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THE NATIONAL GEOGRAPHIC MAGAZINE

APRIL, 1959

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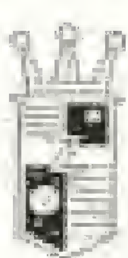

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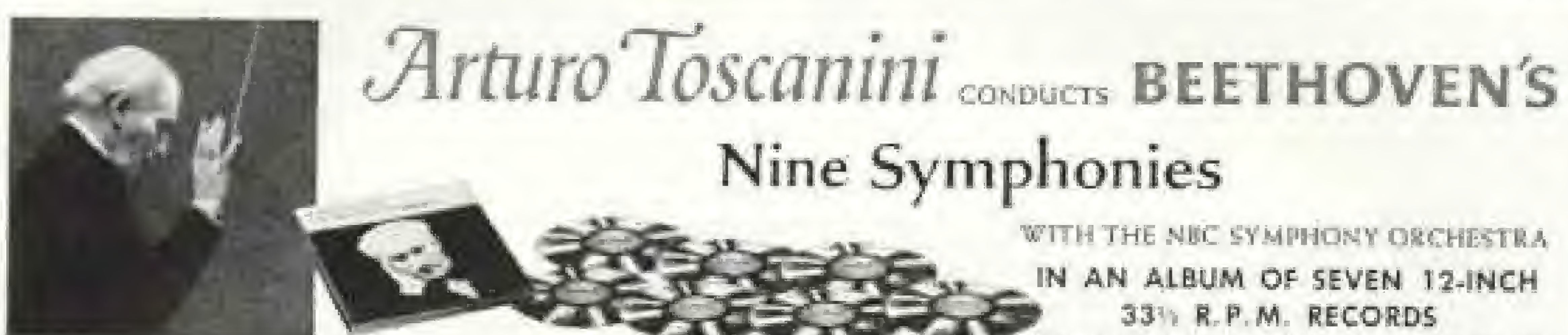

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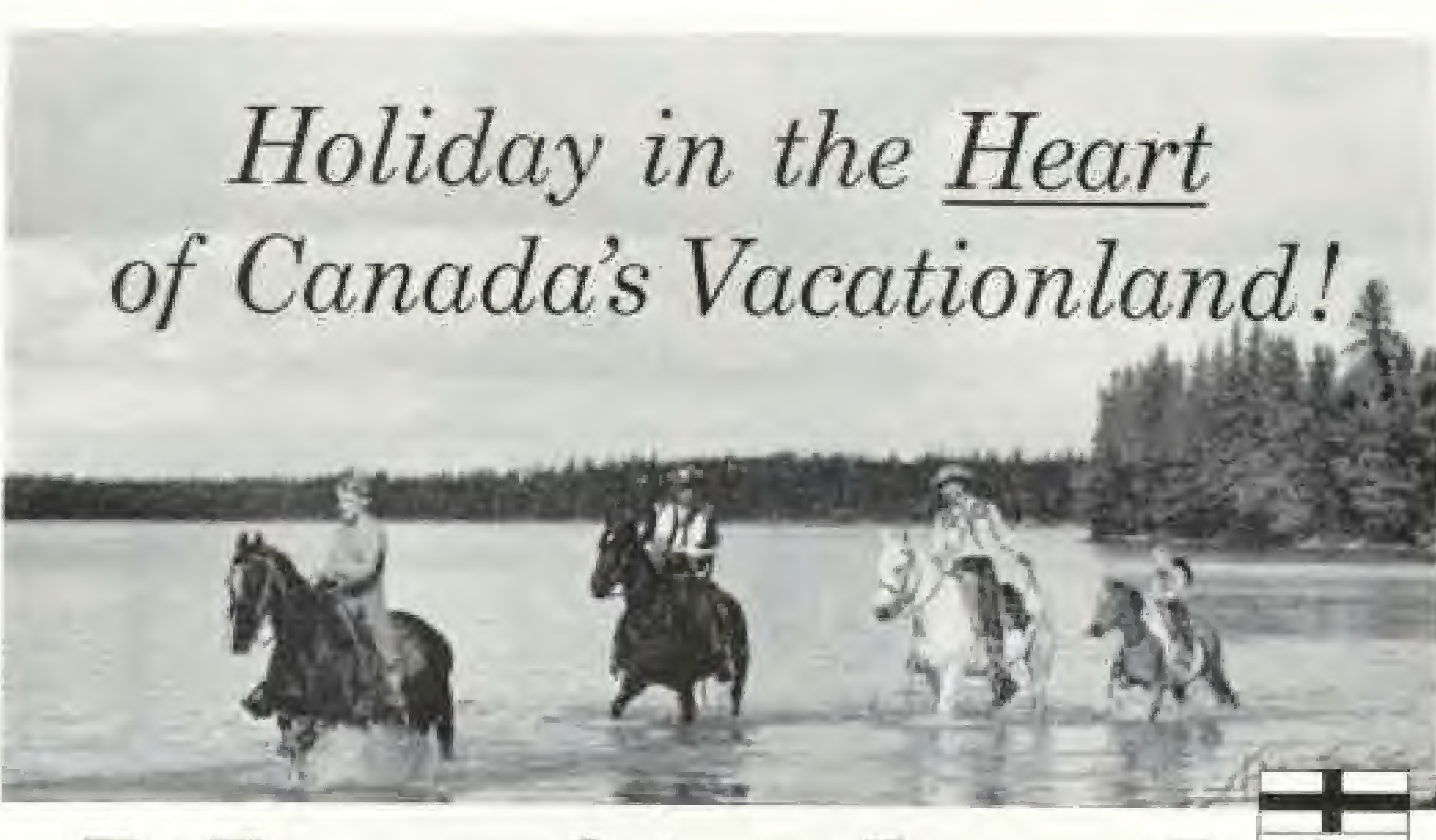

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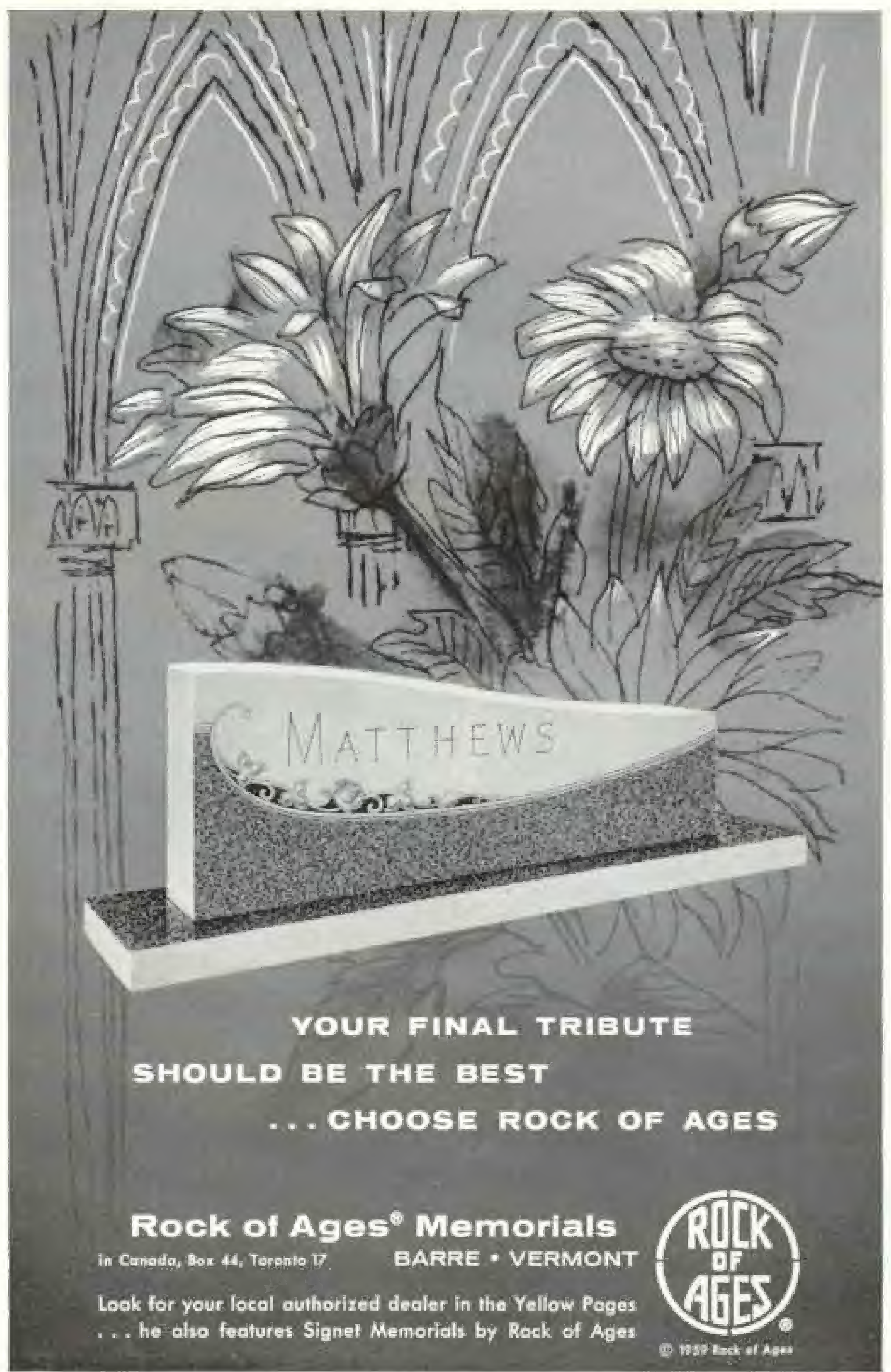
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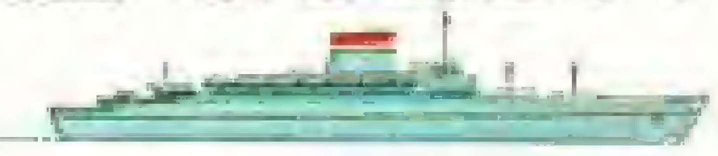

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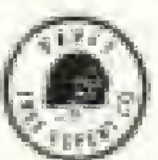

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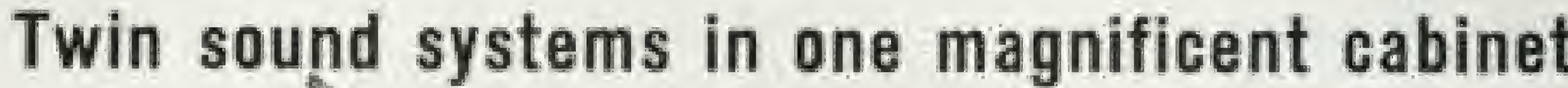

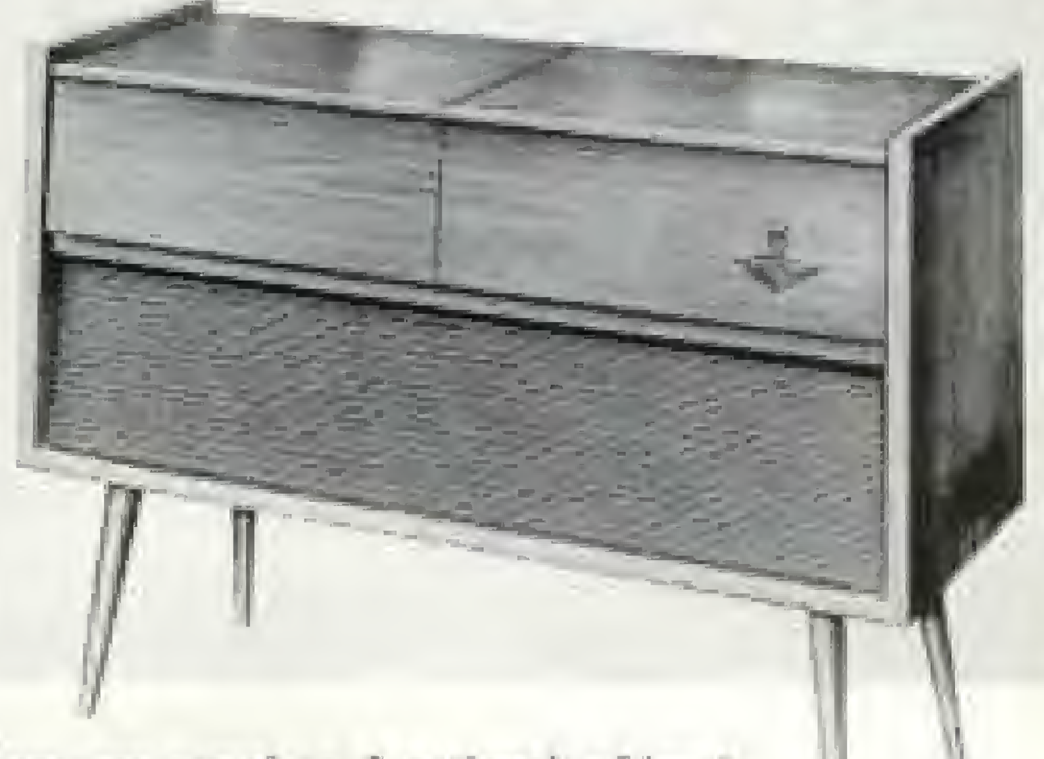

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5 facts you should know about the new spinet organs

...to help you make the most pleasurable purchase of your life!

1. *How easy they are to master.* All electronic organs are extremely easy to play, even for a beginner. However, for *lasting* musical enjoyment, you need a highly versatile organ.

Some organs feature gadgets that produce a variety of unusual sounds. Their novelty soon wears off, because only a limited range of music is possible. The Conn Organ, in marked contrast, offers tonal quality and versatility required by concert artists... yet is just as easy for the beginner to play!

2. *What indicates superiority.* Tone... clear, beautiful tone marks the superior organ. It is the most important feature to look for in choosing a spinet organ for your home.

The Conn Organ is the product of almost a century of musical tradition... made by the world's largest manufacturer of orchestra and band instruments, specialists in tonal research.

3. *How the tone is produced.* Some organs use vibrating reeds or mechanical discs to produce tone. Others try to get the pipe organ effect by using only a few tone sources, plus heavy amplification.

The *fully* electronic Conn is the only popular-priced organ, starting at just $995, whose range of musical color is not restricted to *only one type* of tone. In addition, just as a pipe organ has a pipe for every note... the Conn Organ essentially has a complete, *individual tone generator* for every note!

4. *Why styling is important.* A spinet organ is a lifetime investment, so its styling should be ageless. The Conn Organ is designed for enduring beauty by Raymond Loewy, in a variety of traditional styles, in a wide range of fine woods and finishes. The Conn blends with any setting, taking up as little space as a drop-leaf table.

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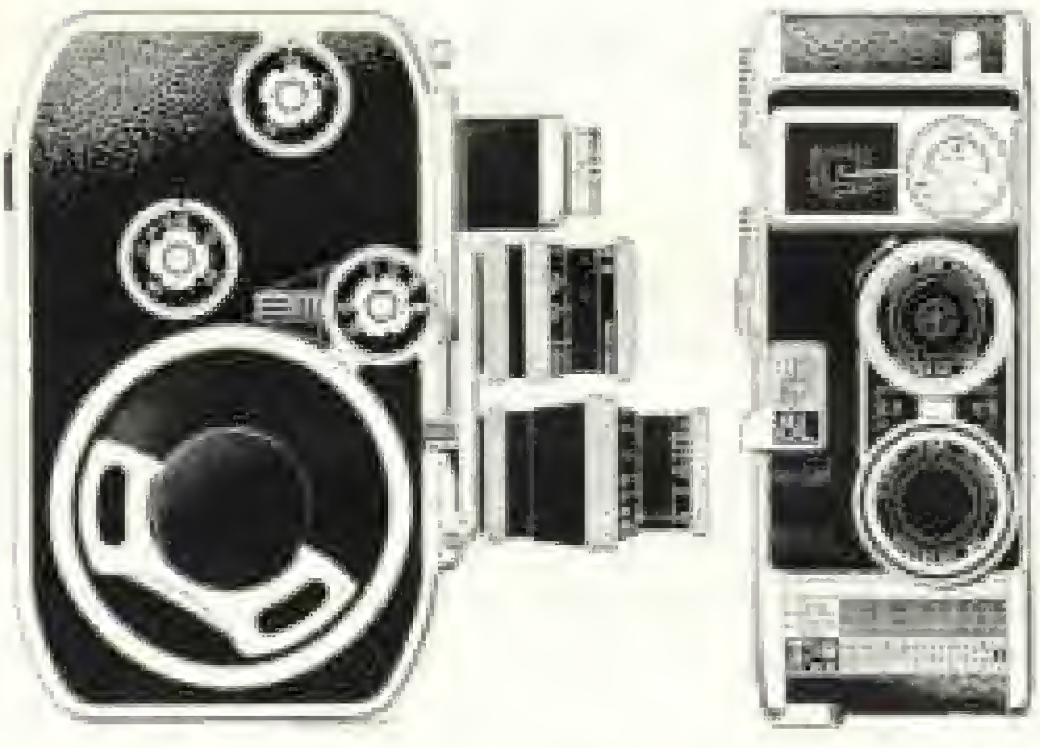

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But when the vaccine was perfected and supplies became plentiful, a strange thing happened. Millions of Americans failed to take it—or neglected to get the three injections needed for their protection.

In fact, more than 35 percent of our people under age 40—the period when most cases occur—have not had any shots; only half have had the full series. *Of the pre-school children who are most susceptible, nearly one-third have not been vaccinated at all.*

To help correct this situation, many of our leading health and medical organizations—the U. S. Public Health Service, the American Medical Association, the American Academy of Pediatrics, the American Academy of General Practice and The National Foundation (for Infantile Paralysis)—are now spearheading a drive for the conquest of polio.

You can strike a blow against polio!

If you have children, don't take a chance. Now is the best possible time to provide them with protection—well in advance of the polio season which is at its height during the hot months of summer.

Three injections—properly spaced by your physician—are 85 to 90 percent effective against paralytic polio. If your children completed their series of three injections a year or more ago, you should ask your doctor about a fourth "booster" shot at this time.

Remember, it is especially important to protect children under age five. Polio injections can be started as early as six weeks of age.

If you are under 40, you, too, should not neglect to be vaccinated. Polio isn't limited to children. Although it rarely strikes adults, it is usually severe when it does occur.

So, you could do no wiser thing than to call your physician or clinic *now*—and arrange for your family's injections.

If we all act immediately, we can face the summer of 1959 with the bright hope that there will be no polio epidemics!

For more information, send for Metropolitan's booklet, *ABC's of Childhood Disease*. Use the coupon below to order your free copy.

Metropolitan Life Insurance Company
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Please send me the free booklet, "*ABC's of Childhood Disease*," 4-59-N.

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Cactus flowers at Big Bend National Park, Texas

For Instant Beauty, Just Add Water

It happens every spring. A little rain falls on the dry desert sands of Big Bend National Park and the land blazes with color, fulfilling Isaiah's prophecy ". . . the desert shall rejoice, and blossom as the rose."

Come see the miracle of the flowers, and all the wonders of Big Bend. In the Dawn Age, this was dinosaur country. Strange fossils are here – a three-toed ancestor of the horse and clam shells four feet long. It's wonderful territory for the explorer, archeologist and camper. In this volcanic land you can see arrowheads and other relics of an unknown, prehistoric "cave people," as well as of the Apaches and Comanches who fought the Spanish Conquistadores. In the Chisos – the "ghost mountains," where Western outlaws had their "owl hoot" hideouts – are the burro trails old prospectors followed vainly hunting a lost gold mine.

You'll enjoy Big Bend's exotic desert beauty. And seeing how Nature struggles to do so much with so little moisture, you'll see the dramatic proof that water, flowing in our arterial rivers and streams, is the blood that gives our land its strength.

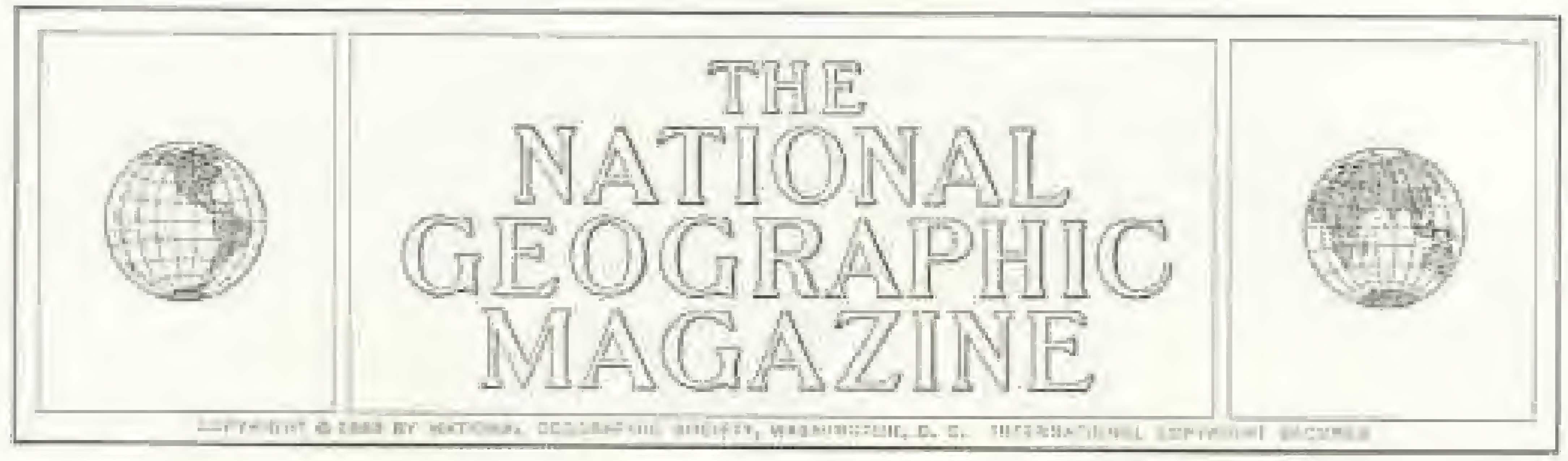
* * *

FREE TOUR INFORMATION If you would like to drive to Big Bend National Park, or anywhere in the U.S.A., write Tour Bureau, Sinclair Oil Building, 600 Fifth Avenue, New York 20, N. Y. Ask for our colorful National Parks Map.

ANOTHER IN SINCLAIR'S AMERICAN CONSERVATION SERIES

SINCLAIR SALUTES THE LEAGUE OF WOMEN VOTERS for advocating the highest principles of political responsibility, and for its concerted effort to establish a comprehensive water conservation policy –specifically to safeguard, control and wisely use the water resources of the whole nation.

Vol. CXV, No. 4 WASHINGTON April, 1959



This spring, when ice leaves the busiest ship-crossed waters on earth, North America will gain a new 8,300-mile seacoast

New Era on the Great Lakes

By NATHANIEL T. KENNEY, National Geographic Senior Editorial Staff

ALWAYS at this time of year the ice leaves the Great Lakes. Then the northering goose paddles once more in the unlocked coves, and the winter-bound ships move anew over the sweet blue water.

It is, as from time immemorial, a good season, a time of hope and quickening. But this year it is a better time than ever: April, 1959, will be remembered as the month the new St. Lawrence Seaway opened.

My National Geographic colleague Andy Brown has already told you about this Seaway. You saw it last month, a miracle of engineering piercing an ancient bottleneck, offering big ships of the modern ocean fleets passage to the heart of a continent.*

Wandering the Indians' Inland Seas

Now it is my pleasant task to show you the inland seas those ships even now are beginning to sail—the Great Lakes of the United States and Canada, links that bind together an empire of industry and agriculture, and mammoth air-conditioning plants for some of the most magnificent human habitat on earth (See the Atlas Map, **Northeastern United States,** mailed with this issue of the Geographic).

Glaciers in the hand of God carved the Great Lakes. There are five of them in a kinked chain that forms, when represented by the cartographer's blue daubs, the most eye-catching feature on a map of North America.

The links in this chain tumble westward bearing names of Indian association—Ontario, Erie, Huron, Michigan—until at Superior, the French-named northernmost and westernmost of them all, they culminate in the largest body of fresh water in the world.

Just as the Lakes' first moccasined owners once roamed their far-flung shores and blue waters, so I too wandered last summer across the country I came to call simply "Lakeland."

"Where can I write my mother we'll be?" wailed my wife Fran, as our car homed on true north through the center of Michigan. Burrowed among the baggage on the back seat rode our 8-year-old daughter, Janice.

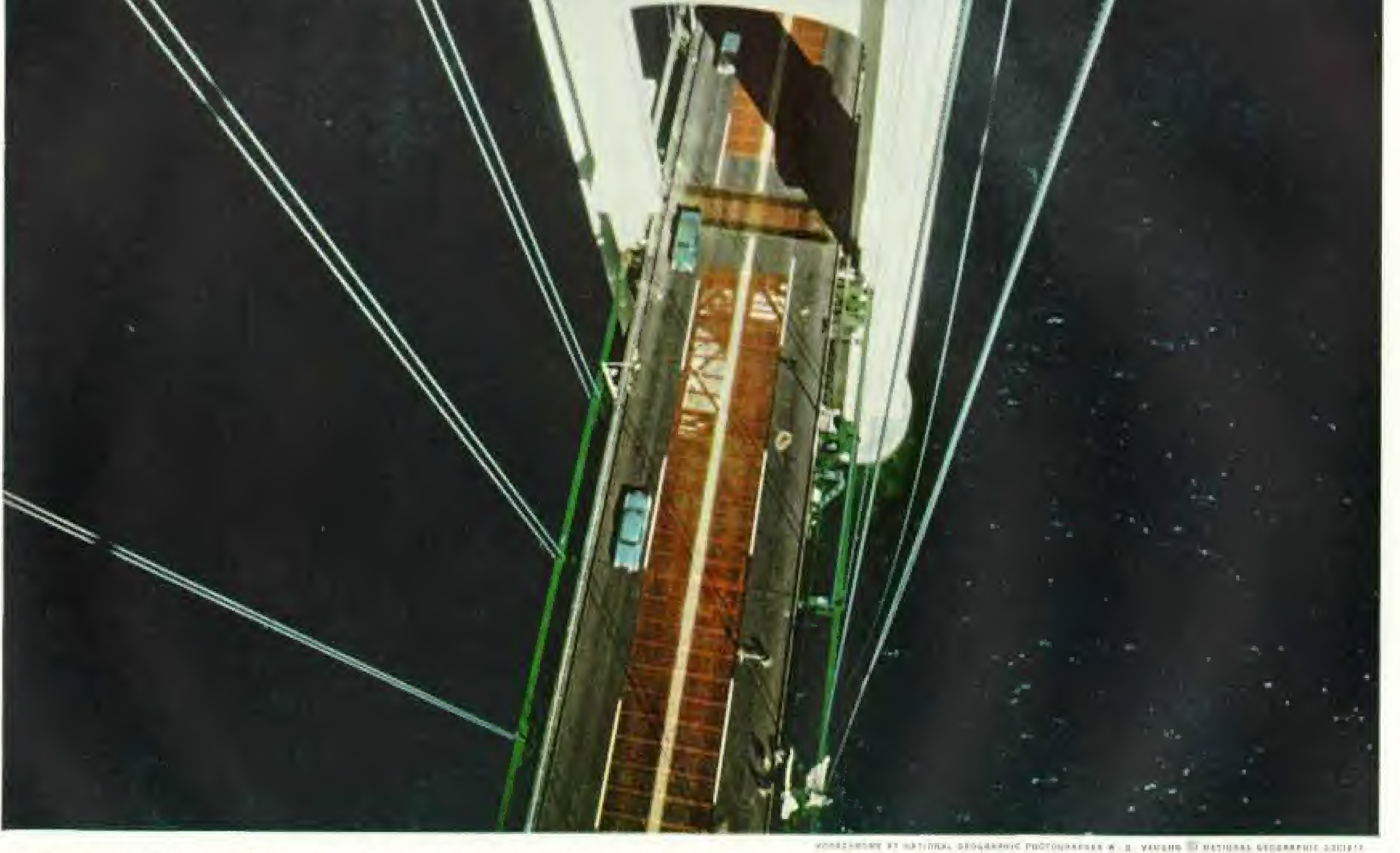
"Wherever the boats whistle and the gulls wheel in the sun. Nowhere else," I said.

And that is how we came one day to the Straits of Mackinac, where ore boats whistled and herring gulls wheeled, and the most recent miracle of Lakeland, the Mackinac Bridge, stood like a giant spider web against the sky.

Time after time doubters had punctured a century-old dream of connecting the peninsulas of Michigan, the State divided.

"It can't be done," they said, "let alone paid for."

* See "New St. Lawrence Seaway Opens the Great Lakes to the World," by Andrew H. Brown, National Geographic, March, 1959.



KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER W. D. VAUGHN © NATIONAL GEOGRAPHIC SOCIETY

Painter's-eye View atop Mackinac Bridge Reduces Cars to Matchboxes and Waves to Ripples

Roped together for safety, this two-man team works beside one of the main towers, whose height above the Straits of Mackinac—552 feet—falls three feet short of the Washington Monument. Fifty workmen apply 300 gallons of paint a day to the bridge, a five-mile skyway linking northern and southern Michigan. To take this dramatic picture, photographer Vaughn tightroped nearly 2,000 feet up a suspension cable, protected only by a safety belt (page 443).

But in 1950 a new Mackinac Bridge Authority, appointed by Gov. G. Mennen Williams and headed by former U. S. Senator Prentiss M. Brown, persuaded the legislature that the bridge was practical. David B. Steinman, builder of 400 bridges in many parts of the world, designed the span. Investors—I imagine more than one of them must have waited for the old ferries on busy summer weekends—bought almost $100,000,000 worth of bonds.

Construction began in May, 1954. Traffic first crossed the span in November, 1957. The formal dedication took place last June.

Photographer Climbs into the Sky

No winds that blow could sway or topple "Mighty Mac," or the greatest conceivable jams of ice in the Straits fell its supports. With its approaches, the bridge is five miles long. The main span measures 3,800 feet, second only to the Golden Gate Bridge's center span. The Mackinac's builders used altogether some 100,000 tons of steel. Cars can roll across the Straits at the rate of 6,000 an hour; one man with a panel of switches and colored lights controls their speeds and the lanes they use (opposite).

This is guidebook stuff. What National Geographic photographer Bill Vaughn told me is not.

"I asked bridge headquarters at St. Ignace if I could climb to the top of the main towers and make some pictures," said Bill. "They looked more than a bit dubious, but because I worked for the NATIONAL GEOGRAPHIC, they gave me special permission to try. A Mackinac Bridge Authority official, Herman Ellis, decided to go with me.

"The easiest way up was to walk one of the main suspension cables, actually 12,580 wires strung into a fat sausage two feet thick. We were 45 minutes reaching the top, about 50 stories above the water.

"It was quiet once we were above the gulls, and a little lonely. Then we ran into a couple of painters, friendly men happy to talk to a stranger (page 440).

"They told me 48 others were scattered around on the bridge somewhere. Their chief worry was not the height, but forgetting where they were. They were inclined to get careless and step on slippery wet paint, or forget to hook their safety belts.

"It was so windy the paint was blowing out of their buckets. The wind worried me on the last few feet to the top of the tower; a hip-high cable I had been using as a handrail stopped, and those last few feet seemed awfully long.

"From this height the big Lakes boats converging on the Straits looked like children's toys in a bathtub, trailing soapsud wakes. I looked north hoping to see the Soo, another great crossroads of Lakes traffic, but the painters told me it was too far away."

Drain Plug Between Superior and Huron

The Soo is a reach of the St. Marys River, the outlet that drains Lake Superior into Lake Huron. When the Frenchman Etienne Brulé first saw it, probably in 1618, it was a boiling rapid where Indians gathered in springtime to catch the tasty whitefish.

It long remained impassable, a stubborn block to navigation from one end of the Lakes to the other, this *sault*, or rapid, of the French discoverers, the mispronounced "Soo" of the Scandinavian lockbuilders who came two centuries later. Here the early fur traders portaged their canoes; even steamboats moved on rollers along what is now Portage Avenue in Sault Ste. Marie, Michigan.

But ores from the ranges of Michigan and prairie grain of the Superior hinterlands could not forever be denied passage to the mills and markets of the East. Charles T. Harvey, weighing machine salesman with a genius for engineering, completed the first adequate lock around the falls in 1855.

Now there are five, four American and one Canadian. Nestled among these steps for

Poised Above Oblivion, Photographer Vaughn Focuses His Leica

Gusts constantly thrust Vaughn back against his safety belt as he scaled Mackinac Bridge. Climbing a main cable, he stopped at each pair of suspender ropes to unhook and refasten the belt. This view looks north toward Michigan's Upper Peninsula. Lake Michigan stretches at left, Lake Huron at right.

Nerve center of the bridge, the control room houses banks of switches for operation of traffic signals. Microphone gives the toll supervisor contact with patrol cars and turnstiles (background). Tolls, reaching tens of thousands of dollars on busy days, drop through a chute to a collecting room. An armored car carries cash to the bank.

KODACHROMES BY W. D. BLAIR (TOP) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER W. D. VAUGHN © N.G.S.

Lake Michigan bathers stroll a surf-swept beach at Indiana Dunes State Park. The five Great Lakes, an incomparable playground, give the United States a fourth coastline and a vast inland sea often called "North America's Mediterranean."

BRIAN ALLEN

Holiday Crowds Jam a Michigan Beach

More than a million visitors a year flock to Holland State Park, 43 acres of dune-studded preserve on Lake Michigan, west of Grand Rapids.

States bordering the Great Lakes conserve entire stretches of shoreline where vacationers swim, sail, and camp, and city visitors thrill to the sight of wild goose, duck, raccoon, and deer.

ships, the tamed rapids are only a vestigial trickle. Here move, in an average eight-month navigation season, 110,000,000 tons of freight, more than twice the annual tonnage passing through the Panama Canal; it is still mostly ore and grain downbound, and coal westward (page 450).

Added to the 1958 Soo freight were 320 pounds of Kenney family. We went up through Davis Lock on the American side in the little sightseeing boat *Bide-A-Wee*, feeling lordly when all the ponderous machinery gushed into action at the bidding of our puny whistle.

We turned around on Lake Superior's level and came back down through the smaller, shallower Canadian lock. A vendor with a pushcart in the form of a boat wheeled alongside. You might say he did business in a falling market: Trade began on a mutual level and finished when his buyers of imported English toffee and chocolate had been lowered too far to pass their money over the lock wall.

Gates Juggle Superior's Depth

From *Bide-A-Wee*'s deck I had seen, athwart the river above the rapids, a dam in which there appeared to be gates. Next day I asked Clifford Aune, area engineer of the Soo locks for the United States Army Corps of Engineers, what this structure might be. Casually he replied: "A compensating dam. With it we control the level of Lake Superior."

I was flabbergasted. The largest freshwater lake in the world obeys man-made valves?

Eternal Mists Clothe Niagara Falls, Spillway of the Great Lakes

The 36-mile-long Niagara River, part of the United States-Canada border, drains four Great Lakes into the fifth, Ontario. This Canadian view peers east across crescent-shaped Horseshoe Falls past Goat Island to American Falls and Rainbow Bridge. U. S. and Canadian engineers recently evened the flow over Horseshoe to control erosion.

Honeymoon hotels of Niagara Falls, New York, rise on the far bank.

Crowds jam Queen Victoria Park, Niagara Falls, Ontario, for a glimpse of Princess Margaret during her visit in 1958.

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N.G.S.

"Certainly," said Harley Lawhead, head of the Engineers' Great Lakes Hydraulics Branch in Chicago. "Water flowing out of Superior has been regulated since 1922, when the compensating dam was completed.

"The Lake level must be maintained, for there is a lot at stake. A foot less water at Duluth or Port Arthur, for example, would cost the operators of ore and grain boats big money. They load to the exact inch that harbor and channel depths permit."

A Canadian-U. S. commission decided that Lake Superior should be between 602.1 and 603.6 feet above sea level to serve all interests best. The men in charge at the Soo keep it within those limits "as nearly as may be."

Niagara: Colossus in Harness

Similarly, Lake Ontario is controlled through new works in the St. Lawrence River. Lakes Michigan and Huron, which have a common level because of the deep and wide water connection at the Straits of Mackinac, are influenced by underwater compensating dikes at Detroit and to a degree by diversion of water from Lake Michigan at Chicago; we will look into this Chicago diversion later.

Man's tinkerings with the Great Lakes reach spectacular heights at Niagara between Lakes Erie and Ontario. Here he has led the savage torrent that creates Niagara Falls into channels of his own making. Here he floats ships across the Niagara peninsula and makes electricity that lights the countryside for miles around.

The Canadians have turned a corner of Queen Victoria Park into a charming place of tumbling waters by leading a small piece of the Niagara River through its wooded glades. Janice knows all about this baby Niagara. She fell into it in her Sunday clothes.

"I fell in the river above Niagara Falls," she tells guests in our home, and if the statement fails to stop conversation, I have one of my own that will:

"They shut Niagara Falls off at night," I can say, and like Janice I will be telling part of the truth. For they do divert half the river away from the Falls and into the power plants in the deep of night and in the winter season when the sightseers are not around. Old Niagara at such times becomes noticeably anemic in appearance.

An international group watches over Niagara, as at the Soo.

"The Falls are a scenic wonder and the river is a tireless worker," said Roger Repp, of the Engineers office at Buffalo. "The agree-

JAMES P. BLAIR, JONES & LAUGHLIN STEEL CORPORATION

Lord of the Lakes, a Snub-nosed Ore Boat Calls for Cargo at Superior, Wisconsin

Disdaining tugs, Republic Steel Corporation's *Tom M. Girdler* sidles up to the half-mile-long Great Northern Ore Dock, whose loading pockets and retractable chutes are spaced to match the vessel's hatches.

Operator at right loads another ship with levers controlling a chute. Railroad trestle allows gondolas to dump ore directly into the pockets.

Among Great Lakes ports, Duluth-Superior ranks second only to Chicago in total freight tonnage. Iron ore for furnaces on the lower Lakes makes up four-fifths of the traffic.

ments recognize both values. They stipulate there shall always be a Niagara Falls, no matter how great the temptation to divert all the water for power.

"Did you know, by the way, that the two countries just finished fixing Horseshoe Falls so it won't wear out so fast?"

Yes, "wear out": In less than two centuries erosion has moved the Horseshoe 865 feet upriver.

"We cured this by deepening the riverbed on each side," Roger said. "Before, too much water went over the center, cutting the Falls back to its horseshoe shape. Now the flow is even all the way across, and the wear will be much less."

The job was completed in 1957 and cost $17,500,000. No longer does Horseshoe dribble around bare places at the corners of its lips (pages 446-7).

"I Want to See a Bear"

I could fill a book with the hydraulic engineering marvels of the Lakes, but my family is waiting back at the Soo, impatient for the cool glories of the north woods.

"I want to see a bear," said Janice.

We rolled west, and the uncrowded expanses of Michigan's Upper Peninsula opened before us. Pines joined the hardwoods in the forests and filled the air with exhilarating fragrance. Roadside fields glowed with wildflowers—devil's paintbrush, ox-eye daisy, the purple American vetch.

Fabled Pictured Rocks on the Superior shore intrigued us with their wave-carved shapes; Indians once viewed them with awe. In the early mornings and at dusk deer bounded across the highways.

"I want to see a bear," persisted Janice.

That is simple once you learn the trick: You head for the nearest town's garbage pit. In this you will often be aided by local Chambers of Commerce. They know about 8-year-old daughters. They list community dumps as points of interest and mark the way to them with signs.

King Bruin Chases Off Competitors

We joined a ring of parked cars at the Copper Harbor dump on the Keweenaw Peninsula and watched shaggy bruins rooting in a mountain of trash. I got out of the car with the camera, a foolish procedure, for wild black bears are grumpy and powerful. After a while the bears suddenly dashed for the woods, and a woman in the next car berated me for frightening them off.

I heard a soft sound beside me. I turned, and the real reason for the exodus of lesser bears padded by—King Bear, a fine big fellow who must have liked solitude at table.

"Please stay in the car after this," said Fran. "You know you're the only one who can change a tire!"

Lake Superior's most famous bear is the one who, in a time of hunger some years back, padded into Duluth and decided to try the Hotel Duluth coffee shop. He entered not by the door but through the plate glass window. A police sergeant sadly shot him when he refused to leave the sugar bowls. Stuffed,

Water boils from a lock of the Soo, a man-made portal between Lakes Superior and Huron at Sault Ste. Marie, Michigan. An ore boat waits as Sabin Lock empties toward it. Boom in center keeps errant ships from ramming the chamber's gate.

he is still there, eyeing the guests of the Black Bear Lounge from a pedestal beside the bar.

The bear, it occurs to me, is the only geographer with the ability to generalize about Lakeland. He divides it into two parts. One part—the shores of Ontario, Erie, and Michigan, and the south bank of Huron—he marks on his map as man country, and there he does not live.

I, too, sense this as a man-made landscape, the Lakeland of fiery steel mills, checkerboard farms, orchards neatly pruned, smog-hazed cities, and geometric rows of summer cottages along rake-furrowed beaches. Here the works of man hold the center of the stage, and nature is a backdrop shaped to fit the human drama.

But where the bear's map says "home"—along Superior's shores and in the rugged country of Canada from the Pigeon River to the north shore of Huron—I feel the wilderness near me, even in the cities; the bear still owns this land, at least for the time being, and I am the intruder.

Indians Mined Isle Royale's Copper

Paradoxically, the wildest bit of Lakes country I know—Isle Royale—has no bears. Moose and wolves come over occasionally on the ice from the mainland wilderness, but bears are asleep by the time the ice forms.

Isle Royale, a United States national park, lies in the western half of Lake Superior, a score of miles from the mainland shore where Canada meets Minnesota (following pages). True devotees spend chilly nights in sleeping bags beside wooded lakes teeming with pike and perch, walleyes and brook trout, or they putter among the archipelago's 200 rocky islets in outboard cruisers.

The more faint at heart—this included the Kenneys—stay in the comfortable lodges at Windigo or Rock Harbor. Everybody hikes; they must, for there are no cars or horses.

But hiking is a joy. Trails springy with pine needles and damp moss lead past flashing beaver ponds and glades purpled with wild iris. Pits deep in blueberry thickets mark where Isle Royale's Indians long ago mined native copper with fire and hammerstone—copper that found its way to Florida along the amazing trade trails of the red men.

Orchids peep from the underbrush, and Indian pipes gleam by rotted logs. Here, as nowhere else, I envisioned Lakeland as it was when Champlain struggled up the Ottawa River, or when Nicolet stepped ashore at Green Bay in clothes he donned to meet the Emperor of China.

I poked among the ruins of abandoned smelters, where white men failed to mine with profit the Indian copper. I saw sturdy log cabins built by fishermen 100 years ago; in one of them now lives Peter Edisen, who likewise nets his living from Superior's wind-swept waters.

More than any man I ever met, Peter has a way with wild things. Gulls all but smother him when he stands on his wharf. Mink and beaver come to his call, moose venture to his kitchen door.

"One time," said my old friend Park Superintendent John G. Lewis, "we brought four zoo-bred wolves from Detroit over here to try to help preserve a vanishing species. Isle Royale was to be a sort of wolf sanctuary. We hoped they would revert to the wild.

"The wolves soon wound up around Peter's cabin, and they saw through him from the start. He'd throw rocks at them, they'd chase the rocks. He'd holler, they'd wag their tails and roll on their backs.

"Finally, when Peter went back to the mainland for the winter, they did drift off and go wild—maybe from pure loneliness. Two of them became so vicious we had to eliminate them. The other two are still around."

Lakers Lift Mountains of Cargo

One day, across a tip of the island from Rock Harbor, we sat atop pine-clad Lookout Louise. Smoke of distant shipping smudged the horizon. That would be the Great Lakes boats—they do not call them ships—bound east with the ores of Minnesota and the grains of Manitoba.

You must bear in mind that two major types of vessels sail the inland seas. One is the "salty," the ship that trades down the St. Lawrence to distant shores. The other is the slab-sided "laker," most economical bulk carrier ever devised by man. Her home is on the fresh water; she was not built for the sea.

But the laker is the tonnage champion. Pile her cargoes beside those of the Seaway ships, and they would look like a mountain standing beside an anthill. Lakeland could live without the salties; she would die without her beloved lakers.

While we had been at the Soo, United States Steel Corporation's coppery-red bulk carrier *Benjamin F. Fairless* had locked through.

Gulls beg for handouts on Isle Royale, Michigan, largest piece of land in Lake Superior. More than 200 varieties of birds frequent the preserve, a national park since 1940. Pleasure boats moor in this fjordlike inlet.

Vacationist wades Isle Royale's shore in search of colored pebbles. Fanciers occasionally find greenstones, igneous chips used in jewelry settings. Park rules now discourage collectors.

Indian-dug copper pits on the island date from nearly 4,000 years ago.

KODACHROMES (ABOVE AND OPPOSITE) BY [illegible] JOHNSTON AND (LEFT) NATHANIEL T. KENNEY, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Dense Forests Blanket Isle Royale, a Lake-bound Wilderness

No roads crisscross the 210-square-mile island. Visitors roaming its footpaths or cruising the inlet-scarred coast find no poisonous snakes, ragweed, or poison ivy.

Thick stands of conifers and hardwoods shelter flowers that include 36 types of orchids, ground-hugging relatives of the tropic blooms.

Wildlife abounds in Isle Royale National Park. In some winters moose, wolf, mink, beaver, coyote, and fox have migrated from the mainland across Superior's ice sheet.

This view from Lookout Louise surveys fingerlike Duncan Bay. Some 200 islets and countless rocks complete the archipelago.

westbound into Superior. She had been on the go constantly since the ice melted in mid-April, and she would keep on going until the December freeze-up drove her to port.

The young men in her crew, bottled aboard for the eight or nine months of the navigation season, welcomed a chance to chat with the tourists, especially the pretty girls, lining the lock walls.

"What are you hauling, sailor?"

"Coal to heat your house with, chickadee. Where'd you get those nice red shorts?"

"What's the funny pole sticking out over the front of your boat?"

An officer answered that one from the bridge, the so-called texas house, set as far forward as the builders could put it.

"It's to steer by. From up here we can't see the bow. The pole tells us which way we're turning."

"Where are you going?"

The deck hand again: "Duluth for iron ore. Drive around and meet me, Chickadee. We'll be five hours loading; maybe I can get shore leave."

Hooting for her dock lines, the *Fairless* drowned out the badinage. Water churned under her stern, and she moved majestically into the channel. Soon she was gone away west, towing a whirling cloud of hungry gulls.

We followed our 640-foot friend to Duluth. Already she had discharged her coal and was thirstily sucking iron ore from the chutes of the loading dock. Monstrous bins towered above her. To the tops of the bins a trestle soared from the curving cliff behind the waterfront; long trains from the Mesabi mines in the hinterland rattled over it to dump their loads and quickly go back for more (page 448).

A *Fairless* crewman looked familiar.

"How's Chickadee?" I asked.

"Which one?" he grinned back.

Iron for Hungry Furnaces

But already the impatient *Fairless* was moving again. She sailed back to the Soo, passed down into Lake Huron, and in the night steamed through the Straits of Mackinac.

Next day in Lake Michigan the boxy black ferries carrying railroad cars from Milwaukee to Ludington, Michigan, sliced her wake. The *Fairless*, answering their passing salutes, trudged on south.

Soon she moored to a wharf at Gary, Indiana, and here, in the shadow of the steel mills hungrily awaiting her cargo, she suffered the Hulett unloaders to dip into her innards and lift out her 15,000 tons of ore (pages 456-7). It was the end of yet another run.

In my notes I find the name of another laker I saw at Gary, the *Carl D. Bradley*. I recall that she looked much like the *Fairless*, except that she carried self-unloading gear on her deck and was somewhat smaller.

"Brings limestone, the third basic ingredient of steel, from quarries on the northern shore of Michigan's Lower Peninsula," my notebook reads. "This is an important Lakes run with its own fleet of bulk carriers."

I watched the *Bradley* unload and head routinely back to the port of Calcite near Rogers City for more stone. On a wild day in mid-November the run was not routine: The *Bradley* broke up in a Lake Michigan storm and went down, and only two of her 35 crewmen survived. Most often the Lakes are pleasant, but they can be cruel too.

Mohawks and Senecas Rig High Steel

The *Fairless* and the stone boats and all other shipping must pass through the Straits of Mackinac to reach Lake Michigan. High above them, in the realm of the wind atop the Mackinac Bridge, Lakeland's human history comes curiously full circle. Descendants of the most implacable Indian enemies of the French and Americans in this part of the country helped set the "high steel" in place.

Among the most fearless climbers on the project, I learned, were Mohawks and Senecas of the United States and Canada.* Their ancestors, the feared Iroquois, long barred the southern Lakes country to the pioneers. The fur trade to the West perforce traveled the discovery route up the Ottawa River into Lake Nipissing, thence by portage into Georgian Bay far north of Iroquois hunting grounds.

We met the Iroquois face to face on the Six Nations Indian Reserve near Brantford, 20 miles north of Lake Erie in the Province of Ontario. The reserve is the sanctuary to which Joseph Brant's tribesmen, allies of the British in the Revolution, fled from the postwar wrath of the victorious Americans.

"Aren't these the Indians who made life so miserable for the New England colonies?" apprehensively inquired my wife as we ate lunch by the side of a woodsy road.

I was about to tell her they also plucked

(*Continued on page 463*)

*See "The Mohawks Scrape the Sky," by Robert L. Conly, National Geographic, July, 1952.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER © N.G.S.

Rust-colored Cliffs Yield Iron Ore from Minnesota's Mesabi Range

Truck and bulldozer, in U. S. Steel's Hull-Rust-Mahoning mine near Hibbing, work the industry's largest open pit. Pump house above the pool rids the mine of water.

Bulldozer rides an electric shovel into an ore carrier at Ashtabula, Ohio. Called a Hulett unloader, the shovel will empty the ship's hold (right) with the tractor's assistance.

Monstrous Jaws Gape Wide to Take a 20-ton Bite of Iron Ore

"Gold is precious, but iron is priceless," wrote Andrew Carnegie. Time, too, is priceless on the Great Lakes ore-shipping routes. Boats that once took days to unload by hand now yield their cargoes to bulldozer and scoop in six or seven hours. Ore haulers tell of the skipper whose boat spent so little time in port that he went an entire season without a haircut.

This tractor scrapes ore out of corners in the boat's hold. The operator of the unloader rides a cab directly above the buckets.

[illegible] © N. G. S.

Fiery Plumes Sweep the Night Sky Above a Steel Plant's Inferno

Republic Steel's works paint a surrealistic scene in Cuyahoga Valley at Cleveland, Ohio. Light from coke ovens, blast furnaces, and open hearths

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N.G.S.

bathes the gloom and turns vapor from the stacks into tongues of flame.

Coking-coal bunker and conveyer shaft at center left loom above railroad yards and gondolas. Blast furnaces silhouetted at right seem to stand on stiltlike loading tracks.

S.S. *Edmund Fitzgerald* Appears to Stretch the Length of Detroit

Ocean-going ships, for all their grace and speed, bow to the homely laker in tonnage hauled. Largest of the bulk carriers, the recently launched "Fitz" can float 26,000 tons of cargo, one-third the weight of the *Queen Elizabeth*. Bow to stern, she measures 729 feet, more than the length of two football fields.

This view spans 21 cargo hatches to the forward superstructure, called the texas house. Boomlike hatch-cover crane in foreground rides rails set in the deck.

Detroit's new City-County Building dominates the riverside skyline.

ANSCOCHROME (OPPOSITE, ABOVE) AND KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N.G.S.

Automobile designers at Detroit's General Motors Technical Center plan the cars of tomorrow. Drafting rooms, birthplace of future designs, rival defense plants in secrecy.

Deckloads of cars start the voyage from Detroit to the Nation's showrooms. The *T. J. McCarthy*, a converted ore carrier, packs 480 Chrysler-built automobiles on four levels; the sight suggests an aircraft carrier with a loaded flight deck. Distant Belle Isle bridge crosses an arm of the Detroit River.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

Giant Copper Kettles Glow Like Suns in Pabst's Milwaukee Plant

Vats contain boiling water and malt, which, with yeast and hops, produce beer. Attendants in smocks check specific gravity; the man at the tubs samples dried hops.

out Etienne Brulé's toenails, when wild whoops shattered the quiet. I looked down the road, and there was Janice in a pother of Indians. They were about our daughter's size, but since everybody seemed to be throwing rocks, I went to investigate.

"Meet my Indian friends!" shouted Janice, pitching another rock. "Hornets are down by the stream, and we're bombing them!"

About this time a small Hiawatha in blue jeans scored a direct hit. Indians and palefaces, united before a common enemy, departed in a body.

That night we watched the Indians, in the paint and deerskin garb of Brant's day, re-create the councils at which the talented warrior and leader persuaded most of the Iroquois tribes to follow him into Canada.

Tom-toms thumped and campfires danced in the forest. A tiny island in a dammed stream formed the stage. Spectators filed into the rustic amphitheater. A frog croaked in the stream. The ancient tongue of the Mohawks was heard again in the woodland, and the night was sheer enchantment.

"The boy dancer," Janice whispered loudly, "is the one who hit the hornets."

So the spell was broken, but it was all right; we were due in Toronto next day anyway.

Canadian Port Builds for Tomorrow

Toronto is a Seaway port on Lake Ontario, currently handling more overseas general cargoes than any other on the Canadian shores of the Lakes. Last year she logged in more than 650 of the 250-foot salties that were the largest vessels the old St. Lawrence Waterway could handle. There is no reason to believe the larger Seaway ships of today and tomorrow plan to pass her by.

"We're so confident of our maritime future," said Ernest B. Griffith, port general manager, "that we're planning $80,000,000 of harbor improvements. We already have two new foreign shipping terminals built and a third under construction."

Two German, a French, and a Dutch ship lay at new wharves. I watched them unloading machinery, glassware, small automobiles, mysterious crates labeled with Oriental symbols, and baggage of the immigrants now pouring into Canada. The ships, said Ernie, represented three of 27 overseas shipping lines calling regularly at Toronto.

Near by stood a new sugar refinery, here only because large ships would soon travel by Seaway all the way to Toronto with West Indies raw sugar; these ships formerly had to unload their cargoes at Montreal. Two scrap-metal concerns recently arrived, lured by the Seaway. Grain-exporting facilities have been modernized and expanded.

A ship bound for Europe often bottoms with grain, then tops off with better-paying general cargo. Ontario Province's southern peninsula never has produced enough manufactured goods to fill the outward-bounders.

Boom on the "Golden Horseshoe"

But new factories are rising everywhere. Glittering with glass and chromium, they have mushroomed along the road to near-by Hamilton, the Dominion's leading steelmaking city. They will in time, I am sure, squeeze the last orchardist off the "Golden Horseshoe," the curving western shore of Lake Ontario.

Toronto, of course, is more than a port. Canada's second city, she is a cultural and educational center and the seat of the Provincial Government. Less than a decade ago she absorbed a dozen surrounding suburbs, becoming a sophisticated metropolis of nearly 1,500,000 people.

As financial and commercial center of Ontario, she is helping direct the course of the greatest boom in Canadian history. Everywhere Canadians are building towns, industries, and roads.

Natural wealth discovered in the Canadian bush powers the Dominion's present boom. Wilderness a pre-World War II generation believed good only for growing trees has poured forth incredible riches. There are oil, gas, water power, the iron ores of Labrador and Steep Rock. And the uranium of Algoma.

They cannot tell you in the Algoma District just how much ore lies in the producing reef, part of a Z-shaped belt of rock snaking through a 75-mile-long section of bear and moose country north of Lake Huron's scenic North Channel. An early estimate was 100,-000,000 tons. Since I was there, the figure has tripled. Eleven mines working the field hold production contracts for more than a billion dollars' worth of ore.

Each mine has a mill that processes the ore. "Yellow cake," a uranium precipitate, comes out in steel drums, $2,000 worth in a drum. A Canadian refinery finishes the job. The United States buys its output.

Geologist Franc R. Joubin and financier Joseph H. Hirshhorn staked out much of the

Algoma field in six weeks of 1952, using planes to bring in their staking crews. Somehow they managed to complete the job without attracting attention, although some of their 60,000 claimed acres lay less than 20 miles from much-traveled Highway 17.

The center of things is the town of Elliot Lake. Only moose lived there five years ago; now close to 20,000 people make it their home. When I was there, on a mine payday, I was sure that each of them had driven his car downtown. The traffic jam was monumental (page 470).

Through streets still unpaved, bulldozers and trucks rushed to finish the shopping section. Sparkling new stores, restaurants, and office buildings rising from the raw earth would inspire civic pride in Toronto or Chicago. Workmen put the finishing touches on a new bank; its future tenants meanwhile did business in a frame shanty. A multistory establishment bore the proud name of the Hudson's Bay Company.

"But don't try to pay them in beaver," grinned Chic Shave of the local Chamber of Commerce. "Here they're a combination food supermarket and modern department store, and they prefer money to furs."

Sitting atop Uranium Sobers a Town

A busload of businessmen from the States came to town one day, and Chic guided them into a street that ended in a mudhole. The visitors had to push the bus out.

"Boy, were they mad!" said Chic. "They accused me of not knowing where I was going. I had to agree: The street hadn't been there the day before."

NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS. FROM A BELL HELICOPTER

Skyway Traffic in Buffalo Leapfrogs Shipping in the Crowded Harbor

Gristmill of the Great Lakes, Buffalo, New York, yearly converts some 60,000,000 bushels of Midwestern and Canadian grain into flour and breakfast cereals. Deep-laden grain boats thread busy canals to spill cargoes into storage elevators. When space runs short, shippers turn idle boats into floating warehouses.

This skyway connects with the 518-mile New York State Thruway. Elevators of the General Mills Corporation stand above waiting boats. Towering Buffalo City Hall rises at upper left.

Town citizens live in five neighborhoods insulated from each other by little hills. Last summer you may have had to search for somebody's home behind a mountain of boulders and stumps waiting for the trucks to haul them away, but when you did find it, it was brave with color, arresting in new architectural shape, and humming with the most modern appliances.

"I'm going to miss the carefree spirit of these pioneer days," Chic said. "They can't last much longer; living above seven billion dollars' worth of uranium is a sobering thing."

In Chicago my friends all but refused to speak to me when they learned I had visited a four-year-old town in the wilderness before I came to see them.

"You certainly do work backward," they said. "Just because a place has a little uranium, you go see it before you visit the Queen of the Lake Ports."

To be a queen, a port must have a rich hinterland. Chicago has the largest and most productive in all Lakeland. It bites into the South to a point somewhere between St. Louis and Memphis. Seaway shipping costs will now extend it west to the Rocky Mountains.

It includes the richest commercial agricultural section in the world and a big portion of the industrial and urban belt that crosses the middle of the United States from coast to coast. It is an insatiable market and a tireless producer, the finest kind of hinterland.*

The country's best railroad network and a marvelous highway system radiate from Chicago like the strands of a spider web. And serving as trunk lines to the world from the web's hub are two highways of water—the St. Lawrence Seaway and the Illinois Waterway to the Gulf of Mexico via the Mississippi River.†

The waterways meet in Lake Calumet at the southern edge of town. Seaway ships come here from Lake Michigan via the short Calumet River. Towboats bring in barges from the Mississippi by way of the Calumet-Sag Channel, now in the midst of a huge improvement program. Along the shores of Lake Calumet, Chicago is building her port of the future.

New Port Rises from Muddy Lake

"I wouldn't know how to go about figuring it," said James J. Pisco, Chicago Regional Port District engineer in charge, "but I believe this muddy lake is worth as much to Chicago as those uranium mines are to Ontario.

"The old downtown port in the Chicago River area hasn't the room for expansion to Seaway size. Without Lake Calumet, we'd

* See "Illinois—Healthy Heart of the Nation," by Leo A. Borah, NATIONAL GEOGRAPHIC, December, 1953.

† See "The Upper Mississippi," by Willard Price, NATIONAL GEOGRAPHIC, November, 1958.

have an unthinkable choice: build wharves on the Gold Coast or in Jackson Park, or give up and let some other city take over as principal Lakes port."

There is still a lot of vacant land in the Calumet area. New warehouses, wharves, and grain elevators that cost $20,000,000 look lonely. But Jimmy, in his spare time, has built a model of the lake, and on it he showed me where $500,000,000 worth of port facilities will be standing within the next 10 years.

Salties Let Out Their Belts

What appeared to be an ordinary little salty lay discharging cargo at one of the new wharves. Jimmy told me she belonged to the Swedish-Chicago Line.

"Tell the man how you people figure to keep up with all this Seaway business," Jimmy urged her captain.

"*Ja,*" the captain said. "We will take this little ship home in the winter, cut her in two, and add 78 feet to her middle. In fact, we will do this to several of our fleet, and then they will be true big Seaway ships.

"I tell you a secret: We built them in the first place to be lengthened when the Seaway should come. Even the engines we ordered oversized to power a bigger ship one day."

But cutting ships in two is nothing new on the Lakes. As early as the 1880's the Canadian Pacific Railway had to halve its Clyde-built *Algoma* to bring her to Lakeland through the old St. Lawrence and Welland Canals. Another old Canadian Pacific vessel, the *Assiniboia,* is one of the few survivors of Great Lakes passenger fleets that once numbered hundreds of stately boats.

The *Cliffs Victory,* one of the largest bulk carriers on the inland seas, came in via the Mississippi route in two pieces. She entered Lake Michigan through the Illinois Waterway, the Chicago Sanitary and Ship Canal, and the Chicago River, a system now supplemented by the Cal-Sag Channel.

During World War II more than 1,000 ships built on the Lakes, among them 28 large submarines, passed through Chicago on their way to sea via the Illinois Waterway. They went as whole ships, but some had pontoons of air lashed alongside to lighten their draft.

Their navigators perforce noted they held a fair current from the start. I wonder how many of them realized they owed the little boost to yet another remarkable engineering achievement, the reversal of the Chicago and Calumet Rivers.

The job was done with cleverly contrived locks and dams and was undertaken originally to lead Chicago's sewage south into the Mississippi rather than into Lake Michigan, whence the city draws its drinking water.

"But let's not call this a new thing," Harley Lawhead told me. "Down through the millenniums the glacial ancestors of the Great Lakes have used half a dozen spillways to the sea. Here in the Chicago area was one of them. The engineers followed the general route of a waterway that existed thousands of years ago!"

It was a July Saturday in the Queen Port. Perch fishermen on the Adler Planetarium sea wall un-

(*Continued on page 475*)

Old Fort York in Toronto, scene of an American victory in the War of 1812, delights the author's daughter, Janice. Her guide models a 19th-century British uniform.

A Hail of Wheat Curtains Men Loading a Boat at Fort William, Ontario

Grain trimmers fill a shipping bin, Great Lakes term for a cargo hold on a grain boat. They direct the flow with a rope attached to the spout of the elevator.

Golden Fountain Splashes a Trimmer Knee-deep in Grain

In an hour, tens of thousands of bushels of wheat flow into a laker's hold. Filling corners and evening the load, the trimmer diverts the flow with a shieldlike instrument called a plow. His job calls for experience; amateurs have sent grain cascading overboard.

By constantly moving his feet, this Fort William worker sinks no lower than his knees.

Danger lurks in the elevators overhead. Men standing on grain when the valves have opened have been sucked down and suffocated.

Inspection of wheat for damage and foreign matter accompanies every loading. This bucketful will be graded by the Dominion Government.

Workers shovel wheat from a hatch cover into the hold. Loading is done exclusively by trimmers; boat crews do nothing but open and close hatches during the operation.

Most elevators can fill two or three holds simultaneously. Distant spouts in this scene feed two other compartments.

A Sprawling New Town Mushrooms out of the Canadian Wild

Elliot Lake, uranium capital of Ontario, backs up against the forests from which it grew. Ore discoveries in 1953 converted solitude into a modern community (below) whose population is now near 20,000. These cars jam a main street parking lot.

Tractorlike crawler deep in a uranium mine takes ore to a collecting bin. Funnel-shaped canopy houses an exhaust fan. Elliot Lake's mills produce more than 30,000 tons of treated ore a day.

Houses invade the bush around the lake. Head frames of mines rise in the distance.

Chicago at Night Lifts Jeweled Fingers Above Lake Michigan

Size, wealth, and superb location earn for Chicago the title Queen of the Lake Ports.

Radiating canals, highways, rail lines, and air routes make the city the transport capital of the Nation. Chicago's port alone handles more freight tonnage each year than the Panama Canal.

Seen from the top of the 601-foot Prudential Building, the city's tallest skyscraper, the downtown district blazes with life. Floodlights bathe the Wrigley Building. A beacon crowns the Palmolive Building beyond the Tribune Tower. Ribbony lights trace Michigan Avenue's Magnificent Mile, which leads toward the Gold Coast and the lake.

The Chicago River lies in the foreground. Engineers reversed its flow to funnel south toward the Mississippi River rather than north into Lake Michigan.

Drawbridge and parking lot face the site of Fort Dearborn, which in 1803 became Chicago's first settlement.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

Milwaukee memorial center honors the dead of World War II and the Korean conflict. Cantilevered glass-and-concrete structure contains meeting halls and an art and civic center.

Folk dancers perform a Bavarian *Schuhplattler* on the war memorial's terrace. Men mimic the courtship dance of the mountain grouse. Beyond, sailboats heel to a breeze on Lake Michigan.

rigged the little bells that woke them when a fish bit, and looked at the Lake. A fleet of 80 sailing yachts, heeling to a gray northeaster, headed away north in the Chicago Yacht Club's 333-mile race to Mackinac Island.

"Looks like the old days," said a fisherman. "My father captained a sailing boat when there were 2,000 topsail schooners on the Lakes. They carried everything the steamers carry today—ore, grain, coal, and immigrants as well, with their ploughs and household furnishings on deck."

Windjammers were the first lakers and the first to reach the sea too. The Cleveland schooner *Eureka* took forty-niners to San Francisco via the St. Lawrence River and Cape Horn. Under Canadian ensign, the *Sophia* sailed from Kingston to Liverpool in 1850, and the *Sea Gull* of Toronto made a round trip to Durban, South Africa.

They are all gone now, those schooners with the triangular raffee bent to a long square yard. Like the *Bradley*, they died in storms, or on vicious reefs unmarked in sail's heyday. Steamers drove the survivors to moldering ends in backwaters. Only the yachtsmen carry on their tradition.

The northeaster that dusted the start of the race fizzled out, and the skippers were three days working their way uplake in frustrating zephyrs. Waiting for them, I explored Mackinac Island, old crossroads of the fur trade, strategic key in Franco-British and British-American wars of empire, scene of a savage massacre by Chief Pontiac's Indians.

No Traffic Jams on Mackinac Island

Today Mackinac is a highly polished summer resort that has never relaxed, as Bermuda did, its ban on automobiles (page 488). My fellow passengers in a horse-drawn sightseeing bus included several Detroit motorcar executives and Don Hutson, onetime All American and professional football star who now has an automobile agency at Racine, Wisconsin.

"We come here," Don told me with a grin, "for a respite from traffic we help create."

One day Stewart Woodfill, owner of the luxurious Grand Hotel, loaned us his trim private carriage with Harmony, the island's best-known horse, between the shafts.

We clip-clopped through the town and into its backdrop of wooded hills. From Old Fort Mackinac, beautifully restored by the State, we looked down on the wharves where cruise steamers and ferries disgorged steady streams of vacationists. Behind us loomed Fort Holmes; from it the British forced the surrender of Fort Mackinac in the War of 1812.

Janice gloried in this world of horses. She rode a pony, drove Harmony, and met the man who with broom and pushcart keeps the streets of Mackinac safe for bicyclists and pedestrians.

"He must be very important," she said. "He told me I might never in my whole life meet another man like him."

Stern King Strang Went Too Far

Our waitress one night at dinner was Anna Mary Doud. Her great-grandmother, she told us, was a member of an Irish fishing colony on Beaver Island in Lake Michigan west of the Straits of Mackinac.

"King Strang drove them away," she said. "Do you know about him?"

Indeed I did. James Strang, aberrant Mormon, set up a stern cult on the island and actually named himself king. One of his many edicts required the ladies of Beaver to wear baggy, unattractive bloomers. This sort of thing eventually made him unpopular, and he was shot to death by his own colonists.

Lakeland has many islands, and mainlanders know strangely little about most of them. I had to learn from a book, for example, that in the grape-growing islands in the west end of Lake Erie lies the southernmost bit of Canada, tiny Middle Island, on about the same latitude as Hartford, Connecticut.

Commodore Perry had these Erie islands in sight as he defeated the British fleet at Put-in-Bay. On South Bass, one of the group, towers the tall stone column of Perry's Victory National Monument; fishermen use it as a guide to some of the best bass waters in the Lakes.

But back at Mackinac the yachts are ghosting across the finish line, and the high-spirited collegians in the crews of the early finishers are burning the streets on rented bicycles. The race committee has figured handicaps and come up with the winner—*Dyna*, an aluminum-hulled 58-footer from Green Bay, Wisconsin.

Clayton Ewing, her owner, told me she had won the Port Huron-Mackinac race the week before. Before that she had competed in the ocean race from Newport, Rhode Island, to Bermuda.* She had reached the sea via the Erie Canal.

(*Continued on page 480*)

* See "To Europe with a Racing Start," by Carleton Mitchell, NATIONAL GEOGRAPHIC, June, 1958.

Dawn on Lake Superior Silhouettes a Fisherman Hauling His Catch

For centuries men have reaped the bounty of the Lakes: whitefish, chub, herring, trout, and perch. An invader, the hated sea lamprey (next three

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER W. D. VAUGHN © N.G.S.

pages), has wiped out the lake trout fisheries in all the Great Lakes except Superior.

This fisherman works a string of 13 nets off Split Rock Light, Minnesota, averaging 700 pounds of lake herring a day. Cleaned fish sell to markets; others go to mink farms for feed.

NATIONAL GEOGRAPHIC PHOTOGRAPHER [illegible] © N.G.S.

A Marine Vampire Bares Rasplike Teeth

Murderous fangs stud the mouth of the sea lamprey (*Petromyzon marinus*), an eel-like parasite that fastens itself to fish, bores in, and sucks body fluids. The nightmarish creatures entered the four western Great Lakes by way of the Welland Canal.

This view reveals the lamprey's rubbery lips, which act as a suction cup, and the filelike tongue. One eye shows at right.

Speckled Trout-Lake Trout Hybrids Go by the Name "Splake"

Great Lakes hatcheries experiment with the new cross in the hope of developing a fast-maturing fish that will swim deeper than lampreys go. These two-year-olds fill a tank at the French River Hatchery near Duluth. Some fishermen call the breed Wendigo, the name of an Indian cannibal spirit.

Yellow Dye in a Spawning Stream Spells Death to Baby Lampreys

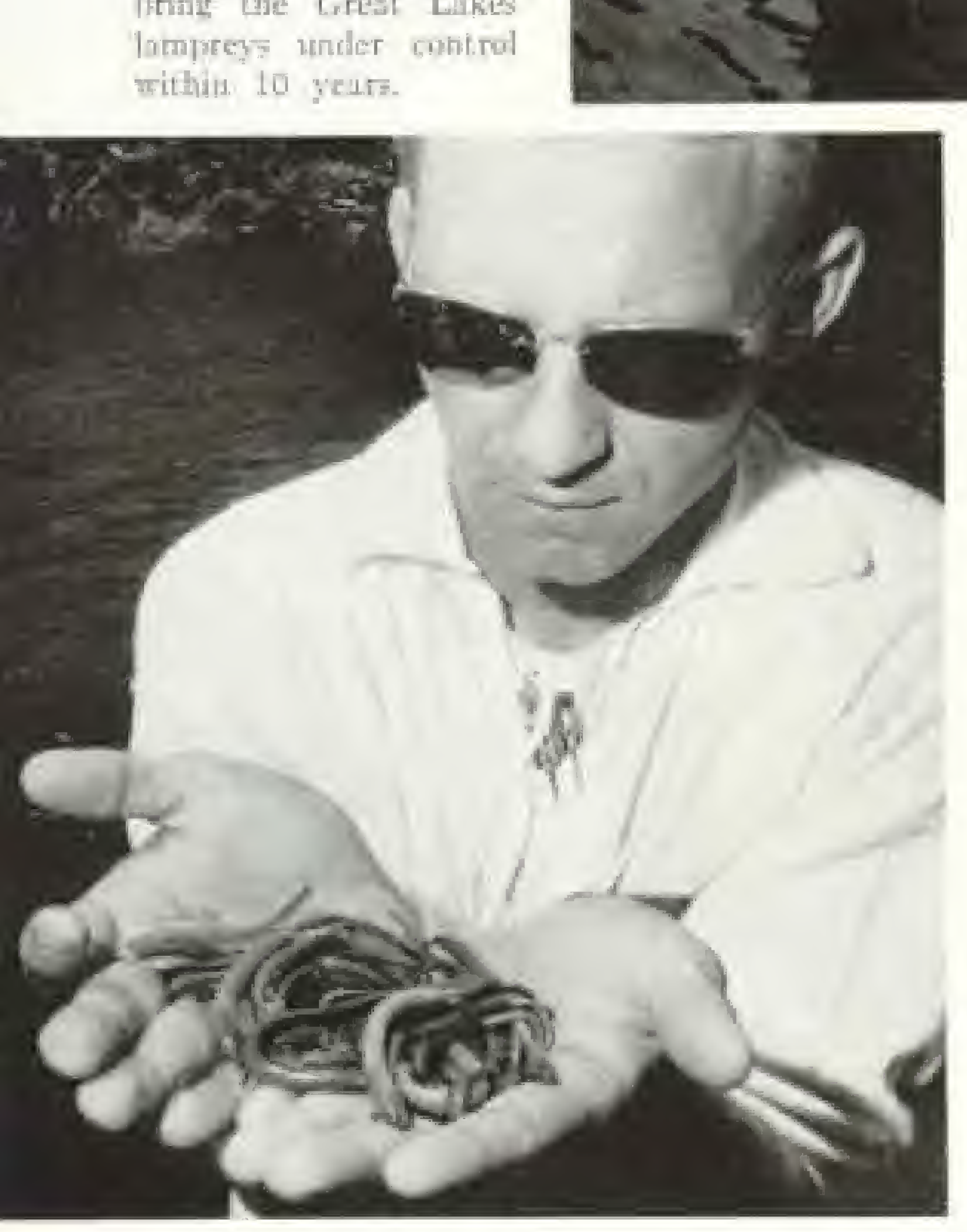
Conservationists treat the tumbling upper rapids of Michigan's Silver River with a chemical harmless to food fishes. This waterfall speeds the mixing process.

Lamprey Hunters Search a Stream for Casualties

Scientists tested nearly 6,000 chemicals before finding a larvicide fatal only to lampreys. Fisheries technicians dilute the poison, pumping it into streams above mud flats where young lampreys burrow. The pests absorb the chemical, usually dying within 12 hours.

This U. S.–Canadian team tests a brook at Baraga, Michigan. Using the walkie-talkie, the men report results to the pumping crew.

Victims of poison, dead larvae fill the hands of a fisheries worker. Scientists believe they can bring the Great Lakes lampreys under control within 10 years.



Not all voyagers between the oceans and the inland seas are so graceful as *Dyna* or so useful as the salties. Take the lamprey eel.

A native of the salt seas, the lamprey is a fish with a vicious, tooth-ringed sucker mouth (page 478). Attaching himself to other fishes, he rasps through their sides and drinks their vital fluids.

The lamprey long ago traveled up the St. Lawrence and into Lake Ontario. Niagara Falls stopped him until 1829, when Canada opened the Welland Canal. The killer was not discovered in Lake Erie until this century, but by the late 1930's it had virtually exterminated the lake trout of Huron and Michigan and was coming through the Soo into Lake Superior. A dozen years ago—probably too late for the lake trout, but maybe in time to save the whitefish and other Lake species—Canada and the United States began joint control measures.

The lamprey spawns in streams tributary to the Lakes. Most of its seven-year life it

spends as a larva buried in the beds of these streams. Weirs and electric fences failed to control the pest. Now the biologists have a poison that is death to eel larvae but does not harm other fish (page 479 and opposite).

The canal that accidentally loosed the lamprey on Lakeland has been superseded three times since 1829; the present 28-mile Welland is the fourth across the Niagara peninsula. It opened in 1932. At about the same time, ships from overseas established regular Lakeland schedules. This was coincidental. The Welland was built primarily to release the Canadian grain fleet of the western Lakes into Lake Ontario and the St. Lawrence.

The Americans at the Soo had to overcome a difference in Lake levels of 23 feet. The difference at the Welland is 327 feet, 186 of it in a single jump at the Niagara escarpment, which produces the 167-foot Niagara Falls, 10 miles east of the canal.

The escarpment passes near the town of Thorold, Ontario, where a mill owned by the Chicago *Tribune* makes newsprint from logs brought in by ship from the St. Lawrence River Valley. Here the so-called "twin-flight locks," similar to the Gatun Locks in the Panama Canal, climb the steep break in the land.

"Only these three of the Welland's seven lift locks are doubled so that upbound and downbound boats can pass one another," said Paul P. Ellis, the Canadian Department of Transport engineer in charge. "When the traffic warrants it, Canada will twin the other four and the upper guard lock."

Ship Sinks Down a Hillside

From where we stood at the bottom of the flight, we could see a red-painted laker on the uppermost step of the huge staircase, the words Canadian Steamship Lines lettered across her sides. It was an incongruous sight, this landlocked ship bound down the side of a grassy hill. She sank from view, then reappeared as the gate opened, gliding silently into the middle lock to repeat the lowering process.

"The *T. R. McLagan*," said Paul. "I think she has ore for Hamilton this time. Last year she set the Welland record for largest single cargo—22,217 tons of coal."

It was a warm, sunny day. Boys swam in the canal. "One time," said Paul, "a lad swam out to a ship in a lock and banged on its side with a rock. The captain thought the vessel was hitting the wall. He swung his wheel over and rammed the other side.

"When he found out what had happened, he wrote us an angry letter. Since then we've kept the boys out of the locks, but they do manage to get into the connecting canals."

The *McLagan* is a 715-footer, longest that Welland authorities will now pass. Shipbuilders we met at the canalside yards of Port Weller Dry Docks, Ltd., jestingly told Paul their next boat would be a lot longer.

"Then plant flowers in her and sell them to tourists," retorted Paul. "I won't let her out of the canal."

Ports Vie for Seaway Trade

The ships from overseas pass out of the canal at Port Colborne and steam west on Lake Erie. As I write this, the pattern of the new Seaway traffic has not been entirely established, and nobody knows for certain which Lakes cities will become great Seaway ports and which will not.

Logically enough, shipping men plan to serve the larger ports at first and add others to their schedules as traffic develops. The larger ports I heard most frequently mentioned were Toronto and Hamilton in Canada, and Chicago, Milwaukee, Cleveland, Toledo, Buffalo, and Detroit in the United States.

Sandusky, Ashtabula, Green Bay, Windsor, Sarnia, and many another city and town on a Lake shore hold aspirations to Seaway port status, and in some cases are backing their optimism with costly harbor improvements. The twin ports of Duluth and Superior, which together ship more iron ore than any other United States port, are looking to $90,000,000 worth of new terminal facilities to attract overseas shipping.

When the Seaway became a certainty, the United States Government declared some of the Great Lakes-overseas routes essential to the national well-being and offered subsidies to American-flag operators who would undertake to serve them; foreign shippers, with their low costs, have long monopolized the runs. Grace Line is one of several American operators planning to enter Seaway trade.

All but one of them are seasoned salt-water operators. The only exception thus far is the T. J. McCarthy Steamship Company of Detroit, long established on the Lakes.

I went to Detroit to see the ore I had trailed from the mines of Minnesota to the mills of Gary reach the end of its journey in the country's best known manufacture, the automobile.

At the fantastic General Motors Technical

Wisconsin's Tidy Dairy Farms Line the Shore of White-capped Green Bay

Trim houses, fertile fields, and painted barns proclaim the prosperity of the Nation's leading dairy State. Near this spot Jean Nicolet, 17th-century

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

French explorer, landed in his search for a northwest passage. Green Bay later became Wisconsin's first permanent settlement. Here tractors on their way to cut corn for silage pass drowsy cows in a new-mown field. Distant laker wallows toward the port of Green Bay.

JOE CLARK, FROM FRIENDS MAGAZINE

Indian Dart Throwers Launch Rocketing "Snow Snakes"

Arm cocked for the throw, an Indian of the Six Nations Reserve near Brantford, Ontario, hurls his snow snake, a javelin designed to streak down an icy track for distances up to a mile.

No skier lavishes fonder care on his gear than the snow-snake addict on his shafts. A player may take two years to fashion his lance of hickory or ironwood, jealously guarding his formula for waxing and finishing. He may boast a collection of a dozen or more snakes, matching his stick to track conditions as a golfer chooses his club. Results dazzle the uninitiated: a well-hurled snake attains a speed up to 120 miles an hour.

Another snaker (opposite) sights down the track—a raised groove of hard packed snow—for the windup.

Spectators at left smooth the course by dragging a log through the slot.

Center, designers and engineers even now are putting the finishing touches on blueprints of cars we will be buying in 1961. My escort unlocked a series of doors to let me into a studio where men in artist's smocks dropped sculptor's tools and covered clay car models with black cloths at my approach.

One was slow: I had time to note that his model had no rear fins:

"You weren't supposed to see that," said the man. "Now I'll leave you guessing: Will it ever have fins, or haven't I gotten around to putting them on yet?"

Ford Motor Company offers visitors to Dearborn the spectacle of its River Rouge assembly line. The company, I hope, will not mind if I think of that line as a symbol of the entire United States automobile industry, a place where the incalculable energy of the earth's mightiest industrial complex focuses to a single point: a two-toned, smoothly purring 1959 automobile. With fins.

Since Detroit is a Seaway port, I went to look at its harbor along the busy Detroit River, and there I saw automobiles fresh from the Chrysler plants being loaded into McCarthy boats (page 461).

"Today they go only to Buffalo and Cleveland," said Tim McCarthy, Sr. "Tomorrow, we hope, we'll carry them all the way to Europe." And he told me about his company's application for a Seaway route.

Mr. McCarthy has had more than 40 years of Lakes steamboating. His home port calls him "Mayor of the Detroit River." But his eyes sparkled like a youth's as he spoke of his plans.

"The Lakes keep a man young," he chuckled when I remarked about his enthusiasm. "Always something new going on."

The conversation returned vividly to mind a few weeks later. I was reading a letter from J. Baylor Roberts, another National Geographic photographer who traveled far and

Trout Lovers Crowd a Wisconsin Fish Boil

The Great Lakes' answer to the southern fish fry, fish boils feature trout simmered in a washtub with onions and potatoes. These chefs at Gills Rock carry a steaming basketful.

Trout, nearly extinct in Lake Michigan because of the lamprey, had to be imported from Lake Superior.

Cherry pies, another Wisconsin specialty, shuttle between cutting board and oven at Wrasse's Washington Hotel, Washington Island. Mrs. Helen Wrasse fills a crust from a bushel of gleaming fruit. Her niece offers a finished pie for inspection.

KODACHROMES BY BRYAN ALLEN [illegible] AND NATIONAL GEOGRAPHIC PHOTOGRAPHER VOLKMAR WENTZEL © N.G.S.

wide across the Lakes country last summer.

"I am aboard the *Edmund Fitzgerald*," wrote Joe. "We are 15 minutes out of Silver Bay, Minnesota, bound for Toledo with 22,600 tons of taconite pellets."

The 729-foot *Fitzgerald*, I knew, was the newest, largest laker (page 460). And so is the taconite process new, the latest development in the steel industry, tapping a bountiful supply of raw material for mills faced with depletion of the rich Michigan and Minnesota ores.

Taconite is a low-grade, iron-bearing rock. You concentrate, or "beneficiate," this poor ore to a grade usable in a steel furnace. It sounds simple, but for decades nobody could do the job cheaply enough. Years of work by E. W. Davis, the genial "Mr. Taconite" of Silver Bay, finally resulted in an economically feasible method.

I saw the process in use at Mountain Iron, Minnesota, by Pilotac, a small experimental plant of United States Steel Corporation's Oliver Iron Mining Division. Pilotac grinds the taconite, containing about 25 percent iron, into a fine flour. Magnetic separators concentrate the iron-rich particles. Ovens bake the concentrate into small nuggets, well-liked at the mills for their controlled 65 percent iron content and their handy uniform sizes.

Mesabi Holds Enough Ore for Decades

Reserve Mining Company is already in the taconite business on a large scale. Its plant at Silver Bay, which loaded the *Fitzgerald*, is less than five years old. So is the town in which its employees live, a neat community that sprang suddenly, in a boom like that of Elliot Lake, from bear-infested wilderness on the heights above Lake Superior.

The Reserve people told me the supply of taconite is all but limitless. The iron-bearing rock of the Mesabi Range, they said, is 95 percent taconite. The rich direct-shipping ores, even including output of the famous open-pit mine at Hibbing (page 455), never amounted to more than 5 percent of the range! Wisconsin, Michigan, and Canada hold vast supplies of taconite.

Reserve's deposit at Babbitt in the Mesabi is nine miles long, half a mile wide, and 175 feet deep at the deepest point. It holds at least a billion and a half tons of ore, or enough to make ten million tons of 65-percent concentrate per year for the next 50 years.

I rather imagine a steelman feels that Lakeland's iron ore is its greatest gift to mankind. But Chic Shave of Elliot Lake would vote for uranium and Peter Edisen of Isle Royale for the herring and the blue water and the bracing silent air with the scent of balsam in it.

I have my own nomination; the thought came to me in our home, one evening after we had returned from the Lakes. Janice was doing her homework on the living room floor. Pete the tiny poodle dreamed his dreams by the fireplace. The hi-fi machine played Dvorak's *New World Symphony*, and I thought, "This music is telling me Lakeland's finest story."

Whole Earth Gave Lakes a Heritage

The story begins a hundred years ago. A wave of immigrants rolls up the Hudson River and along the Erie Canal. They board the sailing boats and the steamers of the inland seas and press westward—the hardy Scandinavians to the pine woods, the Finns and Welshmen to the mines, the Belgian dairymen to Green Bay, the sturdy Germans to Milwaukee.

A band of Czechs landed on the western Lake Michigan shore and plunged on into the hinterland. In Iowa they stopped, and they founded the town of Spillville.

Dvorak, homesick in New York, came to Spillville in 1893. Here he found the culture of his homeland flourishing in the spaciousness of America. Here he polished and orchestrated the *New World Symphony*, to my mind the most perfect description in any medium of the marriage between old and new worlds that created the United States and Canada.

I saw the children of the marriage, the Czechs and the others, one night in the melting pot of Milwaukee, gathered in one hall by the International Institute of Milwaukee County to see one another's folk costumes, dance the old dances, and taste the dishes of their ancestors (page 474).

People of Many Names but One Land

Only the costumes and the dances and the foods were foreign. The people were the Americans of Lakeland, Americans like Lindbergh and Carl Sandburg and all those young men whose foreign-sounding names are carved in the granite tablets of the county war memorial down by the Lake shore.

I think the Great Lakes performed their best service when they attracted to this Nation from afar, as a magnet draws the sturdy iron, these fine people.

KODACHROMES BY NATHANIEL T. KENNEY, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Graceful sloop glides into port after the 333-mile Chicago-Mackinac Island race, one of the longest fresh-water contests in the world. These yachts, survivors of the Great Lakes' age of sail, made the run in three days.

Lake Breezes Lazily Ruffle the Flags on Mackinac Island's Grand Hotel

France and England once fought over this strategic outpost, now a tranquil summer resort. Bicycles and carriages throng its roads. Michigan law excludes motor vehicles from the island. One automobile dealer told the author, "We come here for a respite from traffic we help create."

Excursion ferry and distant ore boats ply the narrows. Mackinac Bridge leaps the Straits of Mackinac from the lower Michigan shore.

Icebreaker and Ferry Chew an Escape Route for a Stranded Ore Boat

Ice clamps a merciless grip on the Lakes four months of the year, driving ships to port. Floes jam bays and narrows for miles, turning the world's busiest waterways into silent white expanses. Trapped in Whitefish Bay, this freighter calls for help from a railroad ferry (foreground) and the Coast Guard icebreaker *Mackinaw*.

Northeastern United States Map Reflects Wealth and Grandeur of the Lakes

TOM PAINE, writing in Philadelphia in the Revolutionary year 1776, envisaged an America with "nothing to do but to trade" with the world.

Yet he could scarcely foresee what the next 183 years of trade would mean to the newborn Nation, standing uncertainly on the Atlantic and looking west across the wild Appalachians to the far-off Mississippi. That same area today, the **Northeastern United States**, unfolds in dramatic perspective on the 10-color **Atlas Plate No. 6**, going this month to 2,400,000 National Geographic families.

Industrial Heart of a Hemisphere

This ninth map in The Society's growing Atlas Series* depicts a concentration of population and industrial power unmatched in the Western Hemisphere.

Here, in barely one-sixth of the United States, live more than half its 176,000,000 people. From this region pour nearly three-quarters of the country's manufactures—measured in money, about 97 billion dollars' worth in a single year. And here, from ocean ports now set deep in the continent, flows the endless trade that has turned a forest-mantled hinterland into a modern "megalopolis"—a single industrial and commercial complex.

The map sweeps from the lower St. Lawrence River to the western tip of Lake Superior, from the Virginia Capes to the confluence of the Ohio and Mississippi Rivers. In generous scale of 45 miles to an inch, it depicts the entire Great Lakes area, as well as the richest part of Canada, with its cities of Quebec, Montreal, Ottawa, and Toronto.

Man-made channels and locks of the new St. Lawrence Seaway, opening this month in advance of ceremonial dedication by Queen Elizabeth II and President Eisenhower in June, will bring deep-draft ocean ships to the newest North American coast.

Motorists in a hurry can now drive the 800 miles from New York to Chicago without slowing down for a single traffic light. Bold red lines of a burgeoning highway system—double lines for toll-free superhighways, dashed-in for toll-charging turnpikes and thruways—give the Northeast other new veins of transport.

New roads, the black web of railroads, and red-starred airports draw ever closer the great cities of the Atlantic seaboard, Boston, New York, Philadelphia, Baltimore, and the Capital City of Washington; the coal fields of West Virginia and the blue-grass country of Kentucky; the steel mills of Pittsburgh and the automobile plants of Detroit; the rolling farmlands of Indiana and Illinois and their overlord of commerce, Chicago, with its front door now figuratively on the sea.

There are still striking contrasts in this realm. The lonely fur trapper, as in days of the French *voyageurs*, still roams the northern Lakes country; his winter's work appears in glossy coats on Manhattan's Fifth Avenue.

The northwest corner of Maine still shows not a road or a town. Elsewhere, cities have exploded with suburbs since World War II. Washington, overflowing the District of Columbia, now fills red-lined shading from Rockville, Maryland, to Alexandria, Virginia. The name Levittown appears three times in 100 miles on the map: the newest, in New Jersey opposite Philadelphia, has 17,300 houses on 5,000 acres, rivaling older Levittowns close by in Pennsylvania and on Long Island.

Lakes Only 100 Centuries Old

The map's most impressive and eye-catching features, however, remain the five Great Lakes. Tracing the course of a Seaway freighter from below Quebec to the twin ports of Duluth-Superior, more than 1,500 miles to the west, one may reflect that nature's work still dwarfs man's prodigious changes.

Geologists believe it took 180 million years of weathering and erosion to carve the lake beds. Four times, at least, advancing ice sheets gouged and recarved the rocky basins. As the last Ice Age melted away about 10,000 years ago, it left behind the world's largest accumulation of fresh water. Together the Great Lakes, sprawling across their domain of trade, cover 95,000 square miles, equal to the combined area of Belgium, the Netherlands, and Luxembourg—plus four Denmarks!

*Atlas Plates previously issued: Southeastern United States (No. 8), North Central United States (9), U. S.-Canadian National Parks (13), Southern South America (28), British Isles (31), Poland and Czechoslovakia (38), Greece and the Aegean (40), and Lands of the Eastern Mediterranean (47).

A convenient Folio to hold Atlas Maps is available for $4.85; a packet of the seven maps issued in 1958 for $3; individual maps for 50¢. Write to National Geographic Society, Dept. 5, Washington 6, D. C.

Doves, sheltered beside the Tomb of Jesus, symbolize the Holy City's hope for peace.

Jerusalem painfully rebuilds its shattered glory. Jordan's Old City, seen through a telephoto lens from the Mount of Olives, spreads out from the shadowy Dome of the Rock. Beyond the walled maze, new skyscrapers on the sunlit slope dominate Israel's capital.

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Jerusalem
THE DIVIDED CITY

By JOHN SCOFIELD

Assistant Editor, National Geographic Magazine

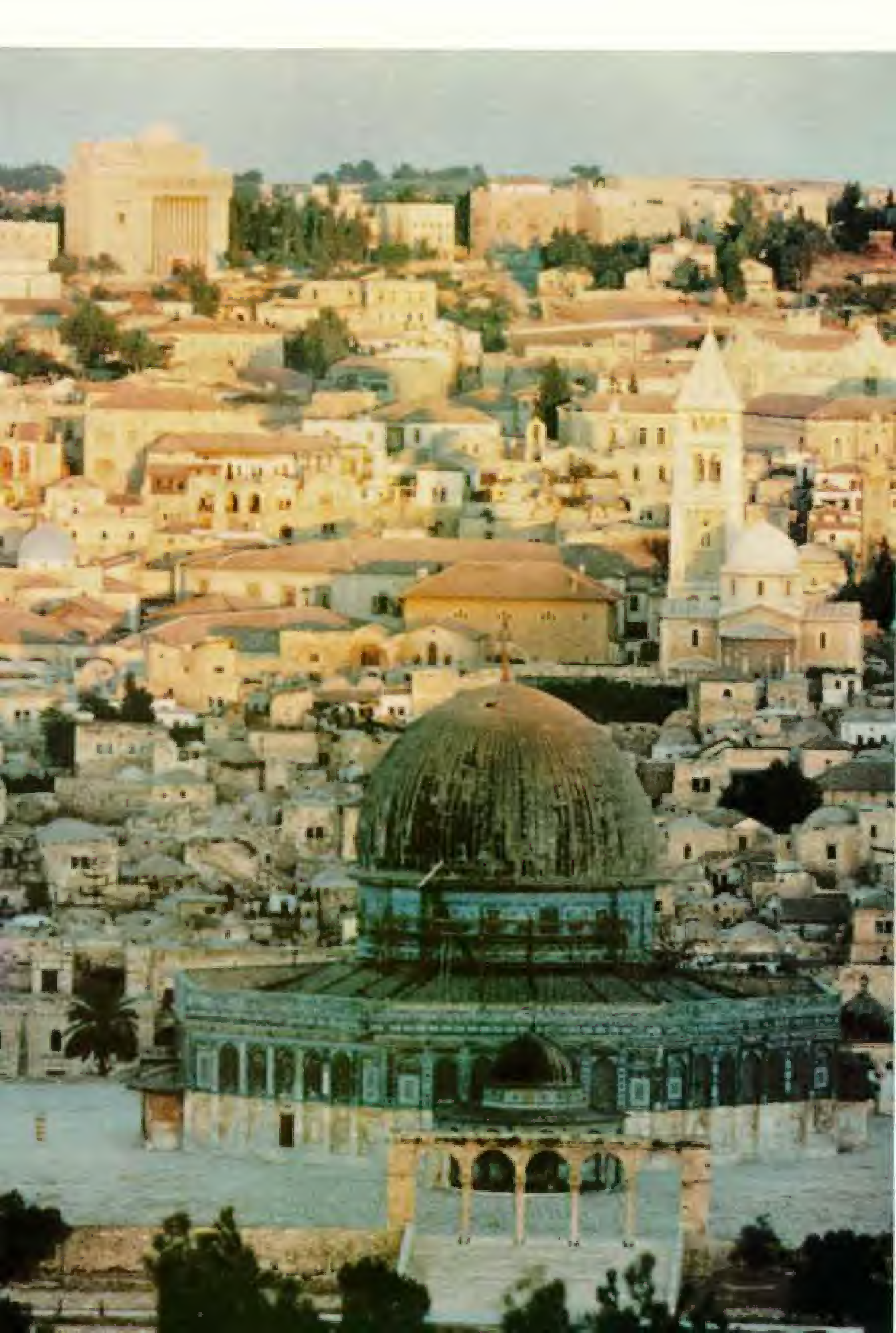
Photographs by BRIAN BRAKE, Magnum

"THERE'S NO PLACE else on earth," my friend said, "where you can travel so far in 100 yards."

I had walked the three blocks from my hotel to stare once again across the familiar strip of no man's land that divides the city of Jerusalem.

"Here on the Jordan side," my friend went on, "things are much as they were when the Crusaders left. There are new buildings, of course . . . but if you were to drop one of Godfrey de Bouillon's knights outside St. Stephen's Gate, I'm sure he could still find his way to the Holy Sepulcher.

"But over there . . ." He waved an arm



toward the Israel side. "Nothing remains the same. French movies, a symphony orchestra, a Chinese restaurant, an Italian puppet show, crowded hotels, a great university . . ." he paused to grope for words and ended lamely . . . "everything."

Near us a bored soldier in British-type battle dress and the red-and-white kaffiyeh of the Jordan Army slowly walked his post. A stone's throw away the blue-and-white flag of Israel snapped in the wind.

My companion on that first morning back in Arab Jerusalem was one of the handful of diplomats, church officials, and United Nations representatives who can cross freely from one side of the Holy City to the other.*

As we stood talking, a Volkswagen with orange-and-black license plates swung around the Israeli customs shed and stopped in the no man's land between the two frontiers. The driver got out and with practiced familiarity unbolted the Israel plates, replaced them with black-and-white Jordan numbers, and spun past us into the Arab half of the city.

"A civilian employee of the United Nations," my friend said, "who bought an automobile out here. He has had to license his car in both countries. Of course, neither will recognize the other's plates."

So much trouble, I reflected, to pick up a few crisp pastries from a baker in the Old City and take them home to a flat a few blocks away in New Jerusalem.

Trilingual Pass Opened All Doors

During 1951 and 1952 I had spent a year in Jerusalem, living there with my family as a military observer on the Israel-Jordan Mixed Armistice Commission.†

In the name of the United Nations, I had traveled freely on both sides of the divided city, investigating frontier clashes between the two nations and occasionally helping to arrange a cease-fire when a really serious disagreement took place. My open-sesame during these eventful months was a small sheet of folded cardboard identifying me in English, Arabic, and Hebrew as a member of the U. N. Truce Supervision Organization for Palestine and calling upon all authorities to grant me free passage.

Now, six years later, I was back in Jerusalem as a *sahafi*, a journalist, to see old friends on both sides of the armistice line and to report on the changes that have come to the City of Peace. But this time there would be no white card to whisk me magically back and forth through Mandelbaum Gate. Like any other traveler, I would start my survey on the Arab side, and then cross into Israel. And, once over the line, there would be no returning to Jordan, for ordinary travelers are permitted to cross in only one direction.

Mandelbaum Gate Links Two Worlds

Since 1948, when a truce halted the war between Arab and Jewish forces in Palestine, Mandelbaum Gate has been the only link between the divided halves of Jerusalem. A few intangible threads have survived. The muezzin, calling each day before dawn from his minaret by the Dome of the Rock, summons the faithful to prayer with a sinuous ribbon of sound that for a moment makes the sleeping city whole again. And at sunset on Friday, Moslems in Arab Jerusalem glance unconsciously at their watches when the whistle blows a few hundred yards away in Israel to mark the start of the Hebrew *Shabbat*.

But for the average resident, there could not be more complete separation if an ocean lay between the two sections of the city. For one has become the capital of the energetic new State of Israel, and the other lies in the Hashemite Kingdom of Jordan (map, page 496). And, technically, the two are still at war.

Actually, Mandelbaum is not a gate at all, but simply a place near the heart of Jerusalem where three streets converge. Open to the sky and ringed by the wreckage of once-stately houses built of the beautiful local limestone, it preserves the name of a merchant who lived near by. To the Arabs it is Saad wa Said, for two brothers whose homes were here too. North and south extends the ugly tangle of no man's land, bounded by walls and coils of barbed wire, where unwitting trespassers are likely to be shot by the first soldier on either side who spots them (pages 511 and 513).

The memory of the Old City—the tightly packed third of a square mile of Arab Jerusalem that holds so many of the Christian world's most sacred shrines—drew me away from the 20th-century drama of Mandelbaum. I slipped into the traffic that surges along dusty Nablus Road and let it carry me south to another, far older, portal.

The walled city, I found, had changed

* See "Crusader Lands Revisited," by Harold Lamb, National Geographic, December, 1954.

† See "Hashemite Jordan, Arab Heartland," by John Scofield, National Geographic, December, 1952.

SUPER ANSCOCHROME BY BRIAN BRAKE, MAGNUM © NATIONAL GEOGRAPHIC SOCIETY

Dome of the Rock Crowns a Site Sacred to Moslem, Christian, and Jew

Here, it is written, Jehovah dwelt in temples built by Solomon and Herod; Christ cast out the money-changers; and Mohammed leaped to heaven on his horse. Fingering prayer beads, an Arab meditates at arcades where, says a local tale, Judgment Day scales will hang.

JERUSALEM
ISRAEL
JORDAN
Mea She'arim Quarter
Mandelbaum Gate, the only link between the divided halves of the city
No Man's Land
Jordanian Sector
Hospice of St. Paul
Zion Square
Musrara Quarter
Herod's Gate
Moslem Quarter
Damascus Gate
Notre Dame de France
St. Stephen's Gate
New Gate
Christian Quarter
Haram esh Sharif
Garden of Gethsemane
Mount of Olives
Church of the Holy Sepulcher
Church of All Nations
At Tur
New Jerusalem
Lutheran Church of the Redeemer
Old City
Dome of the Rock
Jaffa Gate
Inn of the Olive Oil Street
Wailing Wall
Aqsa Mosque
Jewish Quarter
Armenian Quarter
Valley of Kidron
Y.M.C.A.
King David Hotel
King George V Avenue
Dung Gate
Zion Gate
Arab Refugee Camp
Mount Zion
Windmill
Tomb of David
United Nations Training Vocational Center, 5 miles; Airport, 4½ miles; Post Office Project, 1½ miles
Lydda, 24 miles; Deir Aiyub, 10 miles
Old Hadassah Hospital
Mt. Scopus
Israeli Sector
Old Hebrew University
Giv'at Shaul
American Colony
No Man's Land
Mandelbaum Gate
Deir Yasin
Augusta-Victoria Hospital
Jordanian Sector
No Man's Land
Chaim Weizmann Square
Sha'arei Hessed Quarter
New City
At Tur
Old City
New Hebrew University
Givath Ram
Amphitheatre
52 miles to Amman
1 mile to New Hadassah Hospital
JERUSALEM
Bayit Vegan
'Ein Kerem
City Limit
No Man's Land
Qatamon
El Malha
U.N. Truce Supervision Headquarters
Talpiyot
Bayt Safafa
STATUTE MILE
©N.G.S.
2½ miles to Bethlehem

hardly at all in the six years I had been away. The same crush of men and animals forced its way through busy Damascus Gate.* Inside the walls I walked again through the roofed, noisy Malculsinat, the "Street of Bad Cookery" of the Crusaders (page 499), and stopped to eat a square of *baklava*, a confection of thin pastry sheets sandwiching a layer of pistachios moistened with thinned honey.

A porter, bent nearly double beneath the weight of half a freshly butchered camel, growled the guttural *ooo-aaahh* of the carriers who must force their way through the city's packed lanes. And at an intersection I heard once again the familiar cry of the beverage sellers: "*Tamr hindi!* Fruit of India! Here is your drink, O thirsty one."

In the Haram esh Sharif, where Solomon's Temple once gleamed, electric lights outlined a rectangle of graceful Arabic script above the western entrance to the Dome of the Rock: "May God give victory to Hussein, Protector of the Aqsa Mosque and the Holy Land."

The young Jordanian monarch's domain includes sites revered for centuries by Christians, Jews, and Moslems. As if to emphasize the precarious role of the 23-year-old king, colored portraits of King Faisal II, Hussein's ill-fated cousin who lost his life in last year's Iraqi coup d'etat, ornamented the columns on either side of the door.

Paint Spots Mark a Pilgrim's Return

Along the steeply rising Street of the Chain a white house front freshly painted with gay red and orange spots announced the return of a man from the hadj, the pilgrimage to Mecca that every devout Moslem hopes one day to make. And I paused again, as I had done so many times before, in the cool peace of the old Crusader Church of the Holy Sepulcher.

It is a strange place, patched together by many sects—Latin and Greek, Armenian and Coptic, Syrian and Ethiopian—each with its own jealously guarded corner for a chapel or an altar. Protestants are sometimes shocked by the pageantry of the orthodox rites here, the heady scent of incense and the gewgaws that the simple folk of Arab Jerusalem bring reverently to this holiest of Christian shrines. But no one could watch, as I did, from a shadowy corner of the old building and not be moved by the faith of these people whose ancestors may have been present, sorrowing, at the Crucifixion.

That night I wandered through many of the same streets, now shuttered and deserted. From a door I had passed unnoticed by day came a sound as if a huge ball of wet clay were being dropped again and again onto a stone floor. Inside, a man stood in a shoulder-high vat, trousers rolled above his knees, stirring with bare feet an oily mass of *kusbeh* —a sesame-seed residue that supplements the diets of sheep, goats, and cows in this pasture-poor land. Each time he swung his foot in an arc and drove it to the bottom of the vat a huge bubble formed and burst, making the soggy *boom!* I had heard from the street.

Tiaras of Light Crown Old City

Darkness brought another discovery. Crowns of electric lights now adorn Jerusalem's minarets to brighten the city's holidays. King Hussein had visited Jerusalem that afternoon, and in his honor, as I walked slowly home in the dark, the lights sparkled above the sleeping city like diamond tiaras.

Gradually I realized that the Old City has changed in other subtle ways, and for the better. The streets are cleaner, and containers for litter hang here and there on ancient walls. A newly resurfaced road pierces Dung Gate —named for the heaps of refuse that lay outside in Biblical times—so that automobiles can reach another quarter of the town. And, strangest of all, demands for baksheesh no longer greet visitors at every turn. Begging has been forbidden.

"We are trying to modernize our city without changing its character," Rouhi Khateeb, the Old City's mayor, told me. "But we face problems that would give a modern city planner nightmares. Parts of our sewage system, for instance, date from Roman and Byzantine times.

"For century upon century the people have built their houses on the remnants of older houses. Some of our streets rest on nearly 100 feet of rubble. What would an American mayor think if he had to dig straight down for 100 feet to get at a clogged sewer pipe?"

Old Jerusalem's officials, I found, are as concerned as Washington's or Williamsburg's for the fragile quality of their trust. There seems no more likelihood of neon signs appearing opposite the Garden of Gethsemane, or of modern store fronts defacing the Way of the

* See, in the NATIONAL GEOGRAPHIC: "Jerusalem to Rome in the Path of St. Paul," by David S. Boyer, December, 1956; and "Home to the Holy Land," by Maynard Owen Williams, December, 1950

Restless Streams of Life Flow Through the Old City's Markets

Cubbyhole shops in the Arab bazaar spill goods into a dim and tortuous maze. Everywhere hangs a heady bouquet of fresh-ground coffee, fresh-baked bread, and sweet, sticky pastries. Strident voices hawk wares and haggle over prices.

Breadman (above) carries stacked *samuni* loaves past stalls hung with baskets.

A farmwife (opposite) balances a load of pomegranates for sale in Jerusalem's Inn of the Olive Oil Street. Crusaders dubbed the thoroughfare Malcuisinat—"Street of Bad Cookery."

Grandmothers (right) color the scene with red turbans and tattooed faces.

Film Poster Attracts a Contemplative Bedouin

Motion pictures produced in Cairo, the Hollywood of the Arab world, play in theaters from Casablanca to Baghdad. Enthusiastic audiences greet them with cheers, shouts, and hand claps.

This Jerusalem billboard announces a musical show; Arabic characters name the Egyptian stars, writers, and producer-director.

U. S.-made Cars Park Outside Damascus Gate

Bumpy with stairs, few of the Old City's narrow streets can accommodate automobiles. These line up between Arab Jerusalem's busiest portal and the fortresslike Hospice of St. Paul, built in 1910 by German Catholics.

From each car's rear-view mirror dangles a blue-bead charm, a kind of rabbit's-foot insurance against the evil eye.

A new shopping center occupies the arcade at upper right (page 507).

Cross, than there is of a hot-dog stand rising beside the Tomb of the Unknown Soldier.

"A city council must pass on all improvements," the mayor assured me. "And the Department of Antiquities has a hand in safeguarding Arab Jerusalem." No structure may be changed without written permission, and an ordinance forbids the erection of any building within 166 feet of the 16th-century walls that still encircle the Holy City.

One project of the municipal council particularly appealed to me. At the foot of the Mount of Olives, in the Garden of Gethsemane, grow a few gnarled olive trees tended carefully by Franciscan fathers of the neighboring Church of All Nations. Elsewhere, time and browsing goats have stripped the hill of nearly all its greenery.

"The municipality hopes to buy land on the Mount of Olives," Mayor Khateeb said, "or at least to get the agreement of the owners of the land, so that we can terrace the slope facing

the city and plant it again with olive trees."

I left the mayor's office with the feeling that the protection of old Jerusalem's unique cultural heritage rests in able hands. And as I wandered about the city in the days that followed, I saw one bit of evidence after another of an awakening interest in the long-overdue restoration of the holy places.

At the Dome of the Rock, scaffolding now enfolds one side of the stately mosque. Local Moslems, with some $500,000 contributed by neighboring nations, have started the complex job of restoring the seventh-century shrine to its original glory (pages 493 and 495).

Ancient Church Stands Near Collapse

To Christians, the most heartening portent for the future of the holy places centers around the Church of the Holy Sepulcher. Wracked by an earthquake in 1927, battered by mortar fire in the 1948 fighting, and strident with the quarrels of the many sects that share its dim passages and altars, the building has long stood on the verge of ruin.

After the earthquake, British Mandate officials did what they could by shoring the building inside and out with steel scaffolding. But even this well-intentioned gesture contributed to the church's decay. As scorching days alternate with chilly nights in 2,600-foot-high Jerusalem, the scaffolding expands and contracts, loosening the very stones it was built to reinforce. If the girders were to be removed without extensive repairs beforehand, the old structure would almost surely collapse.

Recently the three communities whose shrines occupy the greater part of the church—Greek Orthodox, Roman Catholic, and Armenian—put aside their old quarrels to begin a 5- to 10-year, $1,400,000 restoration.

"The one thing we are agreed on," said Father Albert Rock, who represents the Roman Catholics of Jerusalem on the restoration committee, "is that nothing will be modernized. The Tomb of Jesus will not be touched except for the necessary strengthening."

Elsewhere, he said, there may be opportunities for important discoveries. The square pillars around the Sepulcher, for instance, will be stripped. Inside, it is hoped, are columns of the 11th century, which have lain hidden since the church was repaired after having been damaged by fire in 1808.

"But you must tell not only about the Old City," my Jordanian friends insisted when they learned that I would write an article on Jerusalem. "You must tell about our new city as well."

They are right, for here north of the old walled city is where the greatest change has taken place. When Jerusalem was divided between Arabs and Jews, the Old City's two hotels lay on the fighting lines; the dining room of the American Colony, presided over by gentle, 70-year-old Mrs. Frederick Vester, became a clearing station for the wounded. Today both hotels are back in use, together with eight or ten modern competitors. Whole streets of shops have risen (page 507); not surprisingly in a city that lives by visitors, there are nearly as many travel agencies as grocery stores.

If the walled city clings to the ways of the Arabian Nights, this new section of Arab Jerusalem mirrors constantly the problems and promises of today. Its shops bulge with luxury goods—German radios, Swiss watches, fancy foodstuffs—but prices are high and buyers few. And while I was there, armed patrols of Jordanian soldiers were a constant reminder that the city lived, until a few months ago—as did all of Jordan—under martial law. Gun and rifle ports in every wall and building facing no man's land reflect the uneasiness of a people who have lived for more than 10 years within a few yards of neighbors as well armed and as nervous as themselves.

Unfortunately, the story of Arab Jerusalem has its ugly side. This city of nearly 75,000 holds only a few of the close to a million refugees who fled from Israel during the 1948 war. But even here the misery of these unfortunates defies description.

In a camp within the walled city, where 5,000 displaced Arabs have for 10 years found shelter of a sort in the wreckage of the old Jewish Quarter, I felt my way down a flight of steep, narrow stairs into a windowless underground room to talk to a family of refugees. They had fled from Deir Aiyub, in

Golden Lamps Swing Above the Spot Revered as the Tomb of Jesus

Arab Jerusalem's Church of the Holy Sepulcher encloses the most sacred shrines in Christendom: the traditional sites of Calvary and the rock-hewn chamber where Christ rose from the dead. Believers from the ends of the earth have worshiped here for centuries, wearing the stones smooth with kisses and washing them clean with tears.

[illegible] © NATIONAL GEOGRAPHIC SOCIETY

Worshipers kneel in prayer around the Stone of Unction, preserved as the place where the crucified Christ was prepared for the tomb. "Then took they the body of Jesus," wrote St. John, "and wound it in linen clothes with the spices, as the manner of the Jews is to bury."

Latin, Greek, Armenian, Syrian, Ethiopian, and Coptic religious communities hold services in the Church of the Holy Sepulcher.

A priest lifts his hands in benediction before the altar of the Greek Orthodox Cathedral, one of the many places for worship within the old Crusader church.

Lighted tapers guide pilgrims to the final Stations of the Cross.

what is now a no man's land west of Jerusalem.

Inside the cavelike chamber, pleasantly cool now but murderously cold during the winter rains, an old woman puttered aimlessly. Two teen-age girls slipped shyly into a corner. There was no furniture; only a few sleeping mats and an earthenware jar for water. On the floor a man dozed fitfully, as if aware of a stranger's presence.

"Insane," the camp director said. "There is no place for him. We have an asylum, but there is room only for the dangerous ones."

I asked how many people lived in the room, and the camp director relayed my question to one of the girls.

"Seven," she said.

"Are any of them working?"

"*Fecsh,*" she answered. "None."

One of every three residents of Jordan is a refugee who receives from a U. N. relief agency a monthly ration of about 25 pounds of flour, sugar, rice, cooking oil, and beans.

"This has created quite a problem," ration distribution officer George B. Vinson told me. "Jordan is a poor country, where work is scarce. A refugee with a ration card to fall back on can take a job at a lower salary than a non-refugee. The poor man these days is the resident Arab who has no ration card."

Few Graduates Find Jobs in Jordan

At a United Nations vocational training school across the road from Arab Jerusalem's newly modernized airport, principal Henry R. Knesevich—himself a refugee born in Gaza of Dalmatian and Lebanese parents—talked of the difficulties that confront even the most talented of displaced Palestinians.

"We have 272 refugee students here," he said, "selected by competitive examination from some 4,000 high-school graduates. They are our best hope for the future. We give them a two-year course as carpenters, surveyors, draftsmen, electricians, automobile mechanics, blacksmiths, welders—in all, 15 trades that the country desperately needs. Yet only a few of them, not more than 15 percent, will be able to find work here in Jordan.

"Draftsmen are our 'best sellers,'" Knesevich went on. "We have three from past classes working in Jordan. One gets 15 dinars a month—about $42. The other two make 27 dinars. Every other draftsman who has left here has found work in Iraq at an average of 65 dinars a month.*

*See "Iraq—Where Oil and Water Mix," by Jean and Franc Shor, NATIONAL GEOGRAPHIC MAGAZINE, October, 1958.

Jordanian Jerusalem Leaps the Wall; New Shops Line a Six-lane Boulevard

In June 1954, bullets from Israeli-held heights made a death walk of this street near Damascus Gate. In turn, Jordanian fire sprayed Notre Dame de France, on the horizon. Now an anti-sniper barricade at the end of the road discourages shooting and protects shoppers. No man's land lies between it and the hilltop. The Old City wall (left) runs parallel to the road.

"With luck, a carpenter here can earn 20 piasters a day—56 cents. In Iraq the minimum is 65 to 70 piasters. The good ones get as much as $4.20 a day.

"So you see," he said, "we educate the most promising of our refugees—rebuild them from ruined men to trained craftsmen—only to lose them."

Some of the school's graduates have emigrated to South America. Others have actually hitchhiked to tiny oil-rich Kuwait, braving 800 miles of one of the world's worst deserts in a desperate attempt to put their skills to work.

"And even then there is no guarantee of a job," Knesevich said. "Many of them arrive in Kuwait, after taking all sorts of risks, only to be put on trucks and shipped back.

"The older refugees," Knesevich concluded, "who have stagnated in camps for 10 years, have given up hope. People say they are lazy. After so long with nothing to do, perhaps they are. But not these youngsters of mine. You can't call a man lazy who will walk from here to Kuwait."

New Homes Built with Point 4 Aid

On the way back to Jerusalem I noticed an obviously new settlement of stone houses a few yards from the highway. Men were working on a road into its heart, and a gleaming bus stood by, apparently waiting for passengers.

"That's the post office project," my Arab guide explained mysteriously. "Would you like to visit it?"

Inside one of the houses, as clean and spacious as a modern New York City apartment, I talked with smiling Mary Tarazi and her teen-age son. The postal employees of Arab Jerusalem, she told me proudly, had formed a cooperative, each paying $14 a month until their equity amounted to $590. Then they borrowed nearly $130,000 more from United States Point 4 funds to put up 41 houses, one including a clinic, and a community center of five shops, a cafe, and a school.

"Now we pay $28 a month," Mrs. Tarazi said. "When we have paid $3,220 the house will be ours." The bus is theirs too, and carries them back and forth to the city.

In the Jerusalem area, Point 4 has helped train teachers, advised the mayor on the complex problems of sanitation in the Old City, arranged for a supply of antipolio vaccine when the disease approached epidemic proportions in Jordan last summer, lent a hand in the construction of schools and hospitals, supplied funds for roads, and made it possible for talented Arab students to attend schools in the United States and elsewhere.

I asked Mrs. Tarazi if her husband was a refugee. She nodded.

"He was a postal clerk at Lydda," she said. "But he was one of the fortunate ones. He found a job here with the post office right away. Now he is an assistant inspector."

Jerusalem—and, indeed, every other city in the Arab world—has its share of these "fortunate ones," who located jobs promptly in their new homes and have never found it necessary to register as refugees. Others, the well to do, had property scattered throughout Jerusalem, or lost only their homes but retained a livelihood on the Jordan side of the city.

One of the latter is Dr. Tawfik Canaan, a gentle Arab physician who until 1956 served as director of the Augusta-Victoria Hospital.

"In 1948, when the fighting between Arabs and Jews became too much to endure," Dr. Canaan told me, "we moved from our house in the Musrara Quarter—myself, my wife, my sister, and sister-in-law—into the safety of the Old City's walls. We had sent a few packets of clothing ahead, and we found a room in a Greek convent, where the four of us cooked, ate, and slept.

"After about a week," he said, "during a lull in the fighting, I visited the house. Everything was in order—my books, my notes on Palestinian folklore—I had even left money in the house, 400 pounds. It never occurred to me that we would not come back as soon as the shooting ended.

"Then, a few days later," he said, "Jerusalem was cut in two. My house, my library, the manuscript of a book I had just completed—all were on the other side."

I asked if he had ever seen his house again.

"Seen it?" he said. "For 10 years I've seen it every time I go to Damascus Gate.

Monks and Pilgrims Bear a Cross Down the Way of Sorrows

"Then said Jesus . . . If any man will come after me, let him deny himself, and take up his cross, and follow me." In obedience, every Friday a procession winds down the Via Dolorosa, traditional road from Pilate's judgment hall to Calvary. A devout host (lower) joins in during the Easter weeks of both Greek and Latin calendars.

KODACHROMES BY BRIAN BRAKE (ABOVE) AND DAVID S. BOYER, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Foundations known to Crusaders support the Lutheran Church of the Redeemer, here screened by strings of prayer beads. Such pellets, now mass-produced in plastic, are clicked through the fingers of both Moslem and Christian Arabs.

A ribbon of ruin curls across Jerusalem. Only here at Mandelbaum Gate does it part to permit a trickle of traffic between Jordan and Israel. This United Nations employee, one of the few men free to cross the frontier at will, salutes Arab sentries.

just 250 yards away," he concluded sadly. "But it might as well be in China."

A couple of days later I had a last walk through the Arab side of the Holy City, took my passport to the Jordanian authorities for an exit visa, and went with my bags to the police post at Mandelbaum Gate. The sergeant on duty was an old friend from my U. N. days in Jerusalem.

"Going to the other side?" he asked.

The Arabs have never officially recognized the existence of Israel, but only the fact that a large portion of Palestine constitutes what they call "Israel-occupied territory." They carefully avoid reference to the Jewish state. "Over there," they say, or "on the Jewish side." Even Americans and Britons stationed in Jerusalem, not wishing to offend their Arab hosts, fall into the same pattern of euphemisms. "So you're going to Dixieland," one of them commented when I told him I would be crossing through Mandelbaum Gate to Israel.

When I was a child, I used to wonder what it would be like if I could transport myself instantly from one country to another just by wishing it to happen. Now I know. It would be like this sudden leap from Jordan to Israel, this plunge through the looking glass with no ocean voyage, no airplane passage, not even an hour's automobile drive between the two.

It was an eerie sensation, walking across this sunlit bit of nowhere on a street that leads, like the River Styx, from one world to another (page 514). On either side of me rose the gaunt, sun-spangled wreckage of no man's land. An Arab porter followed with my bags, dropped them a few yards short of the Israeli customs post, and then scuttled back to the security of his own side of the line.

It was over quickly. A uniformed policeman said "*Shalom*," which means "Peace" and is the traditional Hebrew greeting, and waved me inside. A customs inspector glanced at my luggage. A few minutes later a taxi was carrying me through the bumper-to-bumper traffic of Rehov Hamelech George V—King George V Avenue—in the heart of Israel's capital.

One of the first things I did after crossing over to the New City was to visit the house in the Musrara Quarter that Dr. Canaan had abandoned 10 years before. Three families live in it today, one from Casablanca and two from Fez—a total of 21 people. I asked one of the men, a mechanic who had been in Israel three years, if he knew who had lived in the house before him.

"Some people from Kurdistan," he said.

"And before that?"

"Arabs," he said, and shrugged.

If many a Jerusalem Arab looks longingly across no man's land at a home he can no longer enter, New Jerusalem's residents too must face daily reminders of the division of their city. The Wailing Wall, where for centuries pious Jews gathered to mourn the lost glories of Israel and the destruction of Solomon's Temple, is at least decently hidden away in the heart of the old walled city.

Not so the empty buildings of Hadassah Hospital and the Hebrew University. From almost any point in the Israeli capital you can see them, high on Mount Scopus, aflame in the sun's parting glow. But you cannot go near them, for they lie a mile inside Jordan.

Truck Convoy Links Scopus and Israel

Militarily, Mount Scopus has always commanded the Holy City; the Roman general Titus understood the importance of the hill when he camped there before destroying Jerusalem A.D. 70. Understandably, in 1948 neither side wanted the other to hold it. A temporary arrangement was made, demilitarizing Mount Scopus and placing the university and hospital buildings under the care of a force of Israeli policemen until a permanent agreement could be reached.

But the agreement has never come. And so, every other week for more than 10 years, a convoy of strange-looking trucks, boarded up so that neither drivers nor passengers can see much but the road ahead of them, and guarded by an escort of armed Jordanian soldiers, has wound slowly up the Scopus hillside. It discharges supplies and a relief shift of Israeli policemen and then lumbers downhill again through Arab Jerusalem to disappear into Israel through Mandelbaum Gate.

Israeli Children Play on the Brink of Jerusalem's No Man's Land

Receiving thousands of newcomers a year, Israel endures a severe housing shortage. Jordan faces the same problem with some half-million refugees. As a result, the two nations have agreed to allow occupation of parts of the disputed frontier zone. These youngsters, setting up a play pen, dare not stray even a few feet into the rubble; guards on either side might fire at the first sign of motion.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Frontier barrier lifts to permit the reunion of an Arab family at Jerusalem's Mandelbaum Gate. Israel lies beyond its flag.

"Scopus is still Jerusalem's chief trouble spot," a military observer for the Israel-Jordan Mixed Armistice Commission told me. "To the Israelis it represents a sovereign part of their nation, an island of Israeli territory in Jordan, and they intend one day to have it. The Arabs just as confidently expect to convince the world that Scopus must become part of Jordan."

When I was serving as a military observer on the same commission, the sound of firing from the direction of Scopus had become so commonplace to those of us who lived in Jerusalem that it occasioned only a raised eyebrow or a muttered comment before dropping off to sleep again. Since then, I learned, such incidents have dropped in number but increased in severity; last May four Scopus policemen and a military observer

Tears, hugs, and a torrent of words fill the minutes allowed two brothers from Amman and Damascus and their father and other relatives from an Arab village near Acre, Israel (page 527). It was their first meeting since the partition of Palestine.

Show Place of Israel: Hebrew University

When the truce of 1948 divided Jerusalem, students and faculty were cut off from their campus on Mount Scopus, an island of disputed territory surrounded by Jordan. For years they continued to work in makeshift quarters scattered across the Israeli half of the city.

In 1954 the university dedicated a rocky wilderness on Givath Ram as its new site. Masons reared walls of native stone loosened by dynamiters who cleared the foundations. Today ultramodern buildings and landscaped patios cover the hill.

Here the glass-bright administration center rises beyond Chaim Weizmann Square. Arcade at left leads to classrooms.

Student gardens beautify the once-barren campus.

University classrooms mix army officers, government officials, dedicated farmers, and teen-age coeds. Israel considers the institution its cultural heart and a chief research center. Each year thousands of new citizens visit the campus to point with pride at this achievement of their 11-year-old nation.

SUPER EKTACHROME (BELOW) AND KODACHROMES BY BRIAN BRAKE © NATIONAL GEOGRAPHIC SOCIETY

lost their lives as the result of a clash between Israeli and Jordanian patrols.

Characteristically, the Israelis have not waited idly for the return of their university and hospital. Today the brightest of Israel's accomplishments is undoubtedly the group of ultramodern buildings on Givath Ram—"High Hill"—that houses the Hebrew University (page 517). And not far from there, near 'Ein Kerem, revered as the birthplace of John the Baptist, an imposing structure takes shape as a new home for Hadassah Hospital and the university's medical school.

New School Symbolizes Israeli Pride

"To our people, Hebrew University is much more than an institution of learning," Rabbi Bernard M. Casper, the school's urbane, Cambridge-educated dean of students, told me. "It has come to symbolize all that we are and everything we hope to be.

"Each week," he said, "thousands of Israelis—simple folk who may never before have set foot in a university—come here just to see the campus. Such pride! You would think they had built it themselves.

"For many, attendance here is a dream that is not to be put aside because of age. People of 40 and 45 leave the collective farms on which they have spent 20 years of their lives to come here and work for a degree. Last year Brigadier Moshe Dayan, who for four years had been Chief of Staff of the Israel Defense Forces, resigned and enrolled with us. He studied political science in the same class with his 19-year-old daughter Jael."

Brigadier Dayan's familiar black eye patch identified him easily among both students and faculty. Far less noticeable is the slight, rather elderly man who quite often walks almost unobserved to a third-floor office in the university's massive Institute of Jewish Studies. Here Itzhak Ben-Zvi, the President of the State of Israel, immerses himself in a spare-time labor that has already produced a definitive book on the strange Jewish tribes of eastern lands—Yemen, North Africa, Iran, Arabia, and India.

In this western suburb of Israel's capital one sees the greatest evidence of the ferment and the frenzy of effort that characterize the 11-year-old nation. New housing developments probe like outstretched fingers into the hills ringing Jerusalem (page 525), and the first structures of an imposing government center, designed to house all the state's administrative agencies, contrast strangely with a fourth-century monastery near by. Roads that seven years ago wound through silent hillsides lead today to towering apartment buildings loud with the laughter of children.

In the city itself, change is less apparent. Downtown streets still have a ragged, unkempt look. Israel is a pioneering state with the tendency of busy people everywhere to start a new job without taking time to clean up the last one; the capital shows it as much as do the newest settlements in the Negev.

But New Jerusalem has a unique charm. Everywhere are evidences that this is one of earth's great melting pots, where men from every corner of the globe have been drawn together. The silent Babel of the city's bookstores reflects the fact that people have come to Israel from more than 70 countries. Signs in shop windows proclaim the languages spoken within; one pharmacy lists 10, including Yiddish, Hungarian, and Turkish.

From Sunday through Friday the Israeli capital buzzes with the commerce of the 20th century. Only an experienced eye can tell the Yemenite jeweler from the Iraqi automobile mechanic, the Hungarian hotel manager from the University of Pennsylvania-trained college professor, the Moroccan waiter from the Afghan shoelace peddler. One must wait until sunset on Friday, when the sound of the *shofar*, the ram's horn, ushers in the Jewish Sabbath, to know how varied are the peoples who have been attracted by the magnet of the Holy City.

Yemenites Rock While Singing Prayers

One Friday evening, just as the sun's final glow flamed on the Mount of Olives, I walked through the narrow ways of Mea She'arim, the religious quarter of Jerusalem, with a businessman who enjoys the trust of all the city's many sects. Around us flowed the myriad pleasant sounds of Shabbat: the vibrant moaning of the shofar, the chatter of fathers and sons on their way to one of the city's 450 synagogues, and above all else the rapid cadence of chanted prayers.

In a tiny Yemenite synagogue a group of walnut-brown men drew black-and-white prayer shawls tightly about their heads and sang their devotions cross-legged, rocking rhythmically back and forth.

"They are the descendants of Jews who were in south Arabia before the Romans destroyed Jerusalem in the year 70," my friend

KODACHROME (ABOVE) AND SUPER ANSCOCHROME © NATIONAL GEOGRAPHIC SOCIETY

Synagogue Goers and Celebrants Observe the Feast of Tabernacles

The younger generation adopts modern fashion; their fathers hold to the traditional fur hat, black caftan, and fringed prayer shawl worn by Jews of eastern Europe. Attending synagogue, they open the festival ordered by the Bible: "When ye have gathered in the fruit of the land, ye shall keep a feast . . ." (Leviticus 23:39). Later, holiday-makers throng a leaf-thatched *sukkah* (below) in obedience to the injunction: "Ye shall dwell in booths seven days." Candles on the table represent the light of faith.

explained. "For centuries they lived in the desert; to this day, their prayers are sung as if to the motion of a marching camel."

The fathers and grandfathers of many of these Yemenites literally walked to Jerusalem across the length of Arabia. Then, in 1949-50, Israel's Operation Magic Carpet ended the centuries-long exile of Yemen's Jews by wafting virtually all the rest of them—some 50,000 men, women, and children—to the Promised Land. The trip gave most of them their first sight of an airplane.

In a near-by synagogue I heard the same prayers chanted by men in the wide fur hats and long caftans of pre-Soviet Russia (page 519). Like the dark-haired Yemenites, they wore long, curled earlocks, but many were red-haired, or even blond. These are the Hasidim, Jews of eastern Europe whose piety is so strict that some of them barricade the streets of their quarter with boulders and barbed wire from Friday evening until Saturday at sunset, lest a passing automobile profane the Sabbath. Their prayers are sung joyfully, to the strong masculine measures of an old Russian military march.

Here in Mea She'arim are the Persians, who more than a century ago were forced under pain of death to become Moslems. For generations they outwardly conformed to Islam while secretly observing their old faith. Their synagogue still reflects the architecture and customs of their Moslem exile. Here, too, are the Sephardim, whose ancestors returned to the Land of Israel when Spain expelled its Jews in 1492. Here are Bokharans, whose prayers are chanted in Aramaic, the language of Jesus. And Indian Jews from Cochin, with their lithe, sari-clad wives, have a synagogue not far away.

Industry Encouraged in Holy City

But the people of Mea She'arim represent only the traditionalism of the past. And more important, the narrow ways and cramped houses of this strange quarter hold only about one in four of the city's population.

To talk about New Jerusalem's other 75 percent, and to guess at their future, I went to see Gershon Agron, the volatile, Philadelphia-educated ex-newspaperman who serves as mayor of the Israeli capital. In his forceful speech and obviously deep concern for the welfare of the city he reminded me of the "Little Flower," New York's beloved Fiorello La Guardia.

"Back in the old days," Agron snorted, "they wanted to turn Jerusalem into a museum. That'll happen over my dead body. Why, I'm even encouraging a certain amount of industry—not great factories and belching smokestacks, but enough to round out the city, to make it an economic entity.

"And we've stopped the flight from Jerusalem," he said. "Until recently, the city actually lost population."

New playgrounds, he explained, 30 of them in the past three years, new school buildings, parks, a central kitchen for school lunches, and a huge reservoir have all done their bit in making Jerusalem more tempting to prospective settlers. And a firm of U. S. city planners is at work, he told me, charting the capital's future growth.

Parks Will Cool Hot Desert Winds

"Right now," Agron said, "we have 155,000 people. New ones are coming at the rate of 5,000 a year. We expect that in 1969, when Israel has reached three million, we will have at least 250,000 of them right here."

As we talked, the city lay under the stifling hand of a five-day khamsin, the hot desert wind that periodically upsets tempers, dulls appetites, and frays even hardened nerves.

"You've heard Jerusalem called 'the Golden,'" the mayor went on. "It's true; watch it on any summer afternoon as the sun goes down. Well, 10 years from now you'll have to call it the Green and Golden for the ring of parks and woodland that will encircle it. One third of the municipal area has been set aside as parkland. And as the trees establish themselves, the climate will improve. Khamsins will still smite us out of the desert, mind you, but the humidity will be less, thanks to the foliage."

There are problems ahead, Agron admitted—big ones. "Jerusalem's people range from some of the world's foremost intellectuals to beggars who slept last year in the streets of Marrakesh and Fez, from young people who came here to help the city grow to zealots whose roots go back six generations and who resist the least hint of change. But in spite of everything, we progress.

"If you think the city has changed in the past 10 years," he challenged as I left his office, "come back in another 10 and try to find your way around!"

A rabbi, one of Jerusalem's many religious teachers, even more succinctly summed up the

Israel's Lawmakers Hear White-haired David Ben-Gurion

Members of the Knesset, or parliament, deliberate beneath a portrait of Theodor Herzl, the Viennese journalist who founded the World Zionist Organization for return of Jews to Palestine. Cabinet officers sit around the center table.

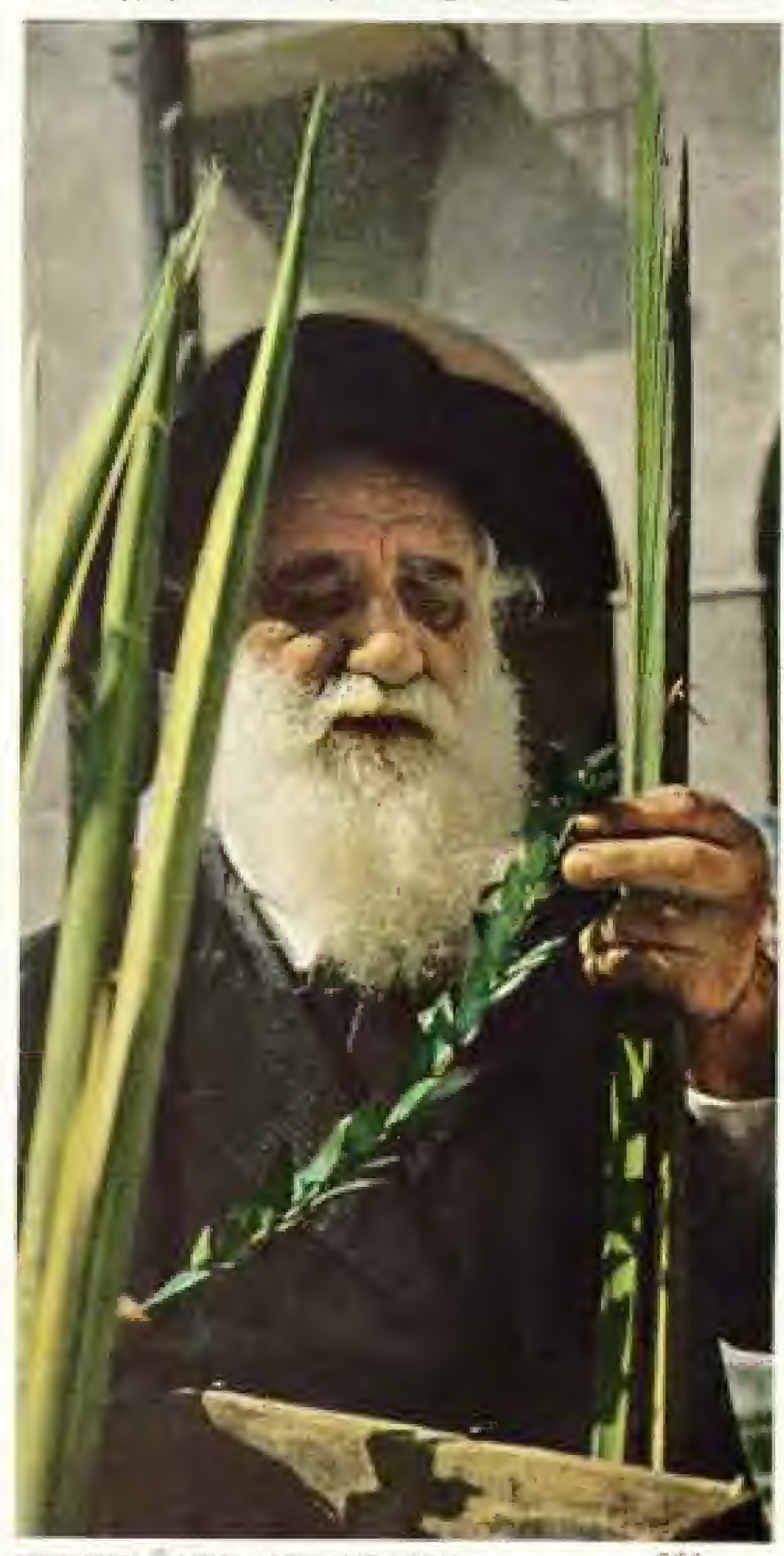
"Take You . . . Boughs of Goodly Trees . . ."
Israelis Buy Festival Foliage

Hebrew law specifically commands Jews to build and decorate booths with four kinds of growing things: the lemonlike citron and branches of palm, myrtle, and willow trees. Shoppers at this

market select only boughs without blemish. Orthodox earlocks and beards comply with Holy Writ: "Neither shalt thou mar the corners of thy beard" (Leviticus 19:27).

Earlocked youth weaves cones to hold myrtle and willow; his companion holds a completed set.

Bearded patriarch selects myrtle. Palm reminds him of his people: bent by bondage, straight when free.



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ISRAEL INFORMATION OFFICE

changes that have come to the City of Peace.

"Years ago," he said, "old people came here to die. Now young people come here to live. And that's a big difference."

One of the anachronisms of the divided city is that it has a suburb split, like itself, between two nations. When I visited the Arab village of Bayt Şafāfā one hot Sabbath afternoon, a woman in the gaily embroidered costume of the Bethlehem region sat comfortably on her doorstep, passing the time of day with a neighbor across the narrow main street.

It might have been any hamlet in the world, and a greeting between any two people who have known each other all their lives. But between these two, down the middle of the street, extended a barrier of barbed wire. One side of the street, the one I stood on, lay in Israel; the other was a part of Jordan.

A trio of men came up to me, and their words reflected the split personality of this strange village. "*Salaam aleikum*—Peace to thee," one of them greeted in Arabic, and then switched hesitantly to the Hebrew equivalent. "Shalom," he said, and smiled.

When the village was divided, he told me, family members chose the side they preferred. His father and mother elected Israel; one brother, a doctor, remained in Jordan.

"Only the cats and chickens can cross freely," he said. For the villagers themselves, the friendly wave of a father to his son or a bit of back-fence gossip from one village housewife to another are all that link these people across their barrier of barbed wire.

While I was in New Jerusalem, the General Assembly of the United Nations was meeting in emergency session to consider the problems raised by a change of government in Iraq and the presence of U. S. and British troops in Lebanon and Jordan. It was a time of excitement and considerable anxiety, with the eyes of the world turned to the explosive lands of the eastern Mediterranean. All eyes, that is, except Israel's.

Bible Quiz Dominates the News

There, with the curious calmness that prevails in the eye of a hurricane, 250 radio, press, and television representatives had converged to cover the finals of the first International Bible Quiz. To an outsider with only a modest knowledge of Scripture, it was astonishing that a whole nation could for day after day forget everything else in its preoccupation with Bible students from 14 countries who were meeting in Jerusalem to test their knowledge of the Old Testament.

Newspapers devoted special editions to the contest; Jerusalem's streets, normally pulsing

Leafy Eucalyptus Shades Zion Square, Business Center of the Israeli City

These small shops display clothing, gifts, antiques, and drugs. Booksellers predominate, however, maintaining almost a dozen establishments in the vicinity. Much of the printed stock comes from the United States by way of the U. S. Information Agency's export guaranty program, which allows Israel to buy American books with its own currency.

New Homes for Immigrants Create a Suburb in a Rocky Wilderness

Expecting 50,000 to 60,000 new arrivals during 1959, the Israeli Government hastens to complete developments such as this settlement west of Jerusalem. The concrete and silica-brick apartment buildings sit on stilts to permit the circulation of cooling air.

Barren for centuries, the slope will shortly show the green of trees that residents will plant as soon as they are settled.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

"Rejoice in Thy Feast": a Hasidic Jew Partakes of the Harvest

In the beard, black hat, and long coat that bespeak an eastern European background, an Orthodox believer buys onions and corn to hang in his sukkah.

with humanity, took on an oddly deserted air during quiz-session broadcasts, and demonstrators massed before government offices to protest the scarcity of tickets for the finals.

I heard of one taxi driver who flatly turned down an invitation to a wedding. "After all," he told his wife, "if I sit in my cab, I can earn money and listen to the quiz on the radio. How will I hear it if I go to the wedding?"

Winner Gets 2,000-year-old Prize

At the finals in the Hebrew University's brand-new amphitheater, President Ben-Zvi and Prime Minister Ben-Gurion, together with some 3,000 fellow Israelis, sat on backless stone benches for five hours as contestants grappled with such questions as "Who in the Bible employed an absorbent hygroscopic substance to collect dew?" Contestant Raul Maya of Colombia promptly recalled the passage: "And Gideon said . . . I will put a fleece of wool in the floor . . . he rose up early on the morrow . . . and wringed the dew out of the fleece, a bowl full of water."

The city's joy was boundless when its own hero, a 30-year-old clerk named Amos Hakham, carried away first prize: a 2,000-year-old glass vase like those used in Solomon's Temple. Dancing swept the streets of Sha'arei Hessed, the quarter where the champion lives, and a crowd of several thousand formed at two o'clock in the morning to catch a glimpse of the contestants.

"It would have been nothing if we were to lose a football series," one Israeli remarked after it was all over. "But for the Land of the Book to have lost a Bible quiz would have been a national catastrophe."

The next day I expressed my surprise to a senior member of one of the Israel Government's offices in Jerusalem. Why did a Bible quiz completely capture the imagination of a busy nation so deeply involved with the immediate problems of today's world?

"But why should you be surprised?" he asked. "You forget that what to you is a religious document from a distant land and an ancient people is to us local history. It would be even more surprising if we were not interested in what you call the Old Testament.

"After all," he added with a smile, "we wrote it."

Before leaving the Israeli capital, I visited Mandelbaum Gate once again. There was to be a dramatic meeting of a family that had been divided, like the city, for more than a decade. The *mukhtar*, or headman, of an Arab village near the Israeli port of Acre would be reunited for a few tearful minutes with two sons he had not seen since the partition of Palestine. One son had come from Damascus, 140 miles away, the other from 'Amman, Jordan's desert capital.

The mukhtar had brought along every relative he could lay hands on. Shepherded by an Israeli policeman, the family filed 35 or 40 strong into the sunny open space in the center of the gate. The father, sobbing loudly, fiercely embraced first one son and then the other; then it was the turn of the male cousins and uncles and nephews, and finally of the women (page 515). Presents changed hands: fish from seaside Acre for boxes of sweet, nutty pastries from Damascus.

For a few minutes the gate echoed with the rich laughter of a family reunited. Then the Israeli Arabs were told that the meeting was over. The group moved back into Israel, the women crying, the older men with strained, hurt faces, all waving continuously until the two sons disappeared behind the anti-sniper wall that guards the Jordan side of the gate.

Christian Pilgrims Flock to Old City

Hardly a week passes, district officer Raphael Levy told me, that one of these dramas, sometimes tragic, sometimes amusing, is not enacted at Mandelbaum Gate. A grieving son is permitted to enter Israel to attend the funeral of his mother. An old man, long separated from his family, receives permission to emigrate to Jordan so that he may spend his last days in the village where he was born. And at Christmas and Easter, Christian Arabs in the thousands flock from their cities and villages in Israel to worship at the holy places of Bethlehem and the Old City.*

Perhaps the strangest pilgrimage of all takes place shortly before or after Easter, when Israel's entire community of Samaritans—some 140 men, women, and children—crosses in a body to join the hundred or so of their fellows still living in Jordan. There, near Nablus, they gather deep in an Arab land to celebrate the Passover as their forefathers did in Old Testament times.

"You must realize," Mr. Levy told me, "that these things can be done only in humanitarian causes."

*See "Pilgrims Follow the Christmas Star," by Maynard Owen Williams, NATIONAL GEOGRAPHIC, December, 1952.

Pilgrims on Parade Carry Israeli Flags to Mount Zion, "Joy of the Whole Earth"

On Jewish holidays thousands pour out of the city to visit the traditional Tomb of David, the nearest an Israeli can get to the Wailing Wall, now held

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

by Jordan. These marchers pass before the first settlement built outside the walls of Jerusalem. Sir Moses Montefiore, an English philanthropist, established the hillside quarters a century ago. Office building (left), windmill, Y.M.C.A. tower, and King David Hotel dominate the skyline.

A Bearded Methuselah Recalls His Years as the Author Scribbles Notes

Surrounded by a few of his 75 descendants, Mohammed Khalil Abul Hawa recites historical events he has witnessed to support his claim to 134 years.

A Jordanian policeman in cloth-covered helmet interprets the Arabic for National Geographic Assistant Editor John Scofield (left).

But humanitarianism can take strange forms. A couple of years ago at a hospice that sits precariously on the edge of the city's dividing line, an elderly woman leaned from an upstairs window and her false teeth dropped into no man's land. It took the combined talents of the Israeli and Jordanian liaison officers and a staff of United Nations observers to get them back for her.

Patriarch Boasts 75 Descendants

On one of my last days in Arab Jerusalem I went to see an old, old man who lives in the village of At Tur, on the Mount of Olives. His name is Mohammed Khalil Abul Hawa, and his birth certificate, issued during Turkish times, proclaims him to be 134 years old.

I had heard about Abul Hawa from a friend in the Jordan Army who gave me a photocopy of the old man's birth certificate. But almost immediately another friend, an Arab doctor, expressed doubt about Abul Hawa's true age. Abul Hawa was very old, he said, 102, perhaps, or even a couple of years older, but not 134.

"Age carries great prestige among the villagers," he told me. "Many of them pretend to be older than they really are."

I found Abul Hawa sitting outside a coffee shop dozing in the early morning sunshine. Around him a dozen men—nephews, sons, and grandsons—puffed on their water pipes or sipped from tiny coffee cups. Abul Hawa was quite deaf, and the policeman who had come with us to translate had to shout his questions directly into the old man's ear.

The night before I had hurriedly looked through some books of local history. One of the things I had come across was an account of the visit to Jerusalem in 1834 of the Egyptian general who then ruled Palestine in the name of the Ottoman Empire.

"Do you remember Ibrahim Pasha?" the policeman shouted into Abul Hawa's ear. The old man nodded and passed a withered hand before his face.

"When Ibrahim Pasha came to Jerusalem I was a small boy, seven or eight," he said. "My mother was frightened and hid us."

There was no way to tell whether Abul Hawa really remembered that visit or was simply recalling something he had been told. If he did remember it, it would make him at least 130.

"Ask him how many wives he has had," I said. The policeman shouted again in Arabic.

"Only one," the old man said, "and 11 children." Seventy-five villagers look to him as father, grandfather, and great-grandfather, he said, gazing proudly around him at the crowd that by now hemmed us in.

"Will you marry again?" I asked.

"How can I?" he cackled. "All the women in the village are my daughters, or my granddaughters, or the daughters of my granddaughters."

Jerusalem's Future Hangs in Balance

I asked a final question before I turned to leave. For many years, through Turkish rule and British Mandate, he had watched the City of Peace from his hilltop birthplace, only to see it finally torn in half and divided between rival nations.

"Will Jerusalem ever be one again?"

"*La*," he said firmly. "No."

As I drove back to Jerusalem, I wondered about Abul Hawa's answer. He was speaking, I thought, not from any special wisdom but simply from the acceptance of things as they are that comes with age. But so many forces—politics, emotions, the sentiment of all the world for one of its favorite cities—may yet contrive to draw it together.

And Jerusalem has so amply demonstrated its will to live. Like the starfish that, cut in half, grows again to become two complete animals, the Holy City has survived its division. Each side has become whole again, with its own beauties, its own shortcomings, and, best of all, its own unique character.

Clattering through the skies, improbable machines with whirling wings are doing more—and stranger—jobs than their inventors ever dreamed of

The Incredible Helicopter

By PETER T. WHITE, National Geographic Magazine Staff

THE WHOLE craft trembled in a numbing downwash of air and noise, as if trying to break free of earth by sheer fury. Suddenly it lifted us, tilted forward, swooped across the concrete apron, and soared high above Bridgeport, Connecticut.

There it stopped, and simply hung.

Looking out at a motionless world, I found myself thinking wildly: This is impossible. We'll fall. Nobody could build a machine to fly straight up, down, backward, sideways, or to stand stock-still in mid-air.

Yet immediately beside me in the thundering contraption sat a fatherly gentleman who had built not just this, but many such machines: Igor Ivanovich Sikorsky, a blue baseball cap set in jaunty contrast to his square gray mustache.

Twenty years ago, when this brilliant inventor produced the first truly practical helicopter in the United States and began testing it in public, many an onlooker wouldn't believe his eyes. Said one mechanic: "It's the biggest lie I ever saw!"

Now I knew what he meant.

We rode facing the cabin side-wall windows. "Watch," said Sikorsky, leaning forward. Calmly he pushed the wall aside, as you might slide open the door of a floor-to-ceiling closet. Before us, and for 600 feet straight down, lay nothing but space.

"Pleasant, isn't it," Sikorsky shouted into my ear. "You can see so much more."

The roaring and whirring and whining from above had become louder still, like some monstrous buzz saw. Actually most of the clamor came from the ingenious machinery transmitting power and control to three huge blades that spun above us. Their shadows scurried steadily past our feet.

The safety belt around my middle helped me overcome the feeling I might fall. As the helicopter moved on, I looked down at Bridgeport's factories glistening after the morning's rain; a deserted beach, and beyond it the open water of Long Island Sound. We stopped once more, suspended low enough to see the sand and the water clearly, but high enough to see a lot of the countryside behind.

The view, so intimate and yet remote, gradually brought a new feeling of quiet exhilaration. I sensed why an old farmer in a helicopter had whispered: "This is the way God sees."

Machines Fly Like Hummingbirds

Back in his office half an hour later, Sikorsky reminisced. "When I was working on my early models, I didn't anticipate all the many uses helicopters find today," he said. "But I was sure an aircraft that could fly like a hummingbird would be immensely useful. I was happy when at last I could hover and fly backward and sideways. But one minor engineering problem remained."

Sikorsky smiled. "I couldn't fly forward! Somebody said, why don't you just keep flying backward, and turn your seat around?

"It looked as if we might have to. But finally we tried moving the little control rotor on the tail. That took care of it.

"Today," he went on, "the helicopter is a kind of magic carpet, the most versatile vehicle available to man. You have a lot of surprises in store for you."

I had already read and heard of some of

Hanging in the Oklahoma Sky, a Helicopter Helps Round Up Bison

Once a year the nearly 1,000 buffaloes in the Wichita Mountains Wildlife Refuge must be corralled for branding and vaccination. U. S. Army helicopters from near-by Fort Sill locate strays and drive them in. On giant Texas ranches other skyborne herders flush cattle out of mesquite thickets. Following fences to spot breaks, they accomplish in hours the work that range riders do in days.

KODACHROME BY ANDREW LEAVENS © NATIONAL GEOGRAPHIC SOCIETY

Whirlybirds on a Test Run Rendezvous over San Francisco's Golden Gate Bridge

Helicopters can fly forward, sideways, backward; they can go straight up and down so smoothly a rider might think himself in an elevator. Two sticks, handled simultaneously, steer this Hiller

KODACHROMES BY WILBUR E. GARRETT, NATIONAL GEOGRAPHIC STAFF © N. G. S.

12C, which tracks a newer model. Test pilot Bob Boughton makes the craft go up or down with a lever at left (not visible) while he pushes one in his right hand in the direction he wants to go. "Like patting your head and rubbing your stomach at the same time," a student pilot exclaimed. The Golden Gate's center span, world's longest, reaches four-fifths of a mile, 200 feet above water.

the improbable feats of these odd machines.

They have hoisted injured men to safety from mountain peaks and turbulent seas, herded reindeer in Sweden, and delivered payrolls to a hundred scattered river barges in New York State.

In New Zealand a copter flew into the crater of an active volcano, deposited a sensitive instrument called a geophone, unrolled cable to an observatory six miles away, and thus helped scientists keep watch for eruptions.

A helicopter's downwash has brought a breeze to yachtsmen becalmed ahead of dangerous squalls. Cherry crops worth hundreds of thousands of dollars have been saved when copters blew raindrops off the fruit—otherwise the unwanted moisture would have split the ripe cherries open.

But occasionally the helicopter's versatility boomerangs.

Thus a cable-laying copter dragged a wire across a power line and put out the lights in a sizable part of Kentucky. A helicopter spraying potatoes in New England didn't just kill bugs, it tore the plants right out of the ground. Another, welcoming *Mayflower II* to New York, hovered so close that it literally took the wind out of her sails.*

I had many a question for Igor Sikorsky about these awkward but engaging machines. How fast can they fly? How much do they cost? What are their most important jobs today, and what will they do in the future?

Windmilling Across a Continent

Sikorsky nodded patiently. "A lady asked me if I thought her grandson would court his girl in a jet-propelled helicopter," he said. "Maybe. But seriously, you should go out and really see helicopters in action. We have some going to California. Why don't you hitch a ride? We'll talk when you get back."

That's how I met nine United States Marines of Helicopter Squadron 363 and their three new S-58's, headed west to El Toro Marine Corps Air Station near Los Angeles. On the Sikorsky Aircraft plant runway the three green-painted ships resembled fat and placid mechanical grasshoppers. But these were expensive grasshoppers. They cost more than a quarter of a million dollars each, I was told. They would cost even more if they had to be shipped out in crates.

"These are among the larger helicopters we now get in quantity," said Maj. Dwain L. Redalen. "Here, you'd better wear these." He handed me a fireproofed flight suit to put over my clothes, and a pair of plastic earplugs.

As the big rotor blades lifted us into the air, I wished he had also given me a bucket of cotton to put over my head. This cabin had no soundproofing and everything vibrated, especially my teeth. When I tried to write on a pad, my notes had that vibrant look, too.

But surprisingly soon I felt at home in the five-foot-wide cabin. After the second day I got rid of my earplugs. By the third I was as skilled as a villain of the silent screen in making faces and wild gestures when I wanted to communicate with my cabin mate, T/Sgt. Willie Sproule from Yakima, Washington.

U. S. Rolls Past Like a Postcard

Willie sat next to the open door. The cabin swayed a little from side to side, like a rowboat rocking on a lake. But nothing ever fell overboard except an occasional piece of paper pulled out by the air rushing past. Soon I sat by the door myself, watching the continent unroll like an endless picture postcard a scant 600 to 1,000 feet below us.

Over Connecticut and New York's Westchester County we crossed estates with swimming pools empty in the wintry bareness of March. Then came the farmlands of Pennsylvania, Virginia, and the Carolinas. Children ran out of schoolhouses and waved frantically. Chickens scattered in panic, because, as Willie explained, "They think we're hawks."

South of Vicksburg our noise flushed a dozen blue herons, and we saw the watery ground shining among cypress trees. In Louisiana muddy tributaries of the Mississippi enclosed rice fields like giant pythons.

Our view was all the better because our pace was leisurely. Our airspeed indicator hovered around 90 knots—104 miles per hour—but

* See "How We Sailed the New *Mayflower* to America," by Alan Villiers, NATIONAL GEOGRAPHIC, November, 1957.

Man on a Flying Pogo Stick: the 300-pound Hiller Rotorcycle

This amazing machine approaches man's dream of strapping wings on his back and flying like a bird. Will the future commuter travel in this fashion? Not for a long time, if ever, experts believe. "Traffic problems of 100,000 random flyers would make the worst road jams seem tame," one builder told the author. Created for the U. S. Marine Corps, this Rotorcycle flies above the Hiller plant in Palo Alto, California. Test pilot Dick Peck flew for the Marines during the Korean war.

KODACHROME BY WILBUR E. GARRETT, NATIONAL GEOGRAPHIC STAFF © N. G. S.

when the wind was against us, we moved much more slowly in relation to the ground. Sometimes cars passed us on a highway below. Once, as we were taking off, a black spaniel chased us with soundless barking.

In New Mexico we crossed dry riverbeds, their bottoms crackly like alligator hide; in Arizona cactus columns stood as high and straight as telephone poles, with jack rabbits dodging among them. Then came the green fertility of California's Imperial Valley, and finally the blue Pacific.

Altogether we covered nearly 3,000 miles in 32 flight hours, spread over six days.

What took us so long? Poor weather—ground fog in Georgia, thunderstorms in Mississippi, high winds in Texas—plus having to refuel every three hours. A balky fuel pump had to be changed. We flew only by daylight, and thus I saw the country as I had never seen it from high-flying airliners.

Marines Leapfrog from Sea to Shore

At El Toro I had another stroke of luck—an invitation to go aboard the Navy's first helicopter assault aircraft carrier, U. S. S. *Thetis Bay* (page 544), and watch copter-borne Marines seize a foothold ashore.

Loading took place on the double, with squad leaders giving each man a boost into the cabin. Soon our five copters in the first assault wave were airborne in a V-formation.

We came in from the sea between the hilltops of the Marines' Camp Pendleton near Oceanside, hovered a few feet over a meadow, and settled gently. No sooner had we jumped into the wet grass than the copter flew off.

Another string of copters appeared swiftly from behind a hill and hovered half a mile from us. Then four more copters were on top of us, raising a whirlwind of dust and pebbles. By the time they had disgorged their troops, still another wave was landing a mile away.

The "enemy," encircled by these swift landings, began firing machine guns; the invaders fired back, with neither side sparing the blanks. I hitched a ride in a maneuver umpire's jeep to a camouflaged command post.

"You've seen an exercise in the Marine doctrine of vertical envelopment," a young major said. "Amphibious landings like Iwo Jima or Normandy would be sure disaster today, for tight concentrations of ships and men make perfect targets for atomic weapons.

"With the helicopter, we can launch an assault from ships widely dispersed many miles offshore, bypassing beaches and defense lines. To us Marines the helicopter is as important as the bayonet at the end of the rifle."

Having ridden in austere military helicopters, I paid my way aboard a plush seven-place copter in Los Angeles for a civilian ride across the sprawling city.

"We've carried mail since 1947," I was told by Clarence M. Belinn, president of Los Angeles Airways, "and passengers since 1954, more than 56,000 in a single year.

"Most of our business is bringing people from as far as 65 miles away to catch a plane at International Airport. And we get housewives coming to shop downtown. Right now we're saving them two hours or more, because the road traffic can be really fierce."

I agreed, as I drove to the downtown office of Capt. Sewell F. Griggers, chief of the Los Angeles County Sheriff's Aero Detail.

"The county covers 4,000 square miles," he said, "much of it in mountains up to 10,000 feet high. Hikers get lost. We've had more than 100 air crashes in the mountains in the past 15 years, and some serious fires. My helicopter gets me to the trouble fast."

Had he ever caught a crook from the air?

"Sure have," was the answer. "A fellow wanted for armed robbery. He escaped into the brush and shot at some officers who went after him from the road. I came up from behind. He was so surprised he gave up without my even pointing the shotgun at him."

Giant and Midget Whirlybirds

The next day I went to see what probably are the world's most impressive and most modest helicopters.

The first was a 17,800-pound giant designed to lift a 15-ton payload. It had cost $4,000,000 and stood three stories high, with rotor blades as big as an airliner's wings. On its side was painted XH-17—the X for experimental. I found it at the Hughes Tool Company's Aircraft Division in Culver City, looking oiled and ready to go. Could I see it fly?

"Certainly not," said the engineer showing me around. "It has lifted all that weight, but we don't fly it now. Just to get it in the air would cost $25,000."

I nodded and drove to near-by Inglewood to the back yard of Bob Hillberg to see a home-built helicopter taking shape on a budget of $500. Bob, a mechanic for Los Angeles Airways, was putting together his own copter strictly for fun.

KAMAN AIRCRAFT CORPORATION

Flying Fire Engine Hovers over a Blazing Plane in a Disaster Drill

Gasoline-soaked derelict simulates an actual crash. Powerful downwash of air from the rotors of the Kaman HOK-1 helps beat back the flames as asbestos-helmeted firemen go into action. Elapsed time from their arrival to rescue of the dummy pilot: 45 seconds!

"So far I've spent about $200, mostly in junk yards," he said. "The motor is the auxiliary power unit of an old Martin Mars. I built the transmission from car parts."

What I saw had unmistakably the look of a helicopter, though some of it was still in the wooden mock-up stage. I asked, "Will this thing—I mean do you think it will really fly?"

Bob gave me the sort of indulgent look that Sikorsky must have given skeptics years ago. "She'll fly," he said, "so long as the weight stays under 550 pounds, including pilot. I'm already on a diet."

How *does* a helicopter fly? I used to think of it as an airplane that had shed its wings and switched the propeller to the top. Actually the helicopter puts its wings overhead and gets along without a propeller. But how?

Try this experiment. While riding in a car, stick your arm straight out the window with the palm of your hand facing down. Now turn your hand upward a bit. Instantly you will feel your arm pulled up.

This happens because your hand forces the airstream passing over it to travel farther than the stream passing underneath. Thus the air on top is "stretched," or "thinned out"; it presses down on your hand with less force than the "thicker" air underneath pushes up. The result is aerodynamic lift.

An airplane gets its forward motion from its propeller; it will rise as soon as the forward speed of the wings produces sufficient lift. But the helicopter can produce lift while it stays in one spot—it makes its wings revolve. That's why it's called a rotary-wing aircraft.

Helicopter Plucks a Pilot from the Sea; His Chute Billows and Pulls Him Back

During maneuvers off Virginia, this Grumman crashed on take-off from the U. S. S. *Block Island*. Skimming the whitecaps, the twin-rotor helicopter flew to the rescue. Here it raises the pilot in a sling, but his parachute has opened unexpectedly. Snagged by the shroud lines, he dangles above water. When a lifeboat arrived, he dropped back into the ocean. Then the crew picked him up and delivered him to the escorting destroyer from which the picture was taken.

In normal rescue operations, barring such mishaps as a billowing chute, a copter can fish out a flyer and return him to deck within three minutes after a crash.

To learn how helicopters are controlled, I watched pilot Bruce Jones on a flight from the Hiller Aircraft Corporation plant in Palo Alto to near-by San Francisco. First he grasped a control stick on his left and twisted its handle. This fed fuel to the engine like a motorcycle throttle.

The rotor blades had been drooping slightly. Now they turned rapidly and stuck straight out, pulled by centrifugal force. By moving the stick up gradually, Jones changed the pitch of both rotor blades simultaneously, making them take more of a "bite" in the air. The helicopter rose about five feet.

As we hovered, the blades described a shallow cone. While this cone was level, we stayed in the same spot. Then Jones tilted the cone forward with a forward motion of his right hand on the stick between his knees. At once we shot ahead. I had a feeling the whole countryside was flying straight at me.

Hoping to make Jones slow down, I asked: "What's that tower we just passed?"

This was a mistake. Skilled copter pilots fly as good horsemen ride, as a part of the mount. As casually as I had turned my head, Jones made a slight movement with each hand. Instantly we swerved in a tight circle to our right and rose 200 feet—all in one swoop.

"It's easier to flip her around than to explain," Jones said as we hovered beside the radio tower.

My stomach had made the turn all on its own, and I was dizzy. But I recalled my mother's prescription for avoiding seasickness: Don't strain against the motion; go with it, and try to keep ahead just a little. I leaned forward slightly, as if to spur the copter on, and had no more trouble.

Presently we landed at the U. S. Coast Guard Air Station at San Francisco International Airport. Capt. Richard Baxter told me that the Coast Guard had pioneered in hoisting people out of danger spots by helicopter. I noticed one of Baxter's orange Sikorskys warming up. Could it pull me out of San Francisco Bay?

"Sure," said the captain, "but put on a rubber exposure suit. The bay's cold."

Author Rescued in Eight Seconds

Within 20 minutes I was in the suit, in a launch, and in the chilly water, holding up a canister spouting orange smoke to show the copter where I was.

Treading water, I wondered how high the copter would hover over me. Would the downwash churn the water? How long would it take to hoist me from the bay?

Then the roaring machine was overhead, a crib-shaped metal basket splashed beside me. I crawled in and was in the copter, dripping.

All had gone so fast that I couldn't remember a thing. But a man in the launch had

U. S. NAVY, OFFICIAL

timed the whole sequence from the moment the copter arrived above me: eight seconds.

I was admiring the countryside on our flight back to Palo Alto when Jones said cheerfully, "Now I'll disengage the rotor. It'll be as if we suddenly had no engine at all."

"What's the idea?" I managed to ask, forgetting the view.

"I want to show you how safe a copter can be even if the engine fails. Look."

I felt as if a roller coaster had dropped out from under me. Down and down we went, fast, while the rotor kept spinning above us. Some 10 feet off the ground we hovered a moment and then settled slowly into a field.

"We call this autorotation," Jones said. "The important thing for the pilot is to keep the blades turning fast. Otherwise they'll no longer function as wings, and the copter will drop like a rock."

He explained how autorotation worked.

At first the rotor blades kept going of their own inertia. Then as we descended, the free-wheeling blades were turned by the air, as if they were windmill sails.

As soon as we were close to the ground, Jones made the blades take a good bite once more. We hovered, and settled gently.

"Remember," Jones said, "autorotation isn't safe if you're standing still somewhere between 30 feet and 300. Up to about 30 feet you have the so-called ground cushion, or backwash from the rotor blades, to ease a fall. But if your engine conks out while you're hovering at 200 feet, you may drop all the way before the rotors are free-wheeling fast enough. Over 300 feet, you're home—your landing will be gentler than by parachute."

Test Pilot Rides a Rotorcycle

As we landed back at the Hiller plant, something small whizzed by with a big noise and settled next to us. This was test pilot Dick Peck on a Hiller Rotorcycle, a baby helicopter hardly bigger than an office chair (page 537).

Here, I thought, might be just the thing to

drive to the office—provided, of course, that there wouldn't be 100,000 other low-flying Rotorcyclists to collide with. I asked Stanley Hiller himself about the price.

"If we build one, a million dollars," he said. "If we build a thousand, perhaps $10,000; a hundred thousand, $4,000. They could be simpler to mass-produce than cars."

"Why not mass-produce them?" I asked him.

"There's simply not a mass demand," Hiller replied. "Did you know that fewer than 8,000 copters have been built in this country? Oh, yes, after World War II we prophesied a helicopter in every back yard. We were wrong. Now I'd rather err in the other direction."

Townspeople Buy a Flying Ambulance

Few as they are, helicopters today are not only serving the Armed Forces and the Nation's largest cities; they also are proving a boon to remote communities. Consider the town of Etna, population 650, high in forest-ringed Scott Valley of northern California.

"Four years ago I fell over a bluff in the mountains and hurt my leg," recalled rancher Bill Mathews. "One of my men got to a telephone, and, thanks to the U. S. Forest Service having hired a Bell for the summer, I got to the hospital minutes later. By horseback, the trip would have taken two days."

Mathews was so impressed that he persuaded a lumber mill owner, Erling Hjertager, to join him and pilot Bob Trimble in starting a permanent helicopter service in Etna.

Dr. Granville Ashcraft, the lone physician for 3,500 people scattered over that region, uses the copter as an ambulance. Every year it helps five or six gravely injured hunters, tourists, or lumberjacks. Gleason Balfrey, the only druggist within 23 miles, calls on the copter to deliver drugs in emergencies. Lumberman Hjertager finds the copter ideal to cruise timber—deciding what logs to cut and where to build roads to take them out. The copter rounds up stray cattle, dusts crops, and patrols telephone and power lines.

On a hop with Bob Trimble, I noticed a mountainside covered with charred stumps. "Thirteen thousand acres of burned-over timber," Bob said. Next day he took me to Gene Newton, the Forest Service fire dispatcher in near-by Fort Jones who watches over one-tenth of nearly 2,000,000 acres of Klamath National Forest.

"Our trouble usually starts when lightning strikes a snag, a dead tree full of pitch," Newton said. "That tree'll burn down to the brush, and the fire spreads.

"Our helicopter makes all the difference. When lightning is predicted, we fly men to lookout posts. If a lookout reports smoke, we can often get there before the brush catches.

"A bad lightning storm may set 100 fires at once. Then I chase around to see what must be done at each spot, and bring supplies to the fire fighters. Now we're experimenting with helicopters unrolling hose up a mountainside in a hurry."

On my last evening in Etna I watched a television program called "Whirlybirds": the hero jumped out of a Bell like Bob's smack on top of the horse on which the villain was fleeing after the big stick up.

"Some of these stunts look downright impossible to me," Bob mused. "Still, I like the program, and I guess copters really do a lot of good deeds people never hear about."

True enough, I thought, never imagining that I might trigger some such unexpected exploit myself. But it happened, in the wilds of New Mexico.

Woodrow B. House, chief pilot of the Anaconda Company in New Mexico, was taking me in a Bell from Grants, where Anaconda operates a uranium mill, to Ambrosia Lake, a brownish-yellow depression of dust, tumbleweed, and grass stiff as toothpicks.

We hovered over recently discovered Indian ruins and chased prairie dogs.

And then I saw her.

She was deep in an arroyo, usually dry but muddy now after a flash flood. Only her head and a bit of her neck showed, so deeply had she sunk into the mud.

She was a cow. On more solid ground near her shivered a little calf.

I pointed her out to Woody. Two minutes later we set down near the radio tower of the Fernandez ranch. A jeep was dispatched immediately. "Glad you told us," the foreman said. "That cow's worth $300."

Helicopters Map the Wilds

"In all sorts of wild country, helicopters have become invaluable for transporting survey crews and equipment," I heard soon after from Chester Lloyd of the U. S. Geological Survey's Topographic Division.

We were talking in Pacific Area Headquarters in Sacramento, which supervises

(*Continued on page 551*)

Aerial Ambulance Swoops to a Rooftop Landing on Santa Monica Hospital

The California Ambulance Service, one of the first in the Nation to use a helicopter, dispatches this Bell to all corners of Los Angeles County for rescue work.

When accidents occur in remote areas and prompt treatment may spell life or death, doctors can ride the machine to the scene of disaster.

Elsewhere, injured mountain climbers, snake-bite victims, and isolated farm dwellers have been flown to hospitals by the versatile aircraft.

Attendants remove a stretcher patient on the hospital roof.

Grammed with Troops, "Flying Bananas" Take Off from the U. S. S. *Thetis Bay*

Navy helicopters perform a host of duties: mine-spotting, reconnaissance and photo missions, distributing mail among the fleet at sea, carrying chaplains from ship to ship on Sundays. Fast enough to sight a sub, slow enough to track it,

KODACHROME BY WILBUR E. GARRETT, NATIONAL GEOGRAPHIC STAFF © N.G.S.

they can destroy their prey with high-yield depth charges. Someday the whirlybirds may spearhead invasions. During joint Army-Navy maneuvers off southern California last fall, a company of these big Army Vertols airlifted more than 1,000 soldiers from ship to shore. *Thetis Bay* is the Navy's first helicopter assault carrier. The sign on the island warns crewmen against whirling rotors; the blades on some craft could lop off a careless man's head.

Marines in camouflage helmets bend heads across arms as their helicopter leaps skyward on a training flight. Their hunched position will minimize injuries in the event of engine failure during take-off.

Rotor-borne Marines Land on a Korean Mountain

Helicopters' dependability under fire in the Korean campaign wrote a new chapter in military history. Performing nearly 10,000 evacuation and rescue missions, the flying windmills wafted wounded men from battle lines to base hospitals and shuttled fresh troops to the front. They snatched downed flyers from enemy hands and helped to capture a strategic peak. Marine helicopter pilots airlifted 60,000 men and 7,500,000 pounds of cargo.

The Sikorsky HRS type is still widely used for rescue work.

SUPER KODACHROME (LEFT) AND KODACHROME BY [illegible] © NATIONAL GEOGRAPHIC SOCIETY

Flying Limousines Shuttle Between Manhattan and Suburbs

New York Airways began the Nation's first regularly scheduled helicopter passenger service in 1953; three years later the line chalked up its first million passenger miles.

Vertol copters whisk customers in a few minutes from a heliport edging the Hudson River at West 30th Street to Idlewild, La Guardia, and Newark Airports. Other flights touch down at Stamford, Connecticut; Teterboro, New Jersey; and White Plains, New York.

Podlike flotation gear above the wheels of this Vertol taking off from Manhattan provides for emergency stops on water. Three-seat Bell in foreground has conventional floats; it carries charter parties and sightseers.

Fifteen passengers may ride in comfort aboard the spacious, plushly upholstered Vertol 44B. Big porthole windows allow a superb view.

Map Makers Cruising over Utah Thread the Needle's Eye of Rainbow Bridge

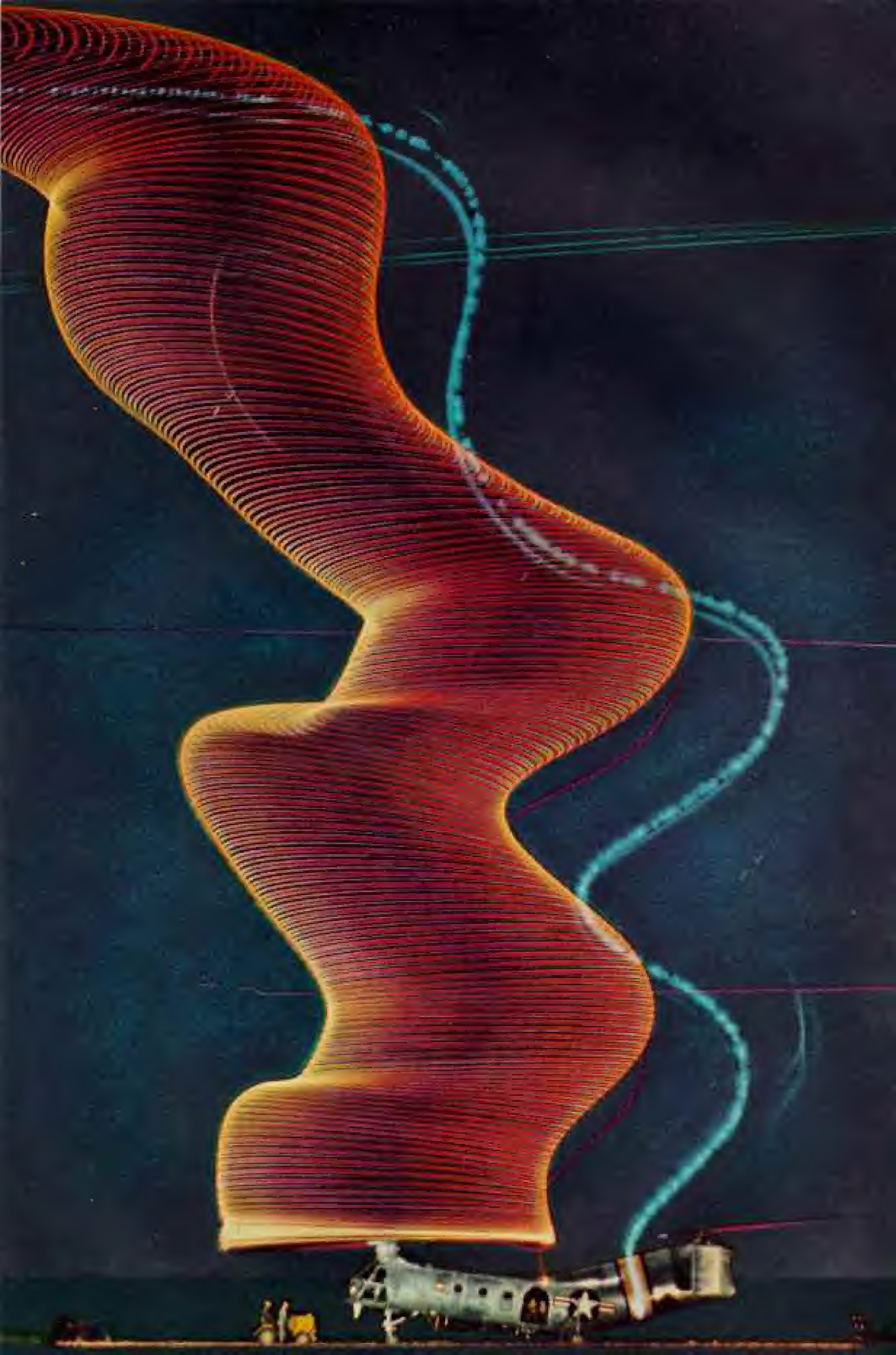
Fieldmen of the United States Geological Survey ride this Bell helicopter into remote, inaccessible canyons. Discarding burros, some prospectors in the West have taken to copters equipped to

detect uranium ore locked below the rocks. Rainbow Bridge, world's largest natural arch, spans an arroyo in the Grand Canyon country. President Taft made it a national monument in 1910.

Skylarking above New York Harbor, a French Alouette helicopter appears to perch on Miss Liberty's torch, 300 feet above the water. Should its gas-turbine engine fail while hovering at this height, the pilot could make a fully controlled descent and land gently at the foot of the statue. Below 500 feet at zero air speed he might crash because his "brakes," the rotor blades, lack time to pick up sufficient speed.

Two years ago an Alouette made headlines when it plucked eight stranded climbers from the heights of Mont Blanc. In June, 1958, a later version set an altitude record for helicopters—36,037 feet.

Using this chopper as a flying gun platform, the French Army has fired guided missiles at ground and aircraft targets.



mapping in seven western States and Hawaii.

Lloyd told me of animals chasing copters—and vice versa. A copter tried to scare a grizzly bear away from some surveying instruments; the bear ran, then turned, stood up, and took a swipe at the copter. Similarly pursued, a cougar flipped on his back and clawed the air, ready to fight when the shadow of the helicopter passed over him.

I had already heard of the bald eagle hazard to helicopters. "Come close to one at nesting time," a pilot had told me, "and he may fly right after you. If he tangles with the tail rotor, he may nick it pretty badly. A helicopter went down in Alaska because of a bird, and the pilot froze to death."

Surveyors want to go to the highest spots, and so the copters carrying them strain for maximum performance. But helicopters can do less and less the higher they go. A type that can hover comfortably at 1,000 feet above New York Harbor with a big load might not manage to hover with even one passenger over Cheyenne, Wyoming, 6,000 feet higher than New York.

The chief reason is that more altitude means less air density and less lift. Engine efficiency also declines, for there's less oxygen to burn the fuel.

At the Bell Helicopter factory and flying school in Fort Worth, Texas, I learned more about the knacks and hazards of high flying.

"A little wind is useful," an instructor explained. "But along mountainsides a pilot must constantly look out for up-and-down air currents, especially where winds may be sweeping over the mountaintop. The same kind of turbulence makes it risky for copters to land amid skyscrapers in crowded cities."

"What would it cost me to learn to fly a copter?" I asked impulsively.

"Do you fly a fixed-wing plane? No? Then it takes at least 40 hours of flight time to get a license. At $75 an hour," he added matter-of-factly, "$3,000."

My impulse was back under control.

Next day I had another lesson in helicopter economics. I wanted to visit the Army's helicopter school at Camp Wolters near Mineral Wells, about 40 miles from my Fort Worth motel. Since this motel had a heliport, I thought I'd go by copter. I phoned a local flying service and asked the fare. $120, for two hours of helicopter time!

"That's special," the man added. "The usual rate for a small copter is $75 an hour."

I canceled the flight at once, mentioning with some embarrassment that Los Angeles Airways had charged only $8 for a 65-mile trip. Certainly, I was told. But only because LAA and two other helicopter airlines, in Chicago and New York, receive a Government subsidy totaling some $4,000,000 a year. To make my $8 hop possible, the taxpayers in effect had contributed about $30, helping a new branch of aviation get off the ground.

Passenger Steers by Leaning

Because I couldn't afford to charter that helicopter, however, I stumbled into a priceless experience: I became a skilled helicopter back-seat driver, if not a full-fledged pilot.

Jim Carmichael of the Bell school offered to fly me to Camp Wolters in a 47J Ranger. Behind the pilot's seat ran a bench for three passengers. I took a seat on the right side, and as we flew, Carmichael talked about teaching this new form of flight.

"Many pupils get tense when they should relax," he said. "Fear locks your mind; to think clearly you must relax. Look, I can take my hands off the controls and steer just by shifting my weight."

He leaned to the right. The copter swerved to the right, slowly and steadily, like a stately sailing ship tacking.

"Now you straighten her out!"

I leaned a little to the left. The copter responded. Carmichael leaned forward and the copter nosed down. I leaned back hard, and the nose came up again. Then, moving to the middle of the bench, I steered right, left, up, and down, merely by leaning slightly. I felt as much a pioneer as Igor Sikorsky.

Carmichael took over again when we were about to land, and I realized that my "piloting" was feasible only in calm, gust-free weather, and in a helicopter like this, with a

Lighted Rotor Tips Etch a Spiral Staircase in the Sky

A zigzag funnel of orange light traces a Vertol's course as it drops to a night landing at San Marcos, Texas. Engine exhaust leaves the blue corkscrew ribbon at right. By studying such time exposures, engineers check the blades' path to help evaluate flight performance. Special navigation lights placed on rotor tips endured the tremendous centrifugal strain but blinded and confused pilots; hence they were given up.

lot of self-stabilizing gadgetry. No wonder the Air Force picked this model to be the first helicopter for President Eisenhower.

Back in Washington, I stood on the White House lawn watching the President take off in his new flying limousine. This was a great vote of confidence for helicopters. Never before had safety officials approved a Presidential journey in any single-engine aircraft.

Pioneers Talk of Early Feats

In Washington I was in time for the annual forum of the American Helicopter Society and a chance to talk to some helicopter heroes I had heard about in my wanderings.

There was the man who built one of the world's largest commercial copter fleets, veteran mountain flyer Carl Agar. His Okanagan Helicopters Ltd., of Vancouver, Canada, boasting 55 copters, made possible one of history's most difficult construction projects, the giant aluminum plant at Kitimat in the rocky isolation of British Columbia.*

There was Joe Mashman from Bell, who lifted a political campaign to uncommonly high levels. If a town offered no safe place for a dramatic descent, the candidate would get Joe to hover overhead. After consulting a list of residents who had written him letters, he'd boom their names over a loudspeaker: "Hello there, Mrs. Jones. . . ." This whirlwind campaigner was Lyndon Johnson of Texas, now majority leader of the U. S. Senate.

I met helicopter designers in the shoestring-to-big-success tradition: Charles Kaman, who improvised his first copter in a garage and now has multimillion-dollar orders from the Air Force and the Navy; and Frank Piasecki, designer of the familiar twin-rotor "flying banana," now made by Vertol Aircraft Corporation in Morton, Pennsylvania, and the "flying jeep" (page 544 and below).

"One of the most striking U. S. helicopter operations today," a helicopter salesman named E. E. "Tug" Gustafson told me, "is in offshore oil drilling in the Gulf of Mexico. Don't take my word for it; go look."

I did, and at Grand Isle, 50 miles south of New Orleans, I realized that the helicopter had truly come of age. From this base alone copters had made 5,175 flights that month, carrying 13,375 passengers—mostly "roughnecks" and "toolpushers," as oil rig workers and their bosses are called—to and from drilling platforms far offshore (pages 556-7).

Helicopters were even more a part of this Gulf scene than the motorboats seeking oil with seismic soundings, setting off explosions that threw columns of water 150 feet high. From a copter cockpit I saw a rainbow atop such a column, and trails of dead fish rising in the boat's wake, welcomed by gulls.

* See "Kitimat—Canada's Aluminum Titan," by David S. Boyer, NATIONAL GEOGRAPHIC, Sept., 1956.

Spectacular new Piasecki 59K, nicknamed the flying jeep, or "fleep," is designed to cross rough terrain, fly over mountains, zip under bridges, or thread its way between buildings and trees. Low, flat chassis houses all major components: dual

PIASECKI AIRCRAFT CORPORATION

Faster and more smoothly than I park my car, our helicopter descended onto a platform atop a converted Navy LST, which contained living quarters for an adjacent tower.

"We have 58 men on this rig," the toolpusher told me. "They stay 10 days and then take 5 days off. Some drive home as far as Texas, and a copter means a half-hour flight back to shore instead of 5 hours on a boat. No seasickness either.

"Copters are expensive, of course. But these rigs cost millions, and to make them pay off they must be worked constantly by men in good shape. With a copter a superintendent can see five rigs instead of two in a day. If I need a replacement part, I get it in a hurry. And everybody knows that if he gets hurt, the copter will get him to a hospital in New Orleans in less than two hours."

Flying Cavalry of Tomorrow's Army

How a life-saving helicopter may also become a fire-spitting dragon of death came home to me the next day at the U. S. Army Aviation Center, Fort Rucker, Alabama.

What I saw at first looked peaceful enough. Swarms of slim Bells returning from training filed past the pines like dragonflies. Four fat Sikorskys with cheerful faces painted on them performed square dance patterns to country music, preparing for public demonstrations of helicopter maneuverability.

Then a colonel in Fort Rucker's Combat Development Office got down to business: "We're arming choppers with machine guns, rockets, and guided missiles," he said. "The copter furnishes both eyes and firepower for our new cavalry of the sky."

"Aren't helicopters too vulnerable for that sort of thing?" I asked.

"No, they keep going even when the blades have been hit, and their mobility gives them their greatest protection.

"Trucks need roads. Obstacles slow down a tank, and a river will stop them. But the helicopter can operate over all types of terrain with equal ease. We say that it moves 'in the nap of the earth.'"

At the door I ran into a commotion. Officers jumped into a jeep and shouted at me to come along: A copter had crashed. We were there three minutes later.

The machine had made an unsuccessful autorotation, and the result was a mess of metallic spaghetti. It seemed impossible that the pilot could have come out alive. There he was, though, looking as fit as anyone else.

"Helicopters suffer proportionally more accidents than fixed-wing planes," I learned later from a safety expert in Washington, "but the fatality rates are lower. Their own energy tears them apart, and pieces fly all over the place. The pilot may not even be scratched, because everything flies away from him."

What if a rotor blade snaps off?

"You would drop like a dead bird. But it's no more likely today than losing a wheel as you drive on a superhighway."

Torture Tests for Helicopters

My visit to the Bell factory at Fort Worth had shown me why this is so.

"When we build a new model," Vice President Bartram Kelley had told me, "we fly it and measure what the stresses are. Then we take its parts to the lab and design machinery to reproduce those stresses."

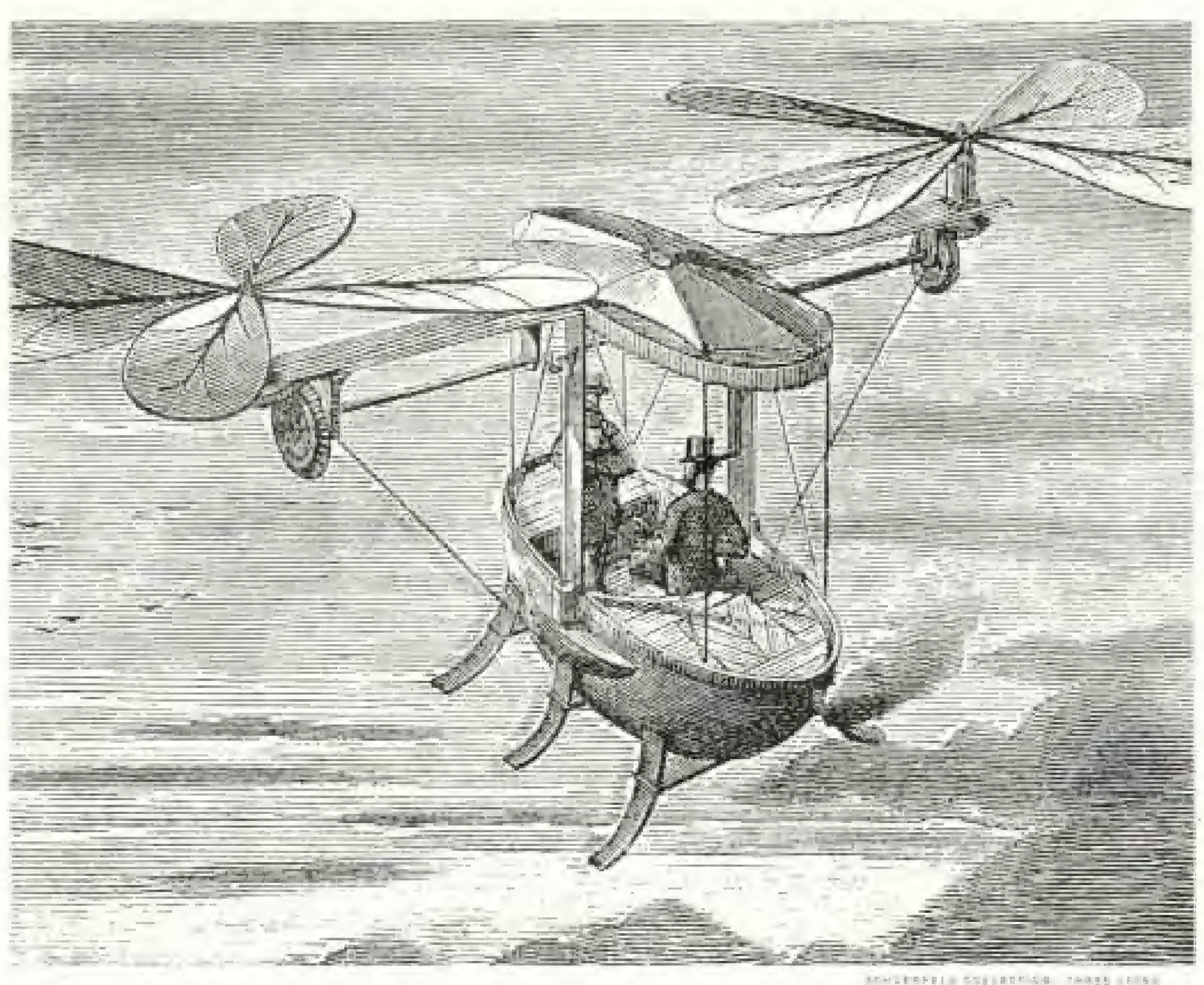
He had led me into a long hall full of gigantic gadgetry in constant and noisy motion.

"Bend a coat hanger back and forth many times, and it'll break," Kelley said. "In a helicopter, every time the rotor turns there's a stress reverse, just as in that coat hanger. We are running a year and a half of fatigue tests for one model alone."

Those vibrations hadn't escaped me—or rather, I hadn't escaped them. Over the Gulf my teeth had shaken so much that they ached.

"You'll get used to it," the pilot said. "If

engines, rotors, and controls. Two ducted fans, safely shielded on all sides, provide lift and forward power. Pilot and passengers ride between the two three-bladed rotors, which at rest sit three feet above ground. The 59K is being test-flown at Philadelphia.



Flight in a Canopied Tub; a Scientific Magazine Published This Dream in 1874

Aviation history is replete with flurries of feathers and glue left in the wake of man's early efforts to fly. And the helicopter principle has contributed its full measure of broken hearts—and heads.

Ancient Chinese supposedly built flying tops and propelled them into the air by means of spinning feathers. Leonardo da Vinci drew a screw to be made of starched linen. If "turned swiftly," he wrote, "the said screw will make its spiral in the air and it will rise high." He called the screw a *helix*—Greek for spiral shape. Much later a combination of helix with the word *pteron*, or wing, led to the name helicopter.

Not until 1878 was a model helicopter actually built. Powered by a small steam engine, it hovered 40 feet above ground for 20 seconds. Enrico Forlanini was the ingenious Italian designer.

In the same inventive era, Thomas Edison and Alexander Graham Bell also were experimenting with rotary-wing flight. Dr. Bell mixed solid rocket propellants of gunpowder, plaster, and shellac to power rockets that he attached directly to the tips of rotors, anticipating the tip-driven helicopter rotors of today. In 1893 one of his rotors lifted the table on which it was mounted. Another of his "fan wings" rose 200 feet.

In the 1920's Juan de la Cierva of Madrid took the wings off an airplane and put rotary wings on top. As the rotor blades lacked power, his autogiro could not hover, but it took off and landed much more steeply than airplanes. Helicopters that followed used powered rotors.

Heinrich Focke in 1937 flew a machine that stayed aloft 80 minutes and made a 143-mile trip over Germany. Borrowing from Cierva the principle of the flexible rotating wing, Focke added one other device needed to make the helicopter practicable: a mechanism for controlling the angle of the wing blades at any point in their rotation.

But the first helicopter destined for useful work was not seen publicly until an early Sikorsky model rose from Bridgeport, Connecticut, in 1942 for delivery to the United States Army Air Corps at Dayton, Ohio. In those 600 miles it mystified onlookers. An air-raid spotter reported, "A windmill just flew by."

my teeth don't vibrate, something is wrong."

I asked a flight surgeon about this, and he wasn't surprised. "It's a highly individual matter," he said. "Some chopper pilots are warned by pressure on the eyeballs. Some say when their feet go to sleep on the pedals, the tail rotor is out of kilter."

I wasn't really shaken, however, until I rode in a copter at the Langley Research Center of the National Aeronautics and Space Administration at Hampton, Virginia. My legs went to sleep up to the knees.

"You're lucky," an engineer said after we had landed. "You never really feel more than a hundredth part of the vibrations that shake a helicopter. The blades are hinged, and they bend and flip. This insulates the cabin as if it were suspended from rubber bands."

However, the recorded data showed quite enough vibration for my taste. The cabin walls had moved back and forth only two hundredths of an inch, but they had done that thirteen times per second.

Outside the main laboratory stood a 50-foot tower shaped like a lighthouse, with rotor blades spinning on top. Dials and recording drums kept track of the blades' performance.

"Our work helps the manufacturers to design out trouble before they build a copter," I was told by another Gustafson, this one named Fred, who had started to work with helicopters in 1936.

"That was the golden age," he said, "between the time when people thought we were crazy, and the time when the thing really began to work. Arthur Young, who designed

Whirling Crop Duster Lays a Lethal Fog Across Texas Farmland

Hugging the ground, this Bell 47G covers more than 100 acres an hour in swaths up to 100 feet wide. Spinning rotors force insecticides to the ground and then upward, coating foliage top and bottom. Helicopters elsewhere in the United States bomb tree farms with seeds, warm orchards during frosts, and shake ripe pecans from trees.

BELL HELICOPTER CORPORATION

the Bell rotor system, had an answer when people asked him what a helicopter would be good for. He said, 'Maybe we can oil weather vanes with it.' "

Gustafson listed some advances to come in helicopters. Many new commercial models will have two engines instead of one. Gas turbines are improving copter performance, and laboratory experiments promise amazing new instruments to help pilots when visibility is poor. The cabin's glass might become a kind of television screen, telling the pilot what he needs to know.

"It'll all be done by electronics, like radar, but much more refined, as a color TV set is to an old crystal radio."

Helicopters Are Here to Stay

I asked if helicopters wouldn't soon be outmoded by flying platforms and tilt-wing planes.

Gustafson shook his head. "Many kinds of planes are being built to take off straight up like a helicopter and to fly forward much faster. But the copter will stay with us. It's essentially a lifting device, and as such, is much more efficient than anything yet designed. Take one of those turbojets for vertical take-off. It gets a half-pound of lift per horsepower. The helicopter gets 15 pounds."

Reassured that the helicopter's prospects were indeed looking up, I went to New York for a dinner honoring Igor Sikorsky upon his retirement as engineering manager of United Aircraft Corporation's Sikorsky division.

He reminisced about building a crude helicopter in Russia in 1910. It didn't get off the ground, he said, because the engine had only 25 horsepower, "or rather, 25 dogpower." Money was so scarce that "the real danger connected with flying was starvation."

Sikorsky asked me if by now my questions had been answered.

I said yes, but would he give me a prediction of helicopter wonders still to come?

"Gladly," he said. "Cargo helicopters will have no fuselage as we know it today. They'll simply be flying frames to lift big loads from one place to another. We're building one now. Such a flying crane may pick up a fully assembled house at a factory one day, fly off, and lower it directly on a foundation in another part of the country."

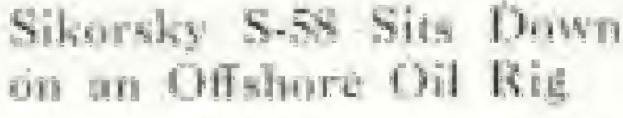
And why not? This was hardly more farfetched than other helicopter doings I had encountered.

"When I was scouting for a whaling fleet in the Antarctic," Bob Boughton at Hiller had said, "I used to touch my floats on the backs of blue whales and sperm whales."

And what about the helicopter that strung cables across the Colorado River to a cave 800 feet up in the wall of the Grand Canyon? This was the only way to build an aerial tramway and recover the cave's contents: 100,000 tons of bat guano, thousands of years old and worth at least $10,000,000 as fertilizer and material for making medicines.

No, nothing about helicopters could surprise me any more.

NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA



Sikorsky S-58 Sits Down on an Offshore Oil Rig

For the army of men who put to sea to extract oil from the Gulf of Mexico, helicopter transport has proved a boon: monotonous and often rough trips by boat have been reduced from hours to minutes.

Petroleum Helicopters, Inc., ferries crews, equipment, and supplies for half a dozen major oil companies. Here one of its 12-passenger machines services a rig five miles south of the Louisiana coast.

Towed to a drilling site, the barge lowers 12 steel pilings to the floor of the Gulf, then jacks itself above the waves.

Heliport overhangs the water. At other rigs, ships alongside provide landing platforms.

Animals look at life—and into an amateur naturalist's camera—in strange and strikingly different ways

Nature's Alert Eyes

By CONSTANCE P. WARNER

With photographs by the author

EVER SINCE I discovered a little-explored realm of photography and study—the world of animal eyes—I have been captivated by nature's many and varied means of sight. I have met unusual challenge, fascinating detail—and, often, return gazes as inquiring as my own.

Twenty-five years of work in the field of eye care had given me a keen interest in human vision. But while preparing an informal lecture a decade ago on the human eye, I became aware of amazing differences in those of other creatures.

Nature's eyes, I found, long ago anticipated many man-made conveniences with counterparts of venetian blinds, tinted glasses, storm windows, bifocal lenses, and windshield wipers, as well as features of the finest cameras.

Some lizards peer through clear windows in their lower eyelids. Those of the Egyptian skink protect its eyes as the reptile lies awash in desert sand.

Our own eyelids, upper and lower, moisten and sweep our eyes clear of grit. Many animals have under these outer lids a third eyelid that flicks horizontally back and forth across the eye. Those of birds are lined with tiny one-celled feathers, serving literally as feather dusters for the eyeball.

Eye pupils, alone, vary astonishingly. The gecko interlocks the scalloped edges of its iris to peep through four pinholes in bright light. Other creatures see through slits, ovals, even rectangles (page 563). I have observed pupil shapes akin to an hourglass, horseshoe, teardrop, diamond, saucer, star, and keyhole.

Strange Eyes Inspire a Hobby

Curiosity afire, I set out to find some of these wonders in the magnificent hunting ground which beckoned within hawk's-eye view of my home—Washington's National Zoological Park, teeming with the full alphabetic range of animal life from ants to zebras. At other times, to view a strange parade of nature's eyes in miniature, I had merely to step outside my summer cabin in Maine with an insect net. Visits to the Marine Biological Laboratory at Woods Hole, Massachusetts, and to other marine laboratories of the East furnished fascinating glimpses of the eyes beneath the sea.

At research stations from Maine to Florida, I found my interest widely shared and subjects freely offered for study. The director of animal training at Miami's sunny Seaquarium proved most accommodating.

"Sparkle!" he boomed to a porpoise that was

(*Continued on page 567*)

The Author: For more than 10 years, a lady of quiet curiosity and gentle humor has met—eye to eye—a succession of creatures of earth, sea, and sky. Widow of a District of Columbia eye specialist, Dr. Carden F. Warner, Mrs. Warner has had the help of National Zoological Park officials and National Geographic Society photographic equipment in pursuing her unusual project. The result is a remarkable series of eye portraits, a selection of which accompanies this article.

Screech Owls Face the Camera with One Eye Winking, the Other Glowering

Owls can see by day; some species hunt in the sun's full glare. Night vision is a little more acute than humans'. Eyes, firmly fixed in their sockets, see a single three-dimensional image, permitting a swift, precise pounce with needle-pointed talons. Hearing is so sharp that some species can catch mice in pitch darkness.

When a storm toppled these birds from their home in a tree, a Lincoln, Massachusetts, family quartered them in a parrot cage hung outdoors. Rescuers and mother owl took turns feeding the fledglings. Here, perched on a pine bough, one owlet demonstrates the ability to pivot its head 180 degrees—even 270 if need be.

Armored Turrets Shield the Eyes of Chameleons

Rings of scales fused to the eyeballs around the pupils of this mother (*Chamaeleo dilepis*) and day-old youngster permit only tubelike vision, but the lizards can stare forward with one eye, backward with the other.

Adrenal glands are believed responsible for the chameleon's color changes. Not background hue, but temperature, light, and excitement prompt the reptile to vary its wardrobe.

True chameleons are native to the Old World; pseudo chameleons of the southeastern United States are remotely related.

These two zoo dwellers spring from African stock. Mouth agape, the parent can flick a sticky tongue a body length to capture insects. The infant, born from a buried egg, clings with toes well adapted to its arboreal existence.

Sapphire eyes studding a scallop's fleshy mantle see no sharp images but perceive faint movements of light and shadow. The tentacle-lined mantle is chemically sensitive to the starfish, a natural enemy.

At danger's approach the mollusk claps shut its fluted valves and shoots twin streams of water from its hinged side. Thus jet-propelled, it can skitter through the sea and even break the surface. This specimen was caught off Woods Hole, Massachusetts.

Circlet of simple eyes enables a grass spider to peer in eight directions at once. Though sensitive to movement and light, the spider is nearsighted. Long hairs aid as touch receptors.

Eye arrangement and number vary in other spider species. Most have eight single-lensed eyes, symmetrically placed.

Club-shaped hairy ends of appendages in foreground mark this Maine specimen as a male. Usually he lurks in the funnel-shaped opening of a sheet web spun near the ground.

KODACHROMES BY CONSTANCE P. WARNER AND ERNEST P. WALKER (OPPOSITE) © NATIONAL GEOGRAPHIC SOCIETY

Twin Periscopes Scan a Giant Tree Frog's Leafy Realm

Eyeballs retract while at rest (right, above). When fully depressed, they help push food down the throat. Diet of the 3- to 5-inch West Indian tree frog sometimes includes its own offspring.

A lower lid (left), raised at the frog's convenience, shields the eye from damage, lubricates the eyeball, and serves as camouflage. Streaked pattern on this transparent screen offers adequate vision for hunting, yet veils the telltale amber iris from prospective prey.

Nature's Ingenious Curtains Shield Eyes from Glare

Palau Island gecko (top right), a nocturnal lizard, interlocks the scalloped edges of its slit pupils to leave four tiny pinhole apertures.

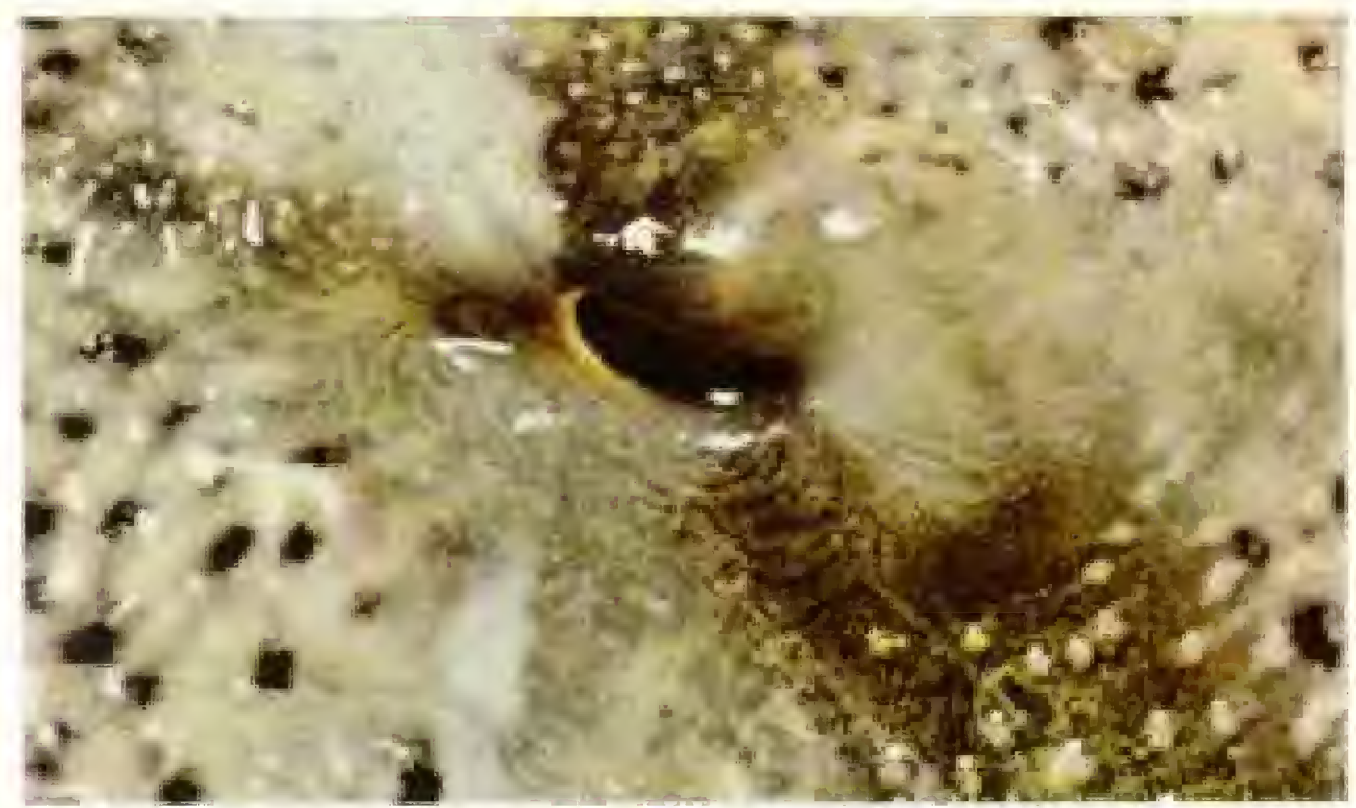
Skate (second), a dweller on the sea bottom, peers between fingerlike slats suspended from the upper border of its iris. Despite the venetian-blind effect, the fish sees only a single image.

South American armored catfish (third) stares through a U-shaped pupil shaded by an iris flap.

Emperor penguin's pupil (bottom) shrinks to a square peephole in icy glare; it widens to a circle in undersea gloom. Transparent membrane at right corner sweeps lubricant across the eye and guards it from antarctic wind and water.

Avian eyelashes, actually modified feathers, fringe the African ground hornbill's lids to screen out dirt and shade the pupil. The eye of *Bucorvus leadbeateri* moves freely in its socket, a rare ability among birds.

This hornbill breeds in tree cavities but does not wall up the nesting female with mud, as related species do. Its booming call, audible for two miles, suggests to African tribesmen: "I'm going home, I'm going home to my relations."



Endangered pufferfish puckers the skin around its gold-rimmed eye and peers through a protected port. Its sudden squint duplicates the lid-making process that took other creatures eons to evolve. To awe an enemy, excited puffer blows itself up like a scaly balloon.

PHOTOGRAPHS BY CONSTANCE P. WARNER © NATIONAL GEOGRAPHIC SOCIETY

Goggle-eyed Mantis Sees Life Through Myriad Lenses

Each of the two compound eyes contains 3,500 to 4,000 facets. Three light-sensitive ocelli, or simple eyes, form a triangle on the armored head. Poised antennae perceive insect prey by touch, smell, and hearing. A watchful mantis often holds its familiar prayerful attitude for hours. An implacable hunter, the female may devour the male after mating.

Horseshoe crab, a living fossil in guise of a spiked helmet, prowls the sea floor. Two simple eyes flank the base of the forward spine (right), and compound eyes bulge from each side of the vaulted carapace. The creature's sight provides a built-in compass, for the animal reacts to polarized light, as does the honey bee in flight. Stiletto tail and pincer claws form better burrowing tools than weapons.

Despite appearances, the spiny horseshoe shares kinship with scorpions and spiders rather than true crabs; it is an arachnid, not a crustacean. Fossils show little change in 200 million years.

KODACHROME BY CONSTANCE P. WARNER © NATIONAL GEOGRAPHIC SOCIETY

Horsefly's Monstrous Eye Transmits 7,000 Separate Pictures to the Brain

Swift insects, like fast birds, possess large eyes. This male's upper facets (magnified 25 times) project bright but coarse images of the world above him; smaller units below convey less light but finer detail. He feeds only on nectar and plant juices. The female horsefly, which sucks blood, lacks the male's "bifocal" vision. Powered by a hundred wing beats a second, she can overtake any horse. Each facet in the eyes of both sexes transmits a fragment of the total picture—a single tile in a living mosaic.

frolicking across a 30-foot pool. "Come over here and show the lady your eye!"

I cannot calculate my debt to officials of the Washington Zoo for generously granting me access to hundreds of precious animals from around the world, as well as space for my home-built, eight-foot photographing cage. The zoo's former assistant director, Mr. Ernest P. Walker, took the time to teach me the fundamentals of color photography—and volumes about animal history and habits.

"If you want to photograph a mouse," he once counseled, "*think* like a mouse!" He gave me a simple stratagem, too, that enabled me to make portraits of dozens of rodents, snakes, frogs, and other shy creatures: Give the subject a dark box in which to hide, lift the box suddenly, and snap the picture while the model is momentarily dazzled by the light.

Edwin L. Wisherd, Chief of the National Geographic Society's photographic laboratory, lent not only invaluable advice from his years of experience but also specialized equipment for high-speed, close-up pictures (page 569).

Eyes Adapted to Owners' Needs

In 10 years I have taken some 5,000 animal photographs, including eye details in about 500. A few appear in these pages. Reviewing them, I marvel at the logic that shines through nature's eyes. Each fits its owner alone. An eye can often tell us where a creature lives, the time of day it is most active, whether it feeds on plants or preys upon its neighbors.

The burrow-hiding prairie dog, for example, wears its eyes high upon its head and widely spaced, like many other hunted creatures. The eyes themselves can focus full circle without telltale movement. A dissected prairie dog eyeball reveals an amber-tinted lens that filters the glare of the plains.

Swift creatures—bird, dragonfly, squirrel—have enormous eyes for their body size, as do night-feeding animals that rely on sight to find their prey. Such eyes need room for many sensitive seeing elements (opposite). A mole or burrowing snake, on the other hand, finds small eyes adequate for a life spent mostly underground.

The common eel dwells in both fresh and salt water, among stones, in mud, at times even in drying air. Its eyes roll, well protected, beneath tough, transparent picture windows, clear places in its head skin.

The Cuban shovel-nosed toad squatting in its burrow folds its upper lid far over the lower, forming a dirt-proof seal that rivals any envelope. The Southwest's Gila monster digs through rough sand for water and eggs of other animals. Its tiny eyes, ringed with beaded scales, are shielded by thick third eyelids that resemble heavy white satin.

Birds have shown me nictitating membranes—third eyelids—in incredible variety of color, pattern, and texture. The hooded merganser wears a glasslike membrane appropriate to underwater pursuit of fish. The northern eider duck nuzzles the dim sea bottom for starfish, sea urchins, and other spiny food; its third lid appears waxy and opaque.

The speedy duck hawk has a crystal-clear third lid that can take the buffeting of a 180-mile-an-hour power dive. The slower bluejay's third lid flashes across its eye, opaque and beautifully cross-hatched; that of the American robin is streaked like onion skin.

While studying the eye of a summer flounder at Woods Hole, I pondered a dainty "parasol" projecting over its pupil. The related winter flounder lacks this eyeshade. Why? A few minutes at the library offered one explanation. The voracious summer species often pursues its dinner to the sunlit surface of the sea.

Some eye features remain a puzzle. I have yet to learn why a scorpion wears two of its six to twelve eyes in the middle of its back. Thirteen "slats," like those of venetian blinds, shield the pupil of the little skate from glare. Why should its close relative, the big skate (page 563), display seventeen?

Lights Vaporize a Fly's Wings

My quest for animal eyes has not been without minor mishap and humor.

An experiment with electronic lighting units ended sadly. I placed a pair of the lights, equipped with special concentrating reflectors for close-up photography, two inches from my subject and pressed the shutter. A wisp of smoke proclaimed that I had broiled a horsefly's wings in 1/2000 of a second!

Returning home from the Smithsonian Institution one quiet, snowy evening, I carried a borrowed Brazilian toad beneath my coat to keep it warm. A calico cat on loan from an animal shelter nestled in a box beneath my arm. As I awaited a taxi, the pair struck up an embarrassingly loud duet. Each passerby faltered in his pace and blinked. I found a friendly smile simpler than explanations.

Zoo spectators, on the other hand, greatly

"Four-eyes" Scans the Water for Enemies, the Surface for Food

Raising twin periscopes, this Central American fish rides at water level, its bulbous eyeballs separated into halves adapted to vision in air and water. These diverse media demand two focal lengths from a single lens. Lacking muscles to vary the focus, *Anableps* solves the problem with an egg-shaped bifocal lens. Air-vision rays pass through the short dimension; water-vision rays through the long. Whether the brain registers these impressions separately or simultaneously remains a mystery.

Four eyes are two, a close-up picture shows.

enjoyed watching Mr. Walker and me in a refrigerated glass cage trying to photograph the eye of a stubbornly pacing king penguin. But one picture proved reward enough. It showed a distinctly star-shaped pupil—to my knowledge, never recorded before.

Capturing animal eyes on film comprises, for me at least, about 10 percent photography and 90 percent improvisation. The hobby has brought me to intimate terms with hammer, screwdriver, and soldering iron. My "photographic" equipment includes not only the marvelously versatile Leica camera, but also doorstops and coat hooks, kitchen utensils and curtain rods.

I have lined the bathtub of my summer cottage with rocks and shells to photograph a Maine lobster—and baked moist seashore sand in my oven to provide a dry desert setting for a fringe-toed lizard.

Holding a skittish scorpion within camera range posed a problem; the kitchen, again, offered a solution. A cork plugged into the central funnel of an angel-cake pan became a perch ringed by an escape-proof moat.

The first spider whose eyes I tried to photograph outwitted me completely. I imprisoned it in a jelly glass covered with a leaf, and punched a hole in this lid just large enough for the spider to poke its head through. I waited, finger on the shutter release. Long minutes passed. Investigating, I found my

prisoner had spun a thick web across the opening. Perhaps to trap its captor? I wondered.

A shy chinchilla taxed all my ingenuity. When gentle squeals and soft blowing on its fur failed to lure it into camera range, I placed a peanut on the cage floor. The canny creature crept nearly within focus and scooped up the bait with an outstretched paw. Only when it scampered from one side of the cage to the other did I manage to snap its picture, showing its large nocturnal eye.

Specimens small and docile enough to rest in one's hand pose few picture-taking problems. They are simply held up to a prefocused frame a few inches from the camera lens for life-sized eye portraits.

Most creatures, when I want to photograph their eyes in relation to the whole animal, seem reassured by something familiar inside the cage: a dead stump for an owl, a tree branch for a robin, a sandy floor for a killdeer, or a few rocks for a snake.

But one cannot always predict how subjects will react. A fierce red-tailed hawk surprised me by posing almost motionless on the perch provided; yet a placid-looking sun bittern strode about ceaselessly, seeking escape. A female wood duck promptly retreated to the rear of the cage and upended among some rocks and reeds; her scissored tail feathers blended beautifully into this background.

Many eye wonders still await my gaze, particularly among the larger mammals. I should like to see, for example, the toothlike edges of the camel's pupil, which shade it from desert glare, or the okapi's curious habit of washing its eye with its tongue.

I hope these animals prove more cooperative than a Dall's sheep I once attempted to photograph. I looked up to find the animal obstinately turned stern-to, shredding my carefully erected paper backdrop.

One day, I am determined, we shall see eye to eye.

Cardboard Tube Stretches the Camera Lens to Capture a Bee's Eye on Film

To determine how much her subject can be magnified without a microscope, Mrs. Warner experiments amid a jungle of improvised apparatus. At this point the mailing tube extends the focal length to 945 millimeters, enlarging the insect's compound eye roughly six diameters—enough to show its hexagonal facets and the pollen-laden hairs between them. With left hand on the shutter release, Mrs. Warner adjusts the lens aperture with the other. Electronic speedlights flash in 1/2000 of a second.

NATIONAL GEOGRAPHIC PHOTOGRAPHER JOHN E. FLETCHER

One foot in the Middle Ages, the other in the 20th century, a remote Alpine community clings to time-hallowed ways

FRANCE'S HIGHEST VILLAGE

Saint Véran

By ROBERT K. BURNS, JR.

Photographs by the author

IN A pale winter twilight, weather-scarred old houses stood bleakly against drifted snow. An ice-caked wooden fountain splashed forlornly in a frozen trough. There was an air of grimness and great age about the scene—so much so that the man who now approached in the street seemed to step from another century. He wore dark, patched clothes. Shaggy bundles of hay hung from his shoulders at the ends of a wooden yoke. Bending slightly, he trudged toward us. Instinctively, I raised my camera.

"*Non! Non! Absolument pas!* I forbid it!"

He dropped his yoke and plowed a few steps in my direction through the snow. "I don't want my picture taken!" he bellowed.

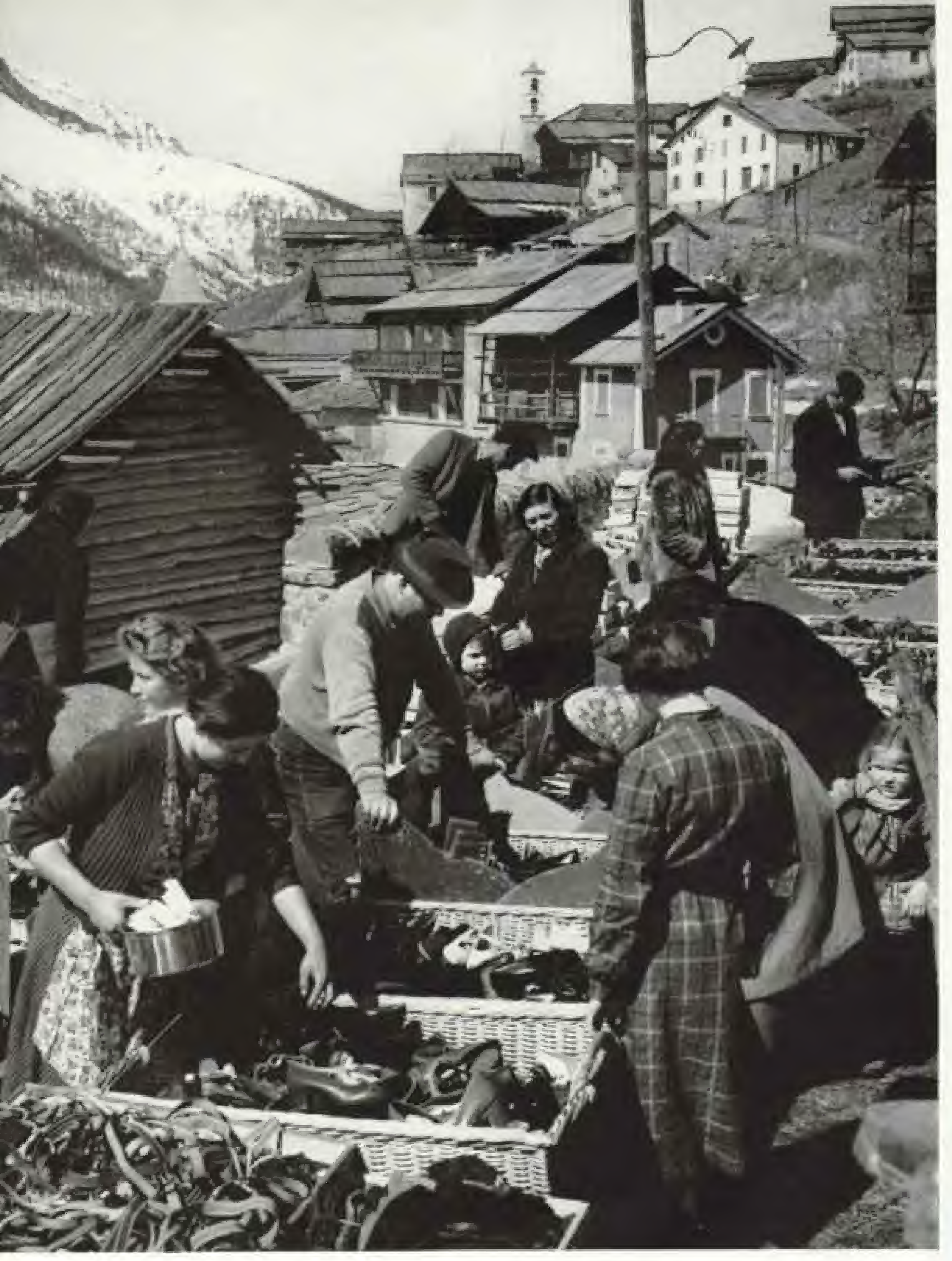
Then, after glaring at us a moment longer, he shouldered his yoke and disappeared between two houses.

My wife Lyla and I walked on in silence through the empty, narrow streets, disturbed by the rebuff. It was dusk when we reached the little inn where we were staying, just below the village. At the doorway we looked back.

Suspended above us in the growing darkness, the twinkling lights of Saint Véran, highest village in France, gleamed in a frozen necklace against the snowy mountainside, lofty and remote, yet somehow inviting.

Since the Middle Ages Saint Véran, nestling more than a mile high in the Alps, has stood apart from the rest of Europe. Today the community's 255 citizens still resist change and cling to traditional ways of life. I was

Saint Véran clings to a mountainside 6,690 feet high in the French Alps (map, page 575). Trails and irrigation canals above the village crisscross fields of hay and rye. A narrow road, Saint Véran's only link with the world, leads to the valley below.



Streetside Bargain Hunters Browse Through a Mobile Bazaar

Traveling merchants take the place of permanent shops in Saint Véran. Truckers labor up mountain roads to sell clothes, toilet articles, and food. These villagers rummage through shoes, socks, and belts. Felt hat identifies the bazaar manager.

there to study the impact of the 20th century upon this isolated village, under a grant from the Social Science Research Council of New York City.

A week before, as we had put mile after mile between us and the sunny Riviera, Lyla's face was tense. We had had more than a few misgivings about taking our four-month-old son to this remote corner of the Alps in the dead of winter.

Just a few miles from Saint Véran, as I turned our heavily laden Renault into the gloomy defile that serves as the village's only year-round route of access, I felt a sudden doubt—perhaps a premonition of troubles to come. Kenny stirred fretfully in his makeshift bed on the back seat. Lyla tended him as I drove grimly on.

But at day's end, in the warmth of the little inn at Saint Véran, the friendly voices of the proprietor and his wife worked magic on our moods. From the kitchen came the aroma of rabbit ragout. Kenny would soon be asleep in a downy bed. I sat back to contemplate the days to come, when we would meet the folk of Saint Véran. The modern age was behind us.

Ticket for Parking High in the Alps

But was it? The innkeeper called me to the door, and there I faced a gendarme.

"Your car, monsieur?" he asked, pointing.

I nodded.

"You are violating the code of the route by parking without a light," he said sternly.

Though not another car or person stirred in the mountain fastness, the officer pressed his charge. I paid a 600-franc fine, moved my car, and returned glumly inside.

Next day Lyla and I set forth in sunshine. Above us Saint Véran stretched for two-thirds of a mile along the mountain slope, as if sunning itself on a great south-facing balcony.

Despite this linear arrangement, the old stone-and-wood houses cluster in small neighborhoods, or *quartiers*. Although Saint Véran is organized as a *commune*, or township, with an elected council and mayor, village affairs percolate to a surprising extent through the quartiers. Each quartier preserves its own name out of the dim past, its own officials, its fountain and community bake oven.

The old houses conform to a single style. A ground floor of stone masonry, dug well back into the steep mountainside, provides shelter for both villagers and cattle. Above this solid foundation towers a two-story hayloft built of logs and roofed with wooden slats or stone slabs. Almost nowhere in the structures can one find a true right angle, for it was a medieval fear that the devil himself lurked in 90-degree corners.

The Author: An anthropologist who teaches at the University of Delaware, Robert K. Burns, Jr., has made the remote, tradition-ordered village of Saint Véran in the French Alps a subject for intensive study. With his wife and now two small sons, he plans to revisit this community that is midway between medieval and modern times.

From the start we were a puzzle to the villagers. To their minds, the fact that we had come to study them represented an intrusion. We were no better than the vacationists who each summer climb the mountain to stare and sometimes poke fun at the village.

There was no open hostility; we were simply ignored. Since my work demanded that we get to know the villagers, somehow we had to prove our good intentions. But how to go about it?

In the beginning Lyla and I simply took snowy walks through the quaint narrow streets. Winter is the season when life in Saint Véran all but stops. There is no reason to face the rigors of winter except to dig paths from door to door after a blizzard. Feeding and care of the livestock takes a couple of hours each day, but, with stable and living quarters all in one, this activity went on without our seeing it.

For days we did our best to smile and nod at every villager we met. There were times when this required courage, for the looks we received in return were more than once cold and distrustful.

As the winter wore on, we sensed a change. Lyla and Kenny undoubtedly helped to soften

the villagers' attitude. A man with mischief up his sleeve doesn't bring his family along. Slowly, smiles replaced suspicious glances.

No longer did our presence cause people to stop what they were doing and turn away. They spoke to us, even commented on the weather in an abrupt phrase or two. Then, one day, Lyla struck up a conversation with a housewife rinsing clothes at a fountain. It was the first opening in Saint Véran's shield of reserve.

The women of Saint Véran boil and soap their weekly wash at home and then beat it out with wooden paddles in the icy waters of the quartier fountains. This goes on in the coldest of winter weather. Though the splash often cakes the fountains with ice so thick that one can't see the woodwork, the clear spring water never ceases to flow.

Gutters Made from Halved Logs

The days lengthened. Bare spots appeared on snowy slopes. People spent more time outside now, puttering about or simply soaking up warm sunshine.

One day we watched a group of men fashioning rain gutters for the church. They placed long larch logs on sawhorses and cut them from end to end with whipsaws, one man above and another below the log. The halved logs were then hollowed with adzes. Thus, while the weather was fair but snow still covered the fields, the men of Saint Véran used their time (opposite).

I never tired of watching Claude Jouve, the blacksmith. He did all kinds of jobs, from making nails or repairing hinges to shoeing mules and shrinking metal rims on wagon wheels (page 581). A leather apron covered him almost from neck to knees. Occasionally his foot pushed a treadle connected to an enormous bellows that filled half his shop, and air wheezed through his forge until the piece he was working glowed with the proper color.

Claude liked to experiment. He had heard about the advantages of a silo and built the first one in Saint Véran. At that time it was little more than a hole in the ground, but the green grass he put in it retained more nutriment for his cattle than the traditional dried

Each man wears the versatile beret according to his taste. These three demonstrate individual styles. Jacques Blanc (above) has the flared type. Claude Philip (center), the milk driver, prefers the close-fitted fashion. The late Véran Prieur liked a peaked brim.

Lacking a Mill, Sawyers Laboriously Cut Lumber by Hand

This two-man team bisects a log raised on wooden horses. Completed halves, scooped out with adzes, will make rain gutters. Goggles shield lower man's eyes from sawdust.

Bell Tinkling, a Cow Clatters into the Kitchen to Her Household Stable;

hay. Others copied him, even obtaining government subsidies to build concrete silos of a more elaborate sort.

Claude had much to say about a plan to regroup Saint Véran's tiny parcels of land into fields large enough to be farmed with tractors and other mechanical implements. The plan was debated that spring at a special village meeting. Claude argued eloquently, listing the benefits and citing the success Antoine Marrou had enjoyed with a gasoline-powered mower in some of his larger fields.

But others seemed to fear that they would lose their good land near the village and be given worthless acreage up near the rocky passes. When the vote was taken, the plan lost, 59 to 16.

Lyla and I thought we had become accustomed to the old-time character of the Alpine village until we saw the town crier make official pronouncements. White-haired and florid of face, he wore a big leather sash over one shoulder. From it hung a drum.

"The Spirit of '76," said Lyla.

He took his position beside a fountain, lifted his drumsticks, and brought them down

Undisturbed, the Housewife Mixes Dough

with a resounding rat-a-tat-tat! House doors popped open, and in no time he had an audience. Raising his head, he began to speak, as if to the mountains.

"It is the order of the mayor and the council that each household provide one able-bodied man to repair the canal. They will leave tomorrow morning at eight."

From the mountain above, the five-mile-long Grand Canal, little more than a twisting ditch, brings the water of melting snows to the fountains and fields of Saint Véran.

Next day I climbed the mountain with the work crew and watched them clear the winter's rock slides from the vital artery, as generations had done before them in similar *corvée* duty.

"When the canal no longer flows," goes an old saying, "Saint Véran will be dead."

Almost every day now Lyla took walks through the village, pushing Kenny in his stroller. No longer did housewives nod stiffly and pass; they stopped to talk as women have always talked about babies.

Mademoiselle Fine, a slight, graying woman with thick glasses and gnarled hands, kept a store where Lyla would stop to buy a bit of ribbon or a spool of thread. The little lady liked Kenny and never failed to give him a piece of candy as he left.

Madame Sibille-Jouve became another of Lyla's special friends. Though she had no children, she liked to talk about them.

"Some do so well on eggs," she said. "Does he like them?"

Lyla's answer must have been more than a simple "yes," for from that day on she went frequently to the Sibille-Jouve home to get a fresh egg for Kenny's breakfast.

When Lyla tried to pay her, the kindly woman said, "No. One doesn't sell an egg to a small child."

Hearing Aid Starts Conversation

Perhaps the incongruous sight of a modern hearing aid caused me to stop one April day to speak to a villager in the street. At any rate, instead of merely saying "*Bonjour*" and passing, I found myself chatting with Jean Baptiste Brunet. Even more startling, before we parted a few minutes later he had asked me to have coffee with him the next time I came to his quartier.

"You know my house," he said. "It's the one behind the fountain."

Saint Véran had dropped its barrier!

A few days later, I knocked at Monsieur Brunet's massive wooden door. Waiting for an answer, I felt as if I were about to cross the threshold of time and step back through the centuries.

It was a double door, one side of which almost always stood open. The narrow corridor that reached back from it to the stairway, as well as the old grandfather's clock that stood at its end, were both familiar to me, so often had I stolen glimpses as I passed in the street. The clock was kept in the hall and not in the combined living quarters for man and beast, I learned later, because the moist animal heat would rust its works.

But now my host stood smiling at the foot of the stairs, ushering me into a large rectangular room with whitewashed stone walls. A single 30-watt electric bulb hung from a low and heavily beamed ceiling. The room paralleled the hall and reached back from a single window at the front of the house.

Two large curtained beds stood along the far wall—one for parents, the other for children. A heavy wooden table stood under the window. Coffee boiled on a tiny cast-iron stove, as Madame Brunet in a plain dark dress came forward to greet me.

Central Heating from Six Cows

I was about to sit down when the unmistakable grunt of a pig came from the shadowy depths of the room. Sensing my surprise, Jean Baptiste laughed.

"The pig's in the pen," he said, pointing to the corner of the room. He then explained that in the spring each farmer of Saint Véran buys a piglet and raises it in a hutch, usually at the foot of his bed. There it stays to grow big and fat, its food brought to it until it is led to slaughter eight or ten months later.

"Come see my cattle," said Jean Baptiste, waving me to the back of the room.

Six cows quietly munched hay in their stalls. Their body heat was more than equal to warming the room on the coldest nights. The tiny stove served only for cooking.

The floor in the stable area was earth pounded to rock hardness by the tread of hoofs. Boards floored the living area. Knots and nails hummocked from the worn wood.

Coming from pasture, the cows enter through the front door and corridor, crossing the rear corner of the boarded area (page 576). At this point the Saint Véran housewife goads them on in no uncertain terms before they have a chance to soil her clean floor.

As we returned to the front of the house for coffee, I caught a glimpse of the work mule off in a dark corner. Behind him, in a small pen, four or five lambs chewed their cuds.

My host seated me at the table, shooing a couple of hens from under it. Chickens in Saint Véran fend for themselves, gleaning grain from the livestock during winter and feasting on unwary grasshoppers throughout the summer (opposite).

Kenny Burns takes lunch from mother's hand. The author and his wife Lyla took their infant son to Saint Véran for a 10-month stay.

As we sipped coffee and chatted, a variety of sounds came from the stable. But they were comforting sounds: the rattle of a halter chain, a hoof slamming down on packed earth, a moo or a bleat—and all of these accompanied by the soothing undertone of molars grinding hay. I could envy these people whose assets are so tangible and so close to them.

I said goodbye to Madame Brunet at the door of the main room, but my host saw me out through the corridor and the massive doors to the street, where we finally parted with a handshake.

Spring came to the mountains in May. As the snows receded and the fields dried, plowing began on hundreds of tiny plots. Men rode to work

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Wing to Wing, Chickens Roost on Poles in the Living Room

Hens get scarcely any care. They scratch fields in summer, stable floors in winter.

on muleback, bearing curious wooden plows across their shoulders. Little mule carts bumped along, carrying the winter's accumulation of manure to enrich the land again.

Not until the first of June was it warm enough for the cows to go out. Full of energy after six months in dark stalls, they bounded—almost gamboled—in the streets. For two full weeks, until the grass grew lush and thick, each family tended its own cows in the near-by meadows.

Later, the cows of each quartier were taken to pasture by a single herdsman. He began each morning at one end of the neighborhood. Family after family released their cows to him as he passed.

Goat Has a Mind of Its Own

The herd leaders—cows with prestige, the ones that take the best part of the pasture—had bells dangling from their necks. No two sounded alike. I had seen farmers, buying bells in the market, tinkling one after another until they found just the tone they wanted.

When Madame Sibille-Jouve let her cows out, they were accompanied by a goat of which she was very fond. The bewhiskered creature seemed to feel responsible for the cows. Usually she led them, but now and then, as if to show she had a mind of her own and was not just a cow like all the rest, she separated from the cattle and followed in the rear.

At close of day, when sunset hues softened the snowy peaks, the cattle returned. Slowly the herd twisted down to the village, throwing long shadows across the meadows and back up the road. On they came, mooing now and again, bells tinkling and clanking. They were headed for home, and they knew it.

One day Monsieur Jean Blanc approached me, clutching his hat in obvious agitation.

"Please, could you drive my son Joseph to the doctor?" he asked. "It's his finger ... we were sawing wood."

"Yes, of course," I answered. We drove quickly to his house. The saw had bitten into the boy's knuckle. It was an ugly

Obliging Nanny Yields Milk in a Bedroom Turned Dairy

Jacques Blanc (page 574) and his sister milk the goat in their single rock-walled room. Scenes of the Nile adorn canopy posts of the curtained beds.

wound, and there was no time to waste.

Instead of getting into the car again with the injured boy, Monsieur Blanc beckoned his elder son, Jean, to his side. Without speaking a word, he gave Jean the family wallet and motioned him to the seat beside his brother. Jean was now the head of the household and would go down the mountain with full authority, implicitly trusted to do whatever necessary to save Joseph's finger.

Thus the perturbed man acknowledged his son's superior ability to cope with the outside world. The father's ways were those of Saint Véran, but his son had done a tour of duty with the French Army.

Visitors Are Invited to Dine

This simple act of kindness on my part brought our complete acceptance. Not just the Blancs but the whole village seemed grateful.

By now I had become well acquainted with Antoine Marrou and had spent many a pleasant hour sipping coffee with him and discussing his plans for modernizing his home.

One day, as I was about to leave, he asked with some embarrassment and hesitation, "What do you think, would it be possible . . . would you and your little family come and have dinner with us on Sunday?"

His wife stood at the stove. She seconded the invitation. "Yes, please come."

At one o'clock that Sunday afternoon Lyla, Kenny, and I entered the Marrous' home. The old entrance corridor had been changed into a little kitchen-dining room complete with stove, table, and chairs—and even a radio by one of the whitewashed walls. Antoine Marrou had been one of the very first in Saint Véran to take advantage of government loans for home modernization.

All but one of Antoine's seven children stood ready to greet us. The two youngest had to be nudged forward to shake hands.

Véran, the seventh, was enrolled in a school at Gap, 60 miles away.

Once seated at the table, the reserve both families had felt for the first few minutes quickly melted away. The food was simple but delicious—roast pork, beef stew, and stuffed eggs; salad, potatoes, and rich rye bread with cheese; and red wine to wash it down, followed by steaming hot coffee.

After dinner, leaving Lyla and Madame Marrou talking at the table, Antoine took me into the old stable-living room, now devoted entirely to the cattle. He told me of his hopes for a tile floor, iron stanchions for each cow, watering troughs that would automatically stay full as the cows drank from them, and a bigger window to let the sunlight in. Upstairs in the loft he showed me how he planned to partition off bedrooms for the children.

By four o'clock Kenny had started to get cranky, and we left amid warm urgings to come back soon.

One morning in late June I watched sheep officials count the flock and send it off to the high pastures. Falling rain kept no one indoors, for this event marked the beginning of summer. Villagers joshed Célestin, the

Claude Jouve, the Village Blacksmith, and Neighbor Shoe a Horse

Much of Saint Véran's work is done cooperatively. Families contribute one member each to repairing the irrigation canal, strengthening a bridge, or improving the church. Smaller groups combine to build houses, slaughter animals, or care for livestock. A village forum votes on community problems. Here farrier Jouve pares a hoof.

Shepherd, Inspectors, and Dogs Drive the Flock Home from High Country

Célestin, who has herded the animals alone all during the summer, walks at left. His companions are *syndics*, village officials chosen annually to oversee the care of sheep. Célestin's black mongrel brings up the rear.

permanent shepherd, under whose watchful eye the sheep would browse in lush Alpine meadows until forced down by October snows. Wearing a canvas hat and a loosely fitting work suit of rough blue cloth, he darted here and there among the gathering flock, one moment returning a jest, the next scolding one of his dogs and sending it after a straying sheep.

Most people in Saint Véran take the mountains for granted, but not the veteran Célestin, who lives unsheltered and alone for weeks on end among their high crags. Trying to describe a night of rain and thunder on the mountains, he would wiggle his fingers and hunch his shoulders and lower his head as if to keep dry.

"*Mon Dieu!* You sit there getting soaked, and it's impossible to see. You wonder if lightning has struck your herd or maybe scared it over a cliff somewhere," said Célestin.

But when his sheep were grazing peacefully on sunny days, he had nothing to do but sit and feel the silence as clouds played their shadows on snowy peaks.

Short Hay Season; Long Eating Season

A day or so after Célestin left with his flocks, the village awoke at dawn to the noisy arrival of 1,000 sheep from Provence. For two hours the streets were choked with bleating ewes, eager to reach fresh grass after their 200-mile journey. This was the 46th summer that old Charles, a Franco-Italian shepherd, had brought his sheep to the mountains from the lower Rhône Valley.*

Haying is the single most important and time-consuming activity of Saint Véran. In two months enough hay must be cut to stable-feed cows over the winter. This is a job for the whole family. Men wield scythes, women rake, and their children help where they can. Awakened one morning by a sleepless rooster, I saw men at work in the frost at 4 a. m.

The dried hay is raked onto rope nets and tied in enormous 200-pound bundles. For days the meadows are dotted with these *trousses*, swaying down to the village on the backs of mules. Carts are all but useless in the up-and-down fields.

I came upon Jean Baptiste one morning as he felled the ripe hay with long, even strokes of his scythe.

"Would you mind if I took your picture?" I asked hesitatingly, remembering earlier, unfortunate photographic efforts.

"Not at all. Why should I?" he grinned reassuringly.

"Well," I replied, "there are those who don't like it."

* See "Sheep Trek in the French Alps," by Maurice Moyal, NATIONAL GEOGRAPHIC, April, 1952.

"There are those who are simple-minded," he said, throwing a glance at the village. And then he went on with his mowing.

I felt sorry for little Daniel Sibille, one of Saint Véran's oldest citizens. He lived with his sister and, since he had never married, had no sons to help him. But, like the other villagers, his livelihood depended on cows, and cows must have hay.

"Bonjour, monsieur," I said, and he looked up from his mowing (page 588).

He was glad of the excuse to stop and rest. As if to waste no time, he reached automatically for his whetstone. It hung from his belt in a little wooden box filled with water, held tight by a hank of green grass.

"This is a hard life," said Daniel. "I worked so hard yesterday that I didn't think I could get out of bed this morning. But I had to get out because there isn't anybody else to do the work. It takes me longer at my age, and I have to work late. Tomorrow I'll be stiff as a board."

Daniel wasn't quite alone in his misery.

He had a mule on which he depended to carry his hay. He didn't much like the mule, and the mule didn't care for him. But both knew they had to get along in order to make a living from the ground; they seemed to have agreed on a working armistice.

If the mule stopped working, Daniel would beat her; if she had a chance, the mule would bite Daniel.

"She got me in the neck once," he said, twisting his head. "You can still see the scars."

But somehow the two got along, the old man and his mule.

Saint Véran Gives Thanks for Its Life

At the height of the haying season, on a bright July day when the rocky blue peaks roundabout gleamed in the clear air and the edelweiss was in full flower, the Catholic folk of the village made their annual religious pilgrimage to their lovely mountain chapel of Clausis. A procession, bearing crosses and with the curé leading, departed early in the morning. Young and old alike, dressed in Sunday best, climbed for three hours to the broad green meadows lying in the very shadows of the high crags.

There, in the little chapel, they bowed their heads as the curé said Mass for bountiful crops, flourishing herds, and for the well-being of the whole valley. Then came a picnic lunch and visiting back and forth between family groups.

As afternoon shadows crept up from the valley below, the villagers sang folk melodies and, later, hymns. By five o'clock they started back, mindful of cows to be milked and other evening chores.

We spent our days talking endlessly with the villagers, strolling in the summer sunshine from one family group to another across the meadows. The women would make a fuss over Kenny and pick a flower or a strand of hay for him.

"You don't make a sou in this sort of life," one would say with a mixture of regret and pride. But there was more pleasure than sadness in their attitude. At times it seemed that they held themselves fortunate to be spared the cares of a monetary economy.

From hundreds of such conversations we were able to piece together the calm, almost fatalistic philosophy that enables the people of Saint Véran to live contenterlly amidst their peaks and simple comforts.

September came, and one morning fresh snow appeared on the mountains after a night of gentle rain in the village. That afternoon the harvest began. Field after golden field of rye fell before flashing scythes. Again mules spotted the slopes, carrying their trousses of grain. Sheaves of oats and barley sun-ripened on the enormous balconies of the haymows that rise above each house. The Alpine farmer is often obliged to harvest grain while it is still green, to avoid early frosts or snow. And, as all this went on, men plowed fields and sowed them with rye for the coming year. The autumn whirl was on.

Though the sky remained cloudless, there was an unmistakable nip in the air the morning the sheep herd came down the mountain (page 582). At the edge of the village, the dusty and exciting job of sorting began. Young and old leaped into the herd to drag out ewes as they recognized them. Each family knew its sheep, usually by a notch or a small hole cut in their ears in a certain way. In many cases owners knew sheep by their faces. Célestin, sun-bronzed and proud, bowed and doffed his hat with great ceremony.

Father Bakes the Family Bread

There remained but a single event before the season drew to a close, the annual bread bake that would fill the empty storage coffers of a hundred homes. Flails thumped loudly on the wooden floors of the granaries.

Some villages used an electric threshing machine, bought with funds given by a former neighbor who had made his fortune in the outside world. The villages shared it, moving it from house to house in a mule cart. There were some who used it only for the grain to

Winter Snows Turn Rye and Barley Fields into a Skier's Playground

Local legend says Saint Véran, a 6th-century bishop, banished a dragon from the vicinity of Cavaillon, France. Flying east, the monster rammed the Alps head on. Mountaineers heard the crash and found the carcass, but could not explain its presence until a wandering shepherd revealed the bishop's act. Thereupon the mountaineers raised a church at the site and named their community Saint Véran.

These young people hold a ski meet on the slopes of Montagne de Beauregard, just above the village. A ski lift (cable at left) carries them up the mountain.

be milled into flour, fearing that it might take the life out of kernels to be saved for seeding next year's crop.

Carts heaped with grain twisted down the little road to the mill. Day and night, without stopping, the millstones turned, for soon the stream that powered them would freeze.

Each quartier had its community bake oven, and the families drew lots for the order of their turns to use it. Stone cold after lying idle for a year, the oven required four hours of firing before it was hot enough for the first baking. Everyone provided an equal share of this initial firewood. While this was going on, the women of the family whose turn came first were at home mixing 100-pound batches of dough in wooden troughs. They shaped the dough into pads two or three inches thick and the size of a dinner plate and placed them on boards to be carried to the oven (below).

The men piled wood into the oven, and the fire roared. At last it was hot enough. The head of the first household sent word home to start the dough coming. Promptly, his sons appeared, each carrying a breadboard with a baker's dozen pieces of dough on his shoulder. Using a long wooden paddle, the father pushed loaf after loaf into the blisteringly hot oven. Sixty loaves filled it, and the iron door slammed shut.

Finally, after about an hour, the farmer opened the door, quickly took a loaf, broke it, and tasted a piece.

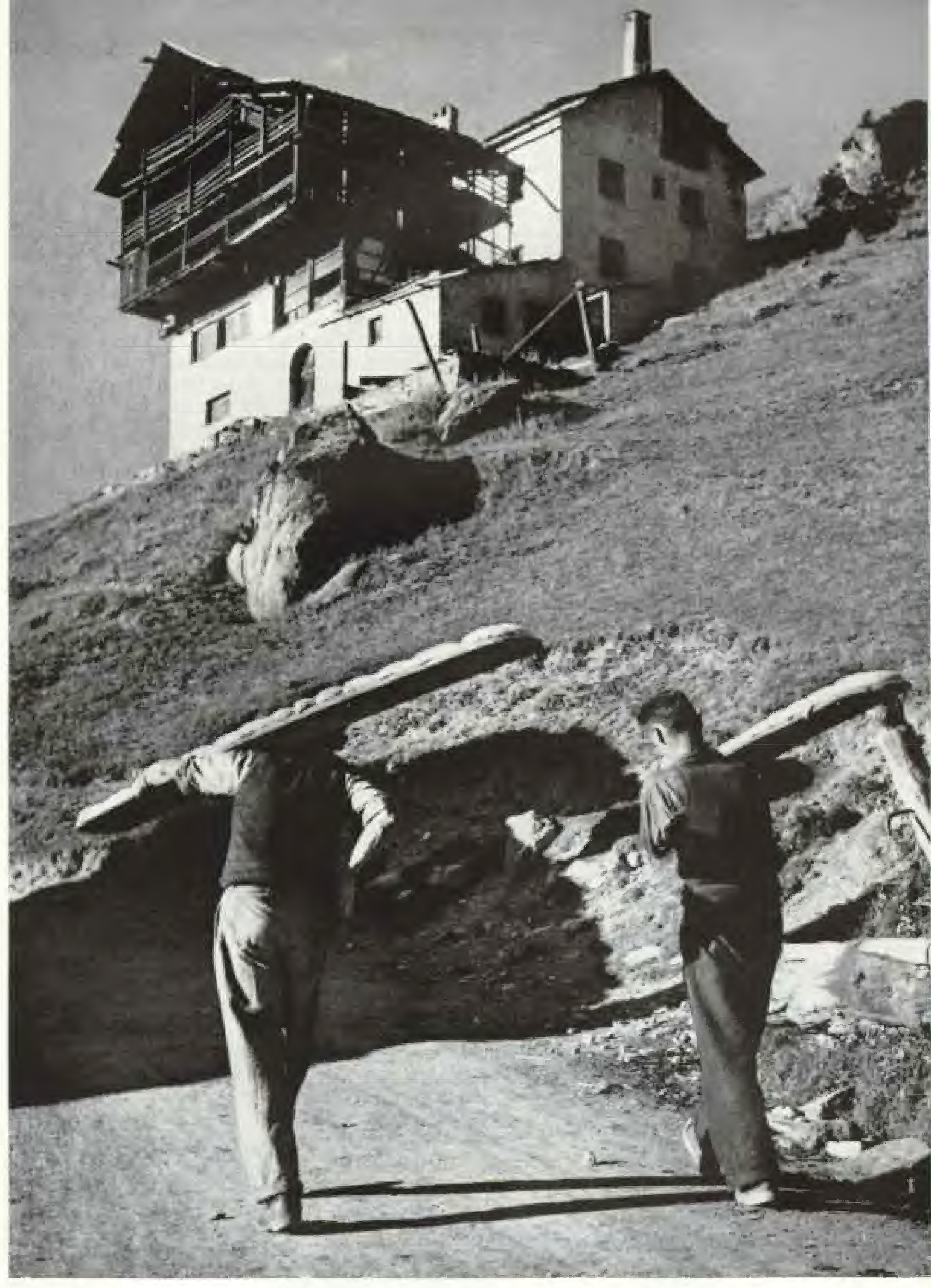
"Not as good as last year," he muttered, and handed it to his wife.

"Oh, it's all right," she comforted, munching a piece. "You know you never like it until it's cooled off."

Other men of the quartier, kibitzing until their turns came, passed the loaf around.

Madeleine Sibille's Rye Loaves Await Their Call to the Oven

Milling and baking occur once a year—after the harvest is gathered and before ice stops the mill wheels. Wives mix the dough at home, sons carry it to the community oven, and husbands supervise the job. Madeleine, sister of Daniel (page 583), has slashed her loaves with an identifying mark to prevent cracking under heat. Mule at manger is Daniel's *bête noire*; the two carry on a running feud.



Two Months' Sustenance on Their Shoulders, Brothers Head for the Bakery

Jean and Joseph Blanc carry their family's first batch past a wayside fountain. The hillside chalet was looted during World War II; it stands abandoned and gaunt.

Each cut off a bit with his pocket knife, tasted it, and wondered to himself if his batch would be as good. Though the center was still moist and heavy, bread never tasted better to me than that first rye loaf.

The sons took the steaming loaves home in the family mule cart and returned, balancing dough-laden boards on their shoulders (page 587). Thus, day and night, the cycle repeated: a few minutes of filling the oven, an hour of baking, a few minutes removing the loaves, an hour of reheating, cleaning out the ashes for the next batch . . . never stopping until every family in the quartier had had its turn. Traditionally, each family fills the oven once for each member of its household.

Bread is stored in chests or on shelves in the granaries, where it dehydrates in the dry Alpine air. Mold is impossible without moisture, and there is never any spoilage. Only a brief dunking in soup is necessary to make it palatable.

The breaking of this new bread that I shared in a dozen homes was the fruition not alone of well-tended crops but of friendships long to be cherished.

Villagers Test New Ideas

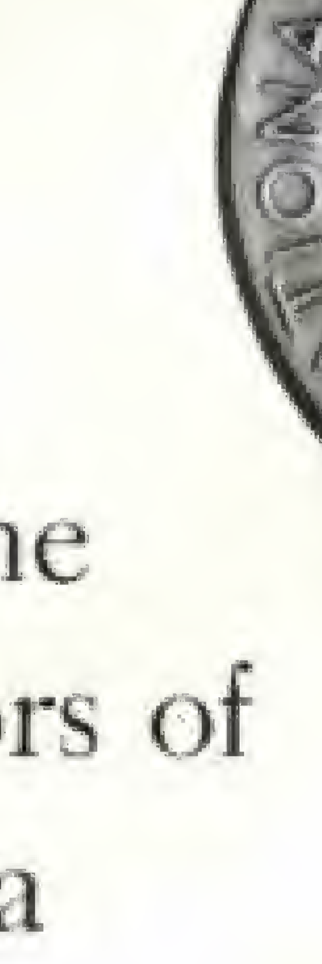
My months of Alpine research confirmed that Saint Véran, though still clinging to her old traditions, is slowly changing under the 20th century's impact. Drawn off regularly now for military service, her young men return home with new ideas. Summer visitors make their way up the mountain each year, bringing their urban influences to the doorsteps of the village. Saint Véran is restrained by the past, but she has one foot in the future.

But those of us who seek stability in the midst of our modern pace might do well, I think, to turn our attention now and then to the strengthening of such homelier joys as still live on in Saint Véran.

Daniel Sibille, Shortest Man in the Village, Whets a Long Scythe

This treasured blade was forged broad enough to endure countless honings. Sibille's belt box holds whetstone and water; his wide beret is that of French Alpine troops.

Society Honors the Conquerors of Antarctica



ON February 4, before a distinguished audience gathered at the White House, President Dwight D. Eisenhower presented the National Geographic Society's Hubbard Medal to British explorer Sir Vivian Fuchs and to the United States Navy Antarctic Expeditions of 1955-59.

The ceremonies took place in the green-draped Cabinet Room adjoining the President's private office. A proud, smiling Lady Fuchs looked on as the coveted gold medal was bestowed on her husband.

Secretary of the Navy Thomas S. Gates, Jr., accepted the Hubbard Medal for the accomplishments of his service in the exploration of the White Continent. For their roles in the conquest of Antarctica, gold duplicates went to Admiral Arleigh A. Burke, Chief of Naval Operations, and Rear Admiral George Dufek.

Medal for Trans-Antarctic Leader

Melville Bell Grosvenor, President and Editor of the National Geographic Society, introduced the medal recipients to the President.

"I speak for the Trustees," he said, "and nearly 2,500,000 National Geographic members when I thank you for your interest in our work—the increase and diffusion of geographic knowledge. We are proud, Sir, that you are a long-time member of our Society.

"Mr. President, the Hubbard Medal is one of geography's highest honors. It commemorates Gardiner Greene Hubbard, a founder and first President of our Society—and, incidentally, my great-grandfather. Admiral Robert E. Peary, discoverer of the North Pole, received this medal first in 1906.

"Today we honor the Commonwealth Trans-Antarctic Expedition for its extraordinary achievement of the first crossing by land of the southernmost continent. In a period of 99 days, from November 24, 1957, to March 2, 1958, Sir Vivian Fuchs and 11 other hardy men traveled 2,158 miles over the South Pole from the Weddell Sea to McMurdo Sound. They accomplished what Shackleton called 'the last great polar journey that can be made.'

"Conditions facing Sir Vivian and his men were cruel. White-outs blinded them. Crevasses threatened to swallow them. Strange illnesses slowed them. And finally, the cold was so bitter that—I am told on best authority—even the penguins turned blue!

"To have made the journey at all is a feat of unprecedented valor and leadership. But, Mr. President, at the same time they carried out some of the most valuable scientific work of the International Geophysical Year. Despite hardships, the explorers stopped every 30 miles to make seismographic shots, and they made gravity tests every 15 miles. Our cartographers will have to remake our maps of Antarctica as a result of these surveys.

"For his mastery of a continent, the National Geographic Society has awarded the Hubbard Medal, with this citation:

" 'To Sir Vivian Fuchs for brilliant leadership of the British Trans-Antarctic Expedition 1955-58 and for his extraordinary contributions to geographic knowledge of Antarctica.'

Navy's Achievements Recognized

"Now, Mr. President, as a sailor and classmate at Annapolis of both Admirals Burke and Dufek, I am especially pleased—and I know you are—that the Trustees of the National

Geographic Society have also awarded the Hubbard Medal to the United States Navy for its outstanding contributions to science through its IGY Antarctic Expeditions.

"Under the leadership of Secretary Gates, Admiral Burke, and Rear Admiral Dufek, more than 10,000 men of our Navy have built the many outposts from which the unknown lands of Antarctica are being studied.

"The logistics would have been impossible for any organization but the United States Navy. Everything had to be shipped or planed in, from delicate instruments to lumber for shelter. Through the world's most dangerous waters, our Navy brought hundreds of thousands of tons of supplies into Antarctica.

"To build and supply the famous station at the South Pole itself, where Sir Vivian and his men received rest and refreshment from American scientists and Naval officers, the Navy and Air Force flew in 1,450 tons of supplies.

"The four-year effort—which is continuing—was in the highest tradition of the Navy, Mr. President. Lt. Charles Wilkes, who first sailed to Antarctic waters in 1838, would have been proud. His successors, whom we honor today, have continued and enhanced the Navy's great tradition of discovery and exploration. The citation on the Medal reads:

" 'Awarded to the U. S. Navy Antarctic Expeditions 1955-59 for outstanding service to science in exploring vast South Polar regions and establishing scientific stations for the International Geophysical Year.'

"Gold duplicates have been struck for Admiral Burke, your great Chief of Naval Operations and father of the nuclear-powered Navy, and for Rear Admiral Dufek, who is still in command of Operation Deep Freeze."

News cameras whirred and clicked as the President received the gold medals from Dr. Grosvenor and presented them in turn to Sir Vivian Fuchs, Navy Secretary Gates, and Admiral Burke. Each received as well a firm Presidential handshake. In response to a question from Mr. Eisenhower, the British explorer briefly described the Sno-Cat, the tracked vehicle that provided his principal means of transportation across the icy Pole.*

The formal ceremonies concluded, the President turned to Lady Fuchs, who was chatting with Sir Harold Caccia, British Ambassador to the United States. Offering her his congratulations on her husband's historic achievement, the President flashed the famed Eisenhower grin. "I'll bet," he said, "you're mighty glad you stayed home."

* See "The Crossing of Antarctica," by Sir Vivian Fuchs, NATIONAL GEOGRAPHIC, January, 1959.

President Eisenhower Presents the Hubbard Medal at a White House Ceremony

Secretary Thomas S. Gates, Jr., (left) accepts on behalf of the United States Navy. Sir Vivian Fuchs is honored as leader of the Commonwealth Trans-Antarctic Expedition. Adm. Arleigh A. Burke holds two gold duplicates, one for absent Rear Adm. George Dufek. Melville Bell Grosvenor, The Society's President and Editor, stands at right.

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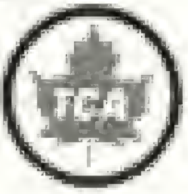

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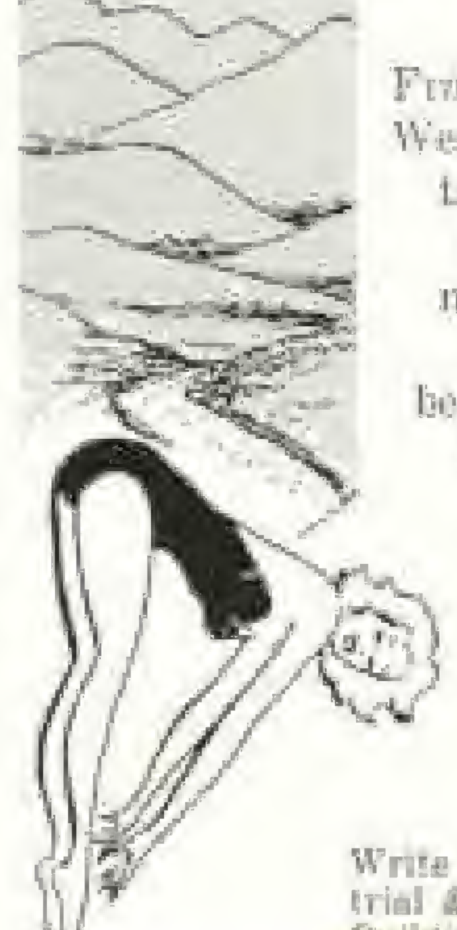

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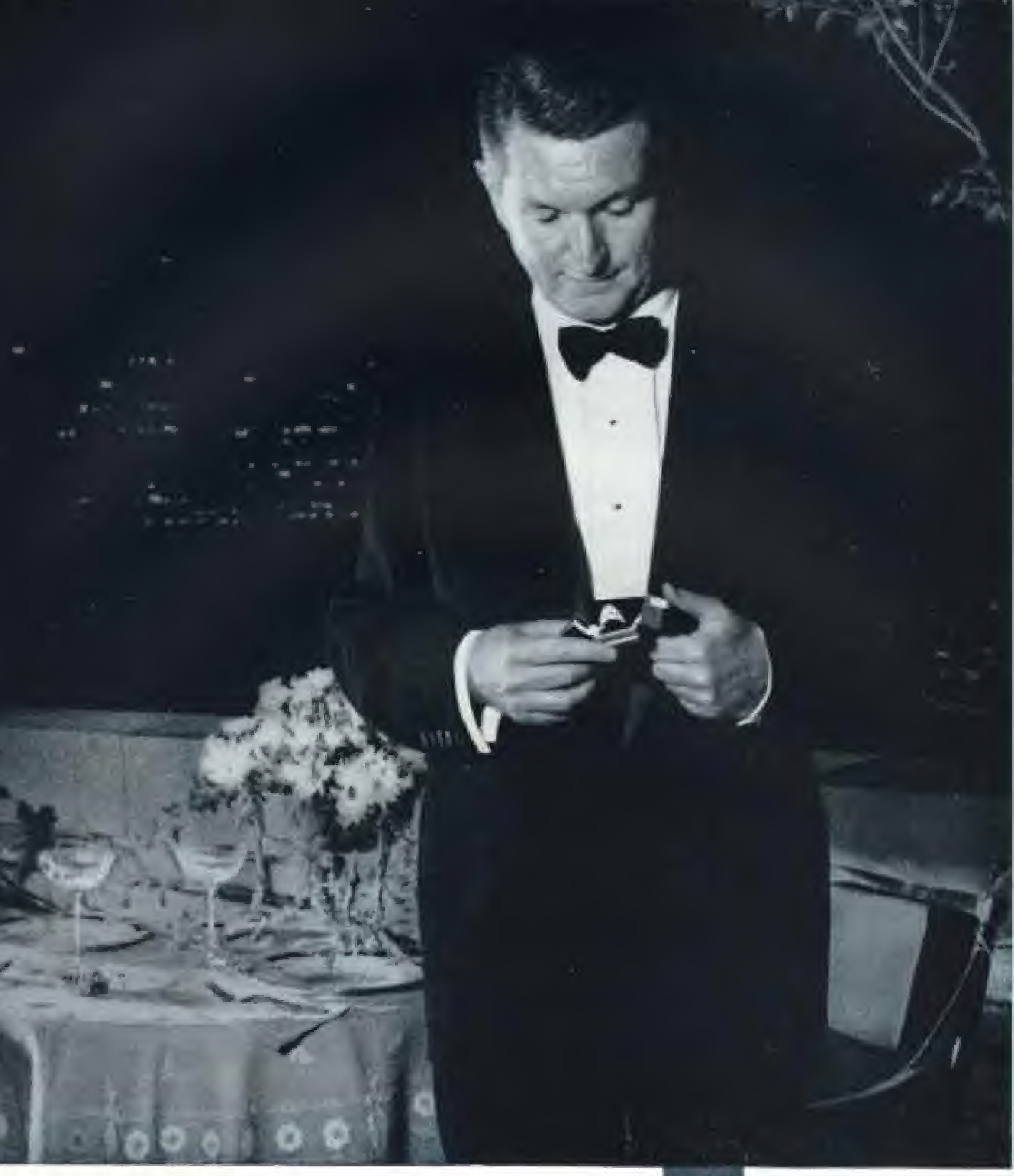

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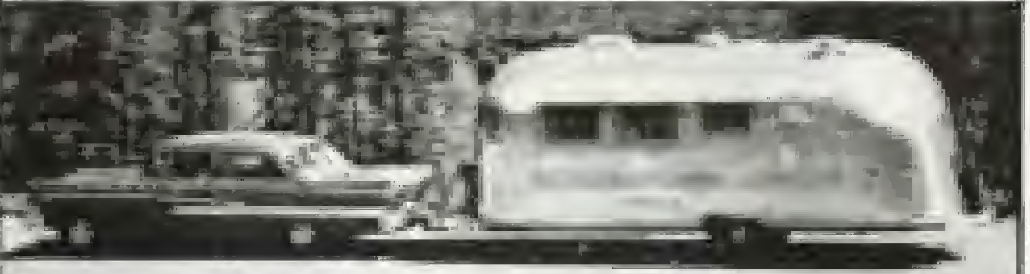

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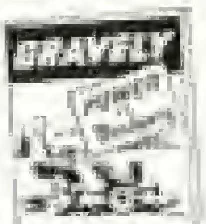

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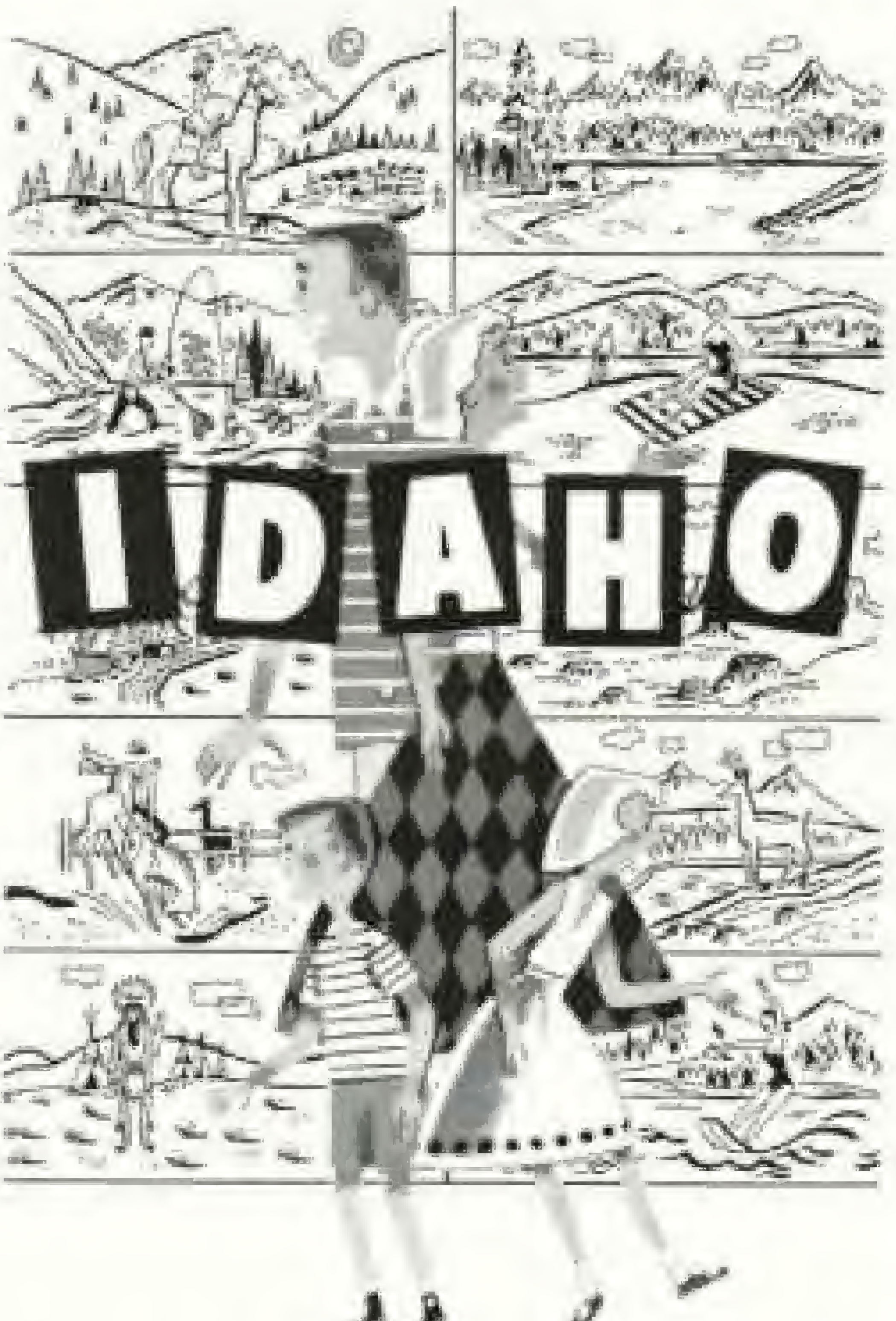

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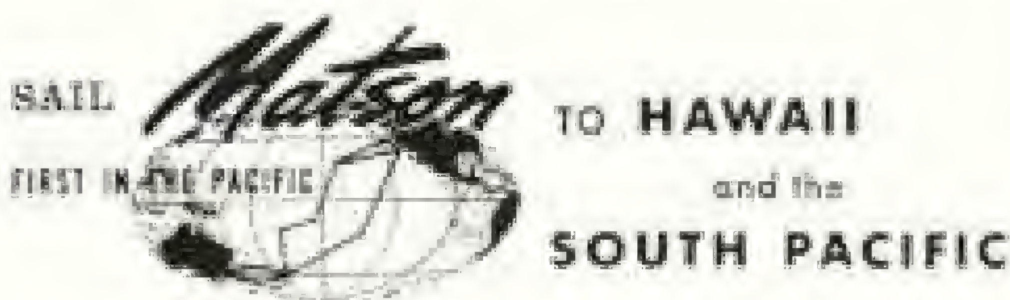

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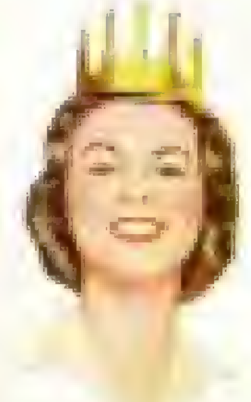

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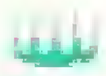

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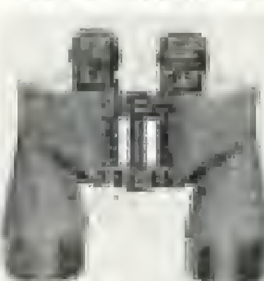

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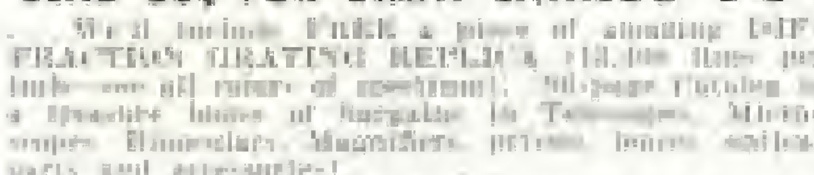

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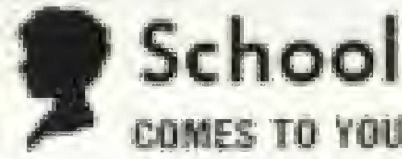

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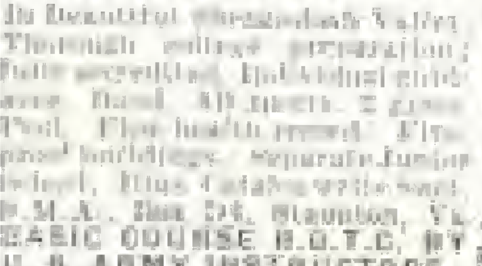

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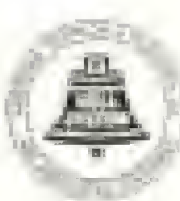

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