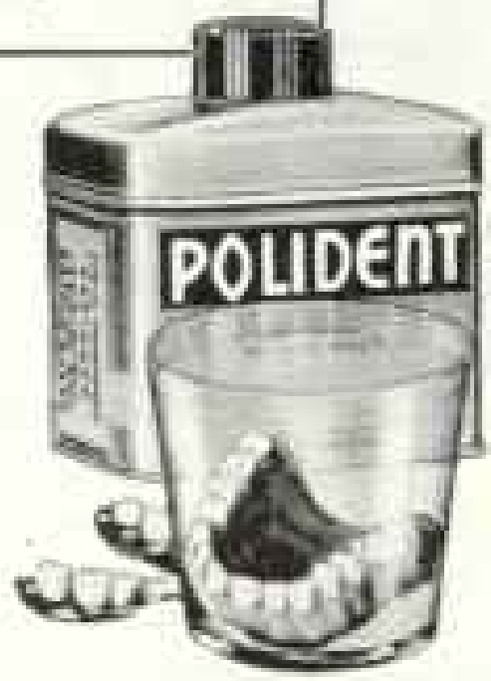

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Progress against ANEMIA

Anemia affects millions of people, both young and old, in our country today. Fortunately, medical science has accomplished wonders in treating certain types of this disease.

Anemia caused by a deficiency of iron can be easily cured. This is usually accomplished by taking medicine containing concentrated iron which the doctor prescribes. Foods such as lean meat, eggs, and green, leafy vegetables are rich in iron and should be included in the diet.

What medical science is doing . . .

The control of *pernicious anemia* is one of the great triumphs of modern medicine. Less than twenty-five years ago, victims of this disease generally lived only two and one-half years from the time the condition was diagnosed.

In 1926, however, a substance was found in liver that usually would do much to control pernicious anemia. Today, as a result of this discovery, the one hundred thousand people in the United States with this disease are able to live nearly normal lives.

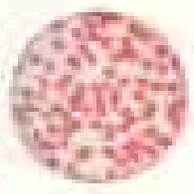
Research has developed other effective weapons against this disease—for example, vitamin B-12. This vitamin controls pernicious anemia as effectively as liver extract.

There are many different types of anemia, each of which has a *specific* cause. Various dietary deficiencies, defects in the functions of the organs that manufacture blood corpuscles, exposure to toxic substances, and certain underlying chronic conditions or infections may be responsible for it.

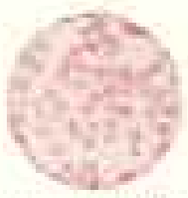
What you can do . . .

Anemia may develop gradually. Often the first symptoms—such as fatigue, weakness, and nervousness—may not seem serious enough to demand medical attention.

If these symptoms persist, however, they should receive proper medical attention. Specialists say that it is unwise to resort to any form of self-treatment. They emphasize that anemia can be cured or controlled only when the *exact* cause of the disease is determined and appropriate treatment is given.



Normal blood looks like this through a microscope. The red cells contain a proper amount of coloring matter, or hemoglobin, a substance necessary for the transportation of oxygen throughout the body.



Anemic blood, from a victim of nutritional or iron-deficiency anemia, looks like this. The red cells are reduced in number, and are pale in color because they lack sufficient hemoglobin.

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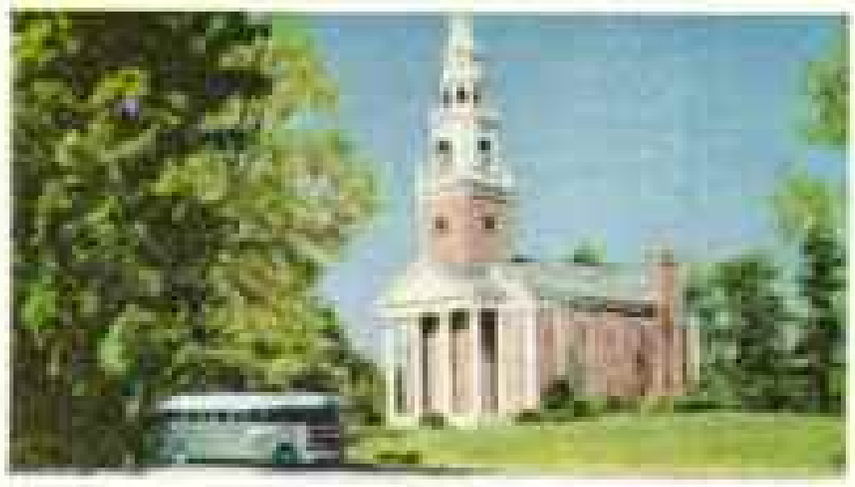

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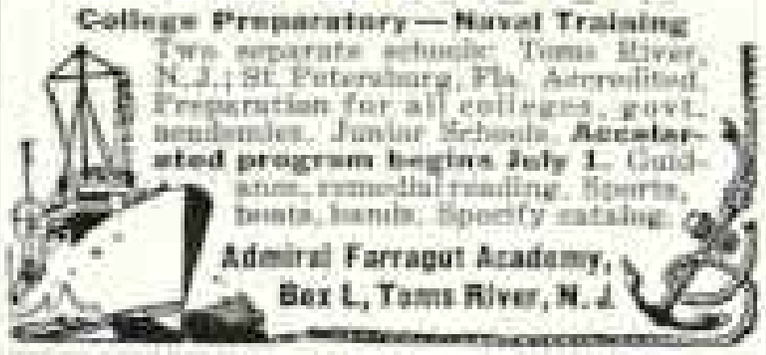

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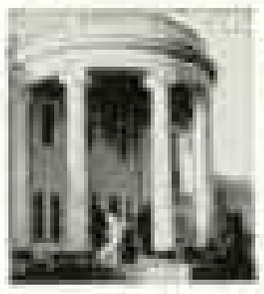

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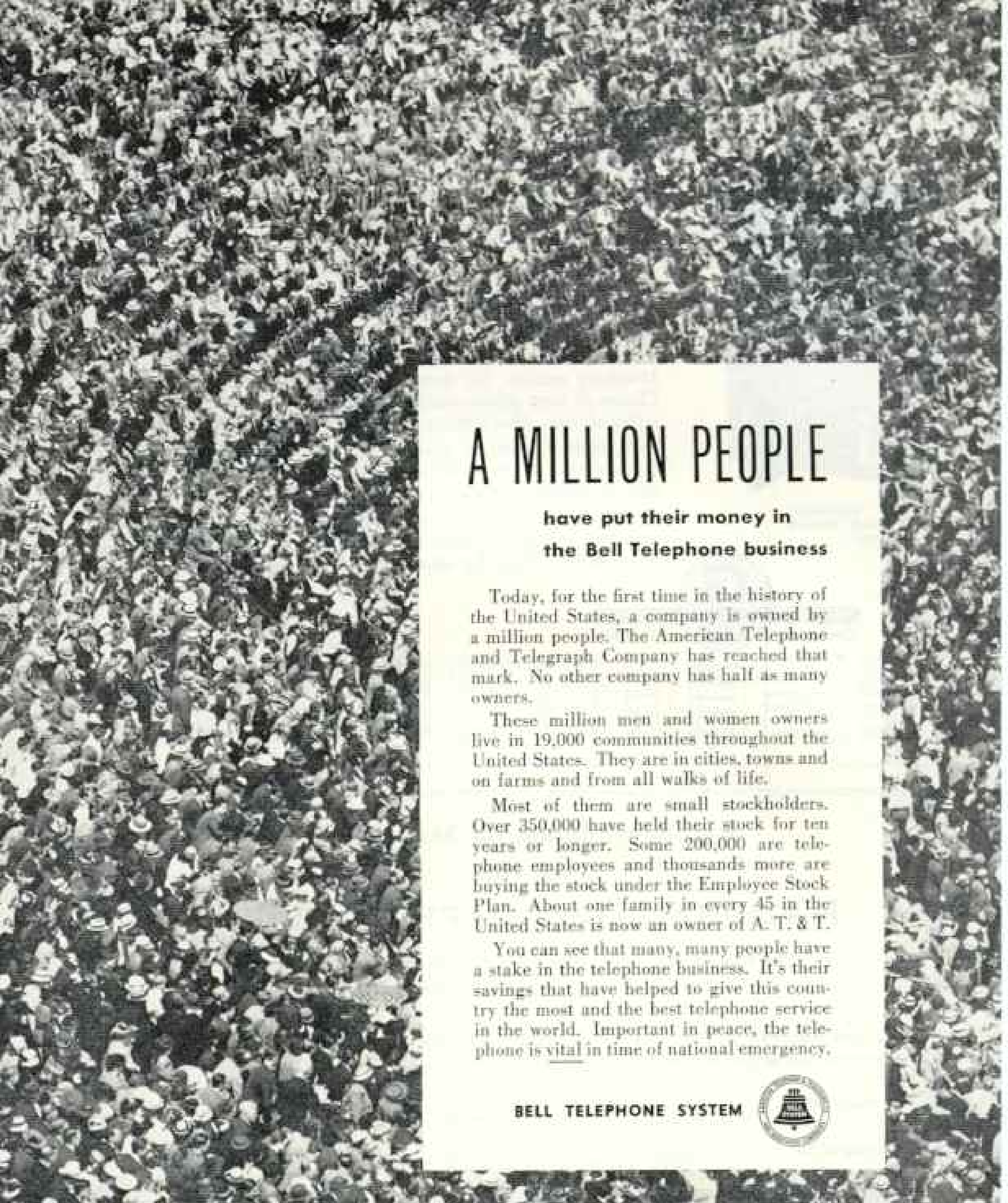

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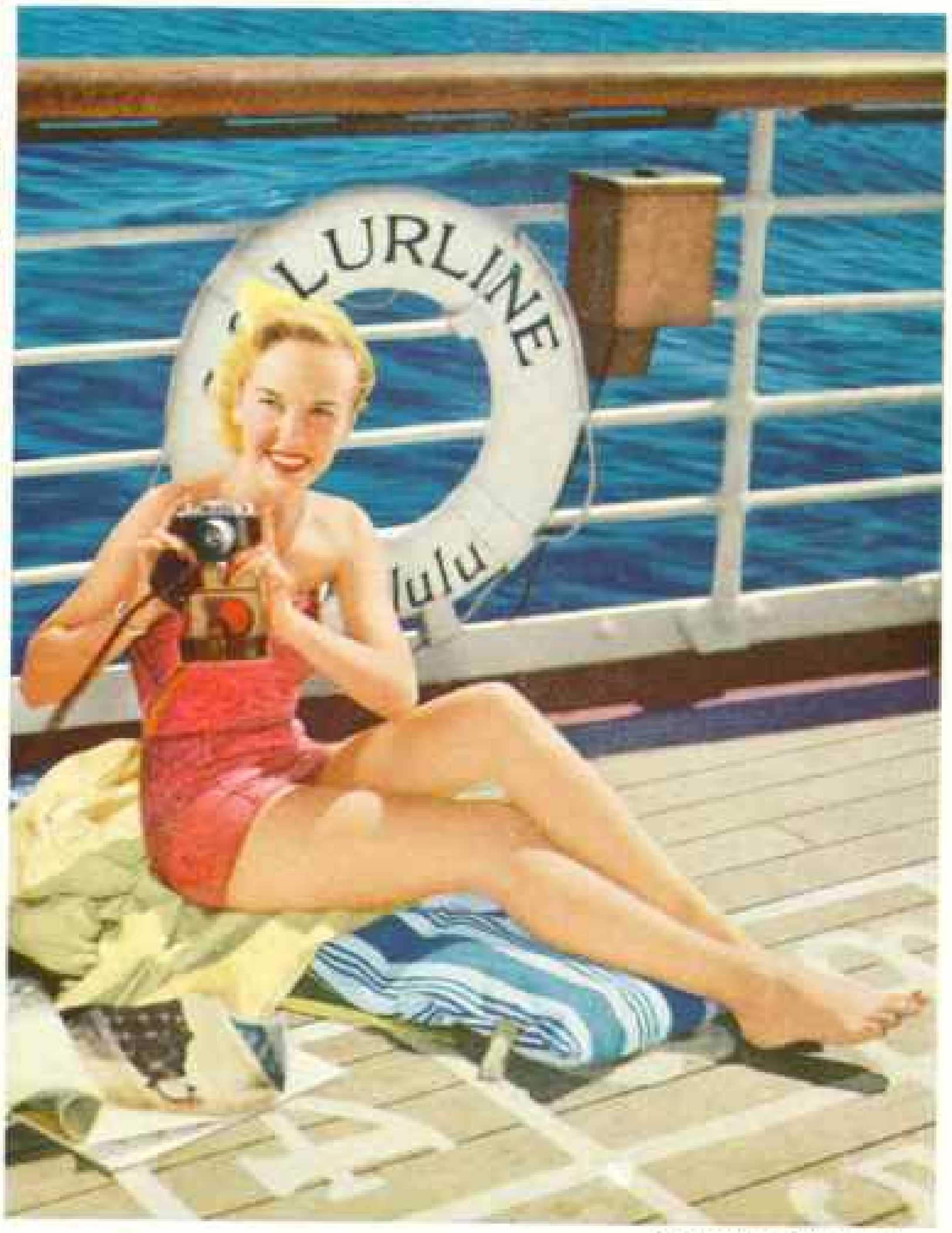

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