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WASHINGTON, D. C.

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NATIONAL GEOGRAPHIC SOCIETY

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded sixty-seven years ago, the National Geographic Society publishes the National Geographic Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys continually being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus. By dating the ruins of vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for 300 years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1933, discovered the oldest dated work of man in the Americas. This stone is engraved, in Mayan characters, November 6, 291 B. C. (Spinden Correlation). It antedates by 368 years anything else dated in America and reveals a great center of early American culture, previously unknown.

On November 11, 1935, the stratosphere flight of the world's largest balloon, *Explorer II*, sponsored by The Society and the U. S. Army Air Corps, reached a world-record altitude of 72,395 feet. Capts. Albert W. Stevens and Orvil A. Anderson took aloft a ton of scientific instruments and obtained results of extraordinary value.

A notable undertaking in astronomy was launched in 1949 by The Society and Palomar Observatory of the California Institute of Technology. This project is photomapping the vast reaches of space and will provide observations all over the world with the most extensive sky atlas yet made.

In 1948 The Society sent seven expeditions to study the sun's eclipse on a 5,150-mile arc from Burma to the Aleutians.

A Greek cargo ship sunk in the Mediterranean 2,300 years ago was found in 1952 and is being excavated by the National Geographic Society-Cousteau Marine Archaeological Expedition led by Capt. J.-Y. Cousteau of the French Navy.

The National Geographic Society and the Royal Ontario Museum in 1951 explored and mapped newly found Chubb meteor crater, 11,500 feet in diameter, in northern Quebec.

The Society and individual members contributed $110,000 to help preserve for the American people the finest of California's sequoias, the Giant Forest in Sequoia National Park.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration in 1938.

What the Captain said to the Lady

The Captain was showing some visitors the bridge. "This," he said, patting a neat mahogany box, "is the soul of my ship. The timing of everything that happens aboard depends on this chronometer.* Not only the timing of the guns, but even our very position at sea hangs on it." The captain paused. "Actually an error of only four seconds could put my ship a mile off course!"

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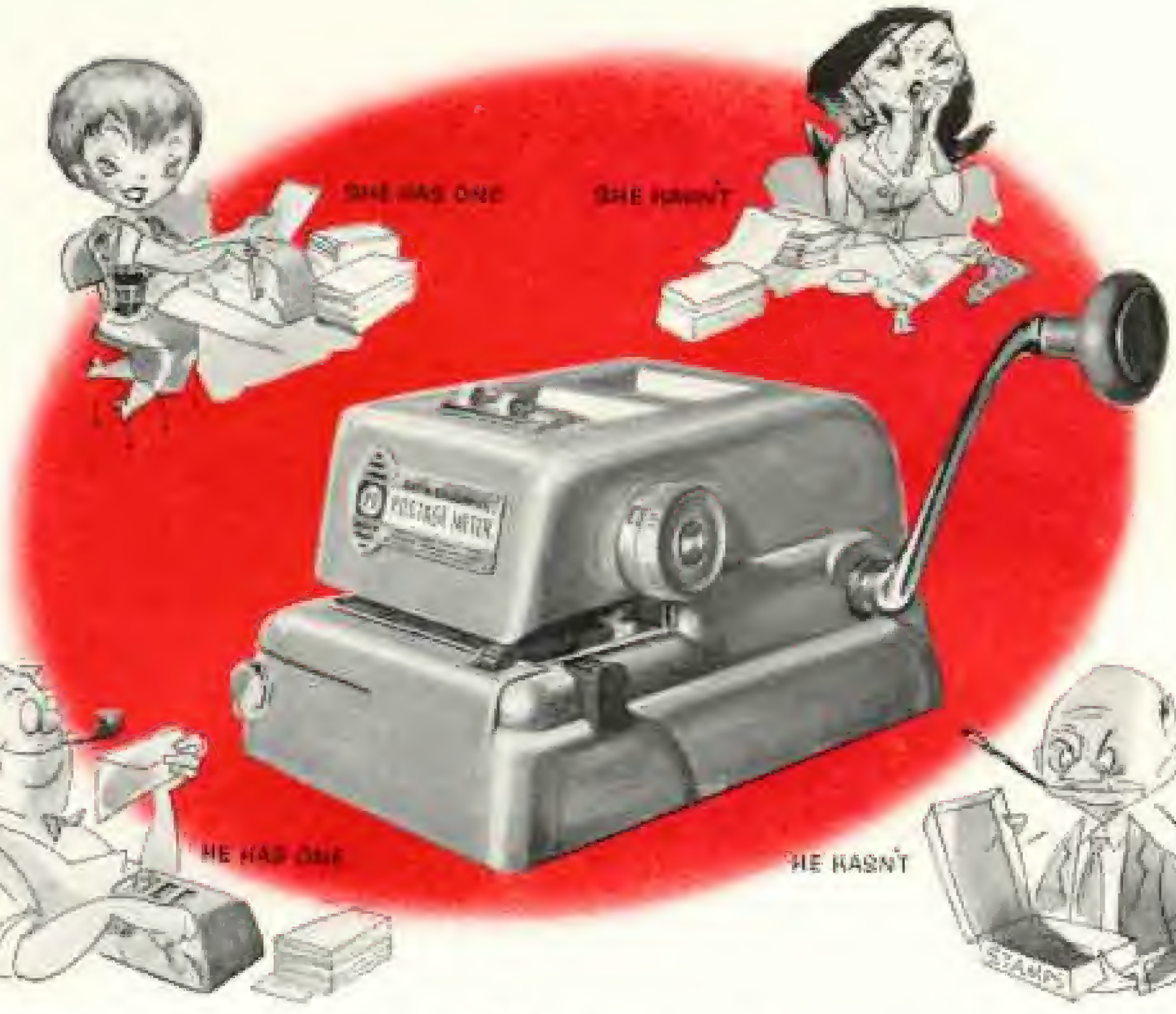

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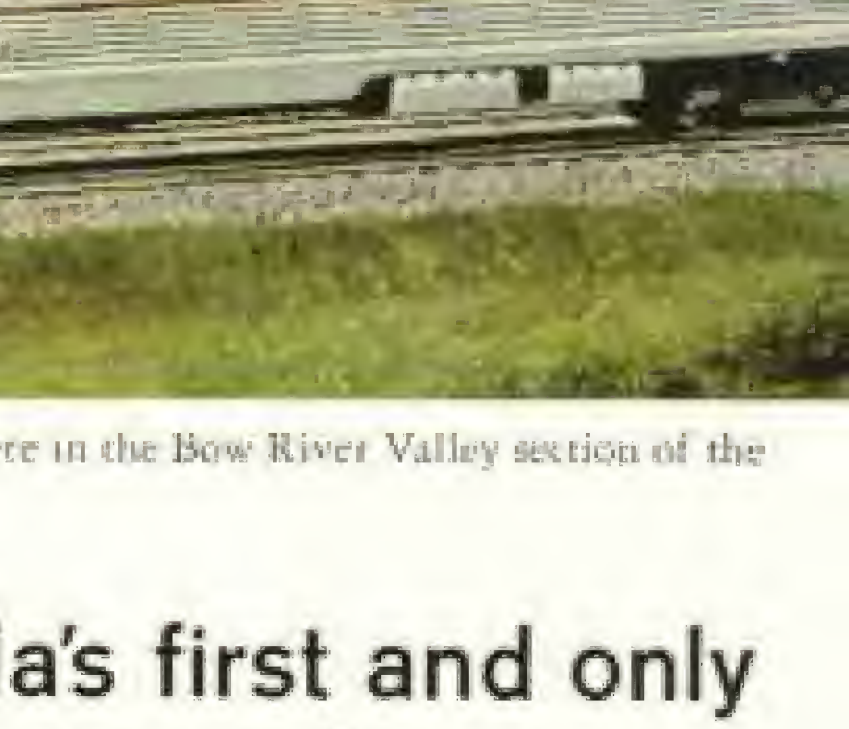

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3,000 square miles of wonderland ... and it belongs to you

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The first of our national parks, the Yellowstone was set aside in 1872 by a far-sighted Congress. Typically American in spirit, Yellowstone is rich in inspiration, sweeping in conception, rugged and raw in its beauty. And if it blows off steam occasionally, well, that's American, too.

A Salute to the National Parks Association

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With headquarters at 2144 P Street N.W., Washington, D. C., the Association stands as a ready means by which Americans can do their part in defending the national parks and monuments. Founded in 1919, the Association is a non-profit, non-political organization with nation-wide membership. Its sole purpose is to see that our great nature reservations are protected from despoiling influences and are administered under highest standards.

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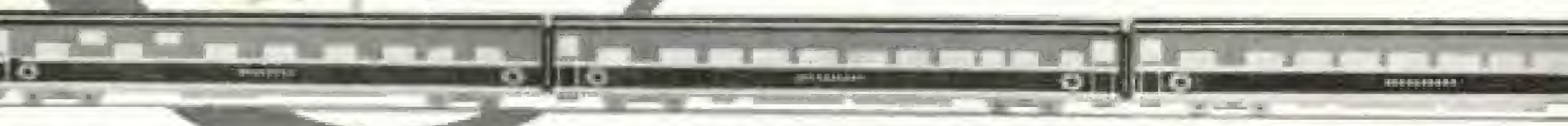

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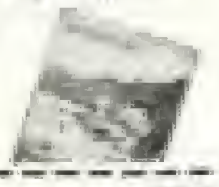

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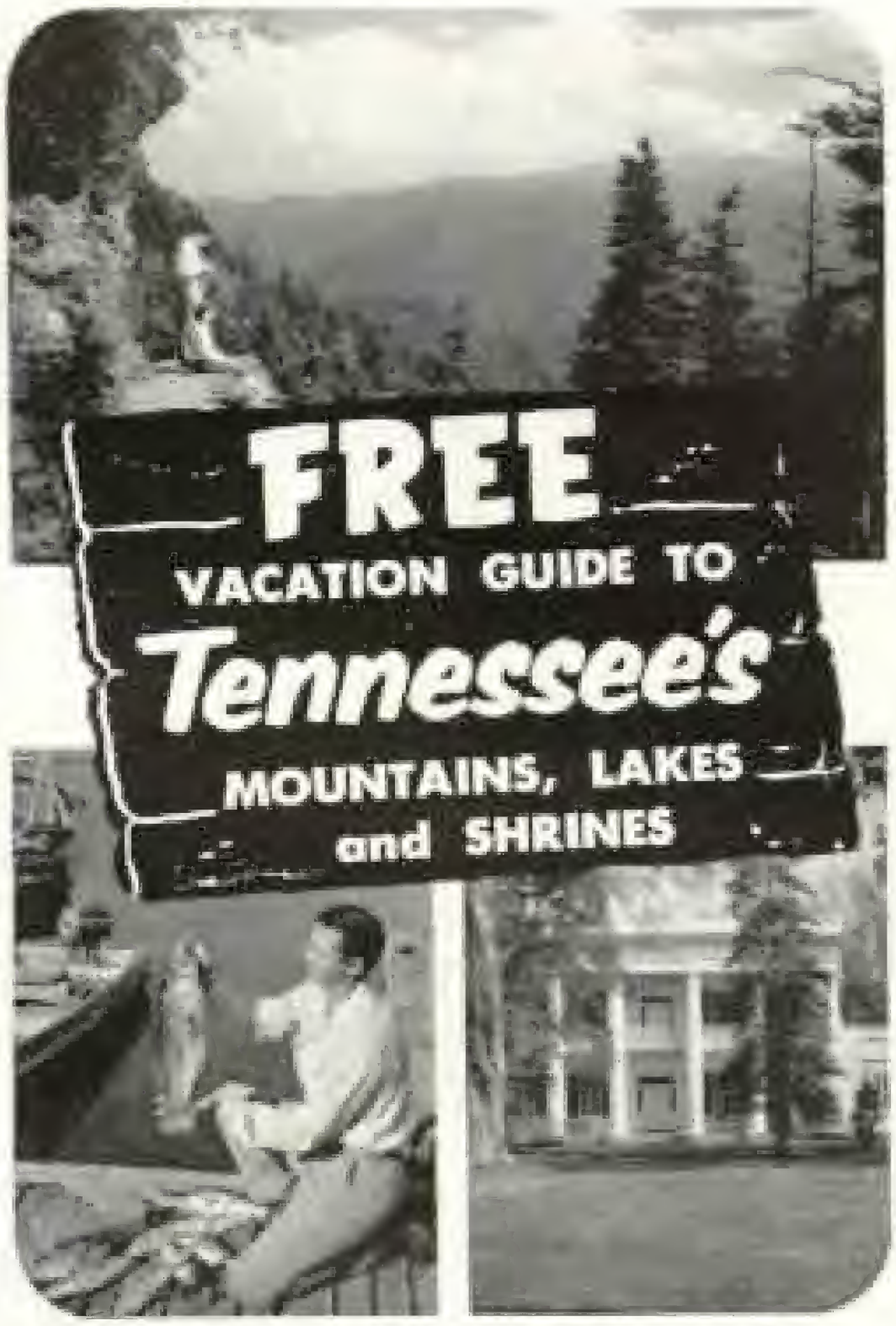

Long after it's over, your Tennessee vacation will linger in your memory. You'll never forget the Great Smoky Mountains National Park, where mountains reach above the clouds, and the romantic Cumberlands, home of folk art and folk music.

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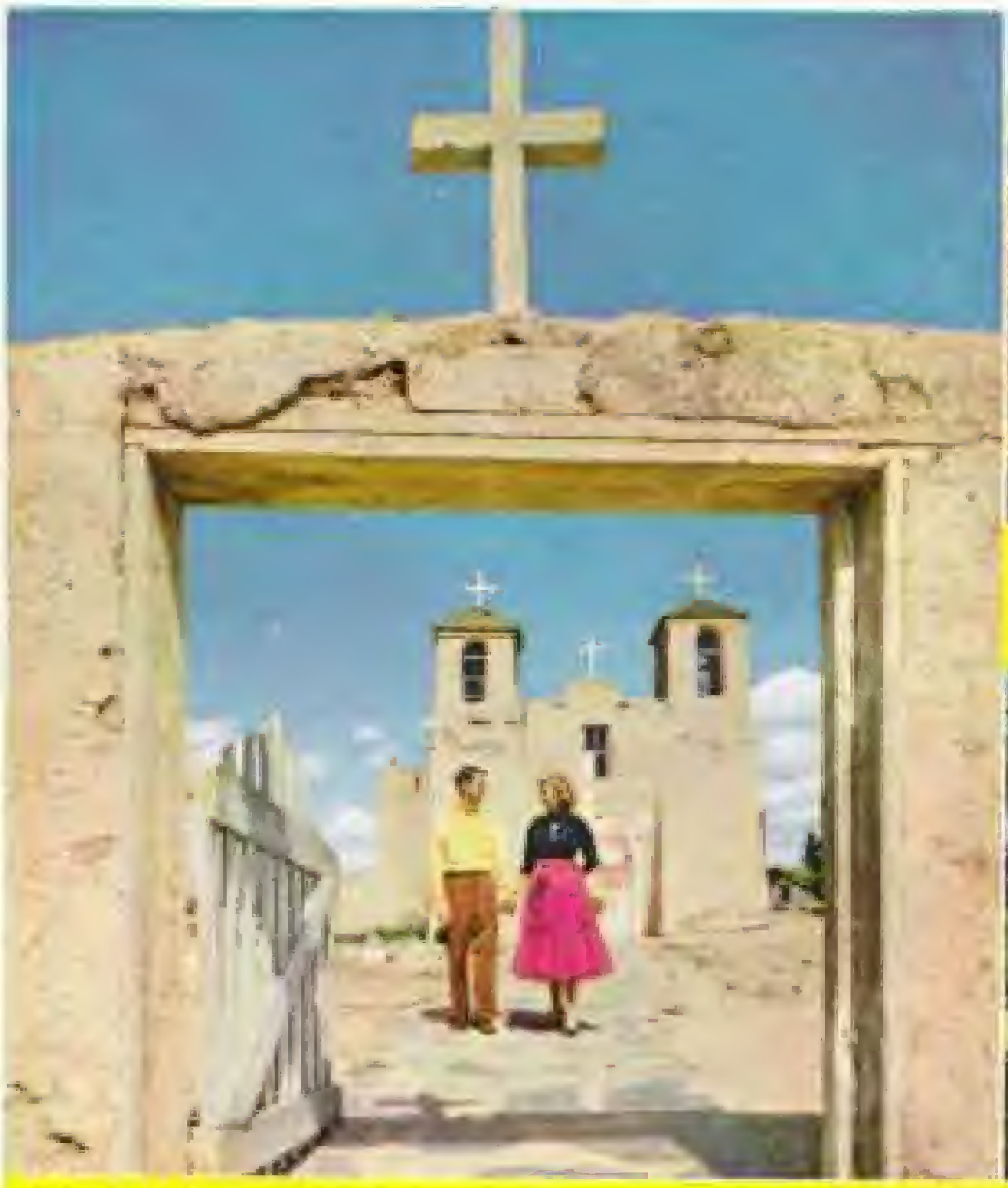

Church of Ranchos de Taos, built by Spanish in 1772. One of scores of historic landmarks you will want to visit. Cities here are modern with a foreign flavor! Many museums, galleries

Wherever you live, you can drive here, tour state (which has 7000 miles of paved roads) and return home within 2 weeks.

"Must See" attractions in Albuquerque include University of New Mexico, Old Town Plaza. Days here are sunny, nights cool.

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Camel Rock, near Santa Fe, is typical of New Mexico's thousands of exotic formations.

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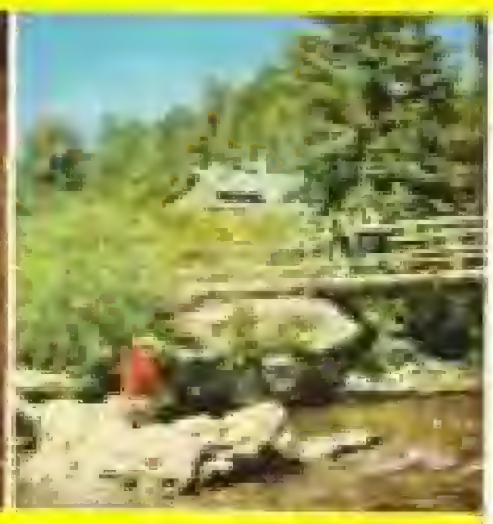

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It is the kind of beauty which designers call functional. It is beauty that grew from within; the basic concept here is that the first function of a fine car is its performance.

The first thing you notice about Lincoln's new performance is *Turbo-Drive*. Here is one unbroken sweep of smooth, silent power through every speed range.

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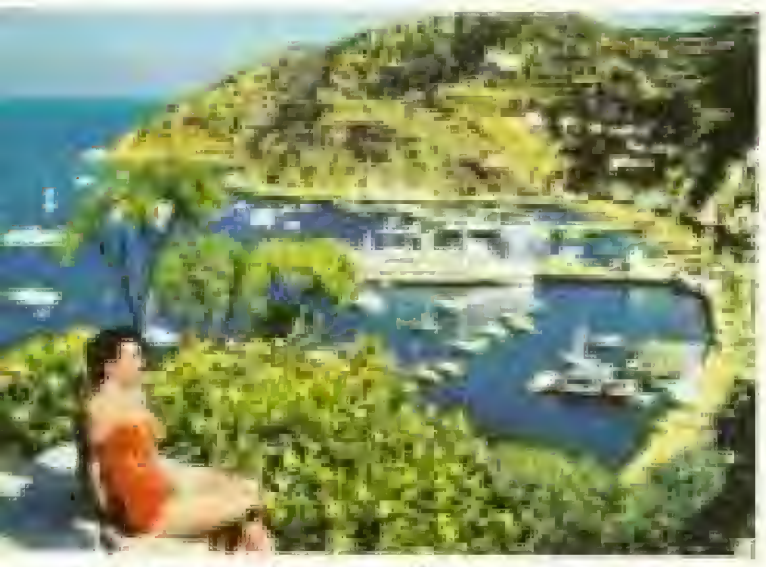
How's this for scenery? . . . In a single glance, subtropic palm trees and two mile-high Mt. San Antonio!

See the world's largest trees at Sequoia National Park: 230 feet high, 20-foot trunks, 30 centuries old.



It's just a short cruise to Santa Catalina Island, home of the big flying fish and strange Undersea Gardens.

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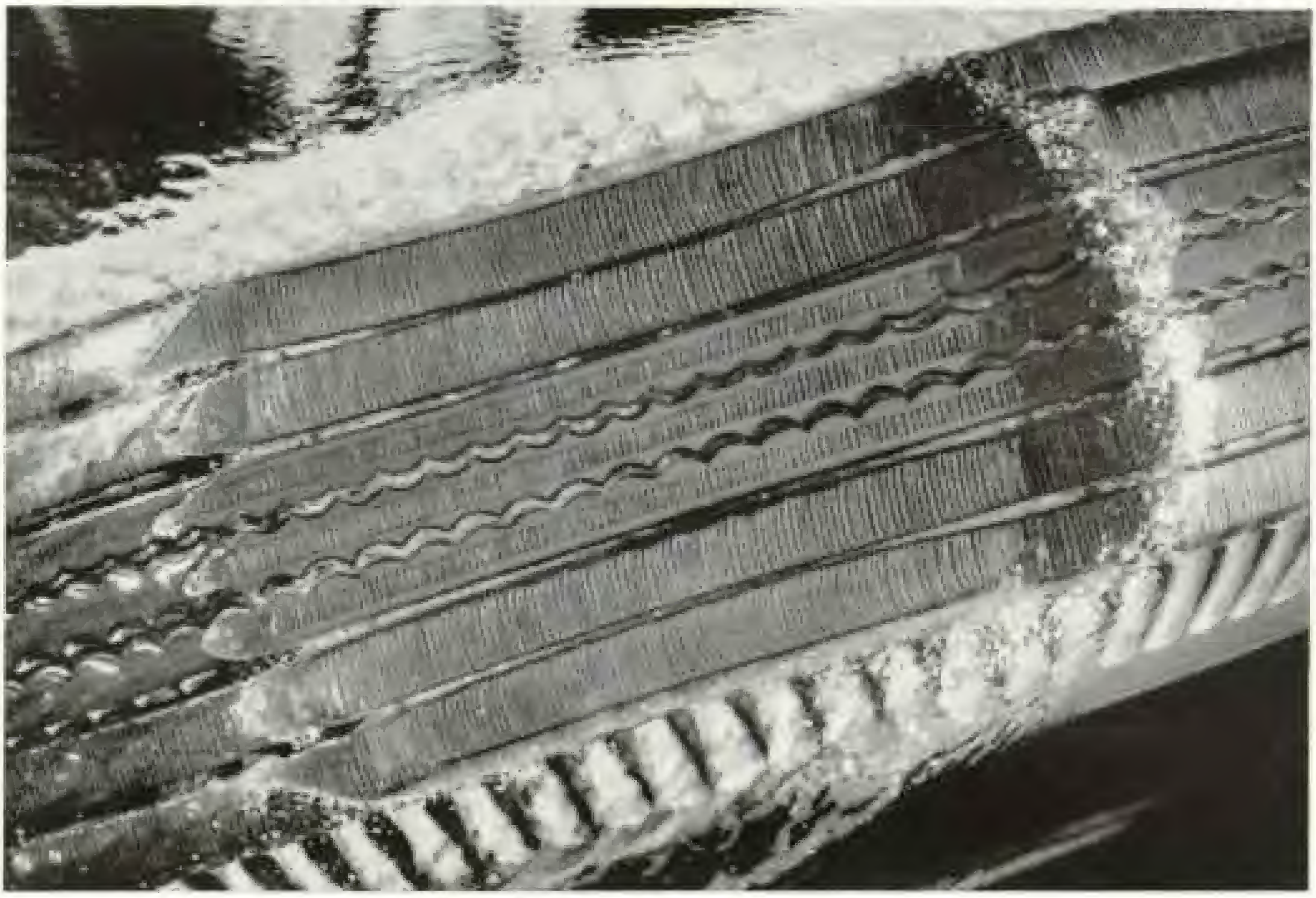

Here's how LIFE-SAVERS stop you safely

THIS IS A CLOSE-UP PHOTO of a B.F.Goodrich LIFE-SAVER coming to a stop on a sheet of wet, slippery glass. Taken from underneath, it shows what happens when you hit the brakes on a wet road.

Thousands of flexible grip-blocks go into action. They *flex*, wipe away the water, *hold* on the dried path, where other tires would slide. They grip with a caterpillar action. They're the result of a costly extra step in manufacturing.

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Compare the Safety; Compare the Cost; Compare—
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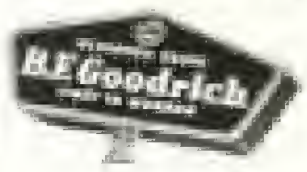

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. . . highest mountain east of the Rockies

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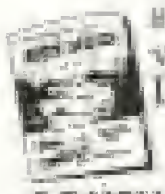

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. . . and my Hartford insurance did the rest!

(Based on Company File #H-52-10726)

Nancy and I are both heavy sleepers. If it hadn't been for Skippy, chances are neither of us would have awakened until too late.

As it was, our dog's barking didn't fully rouse me. But his frantic pawing finally made me realize something was wrong.

Then I got a whiff of smoke. That told the story! Quickly, I helped Nancy from the house, and raced to the alarm box . . .

The firemen soon had the blaze under control. But a lot of damage had already been done. Now—after the fire—I couldn't help thinking how close I had come to making a mighty expensive mistake. *Only a few months before, I had considered reducing my insurance!*

I'm thankful my Hartford Fire Insurance Company Agent steered me away from that idea which, he pointed out, results in seven out of ten people not having enough insurance. When fire strikes, they often lose *thousands* more than they could ever save.

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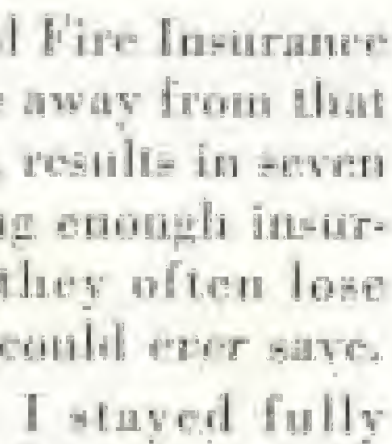

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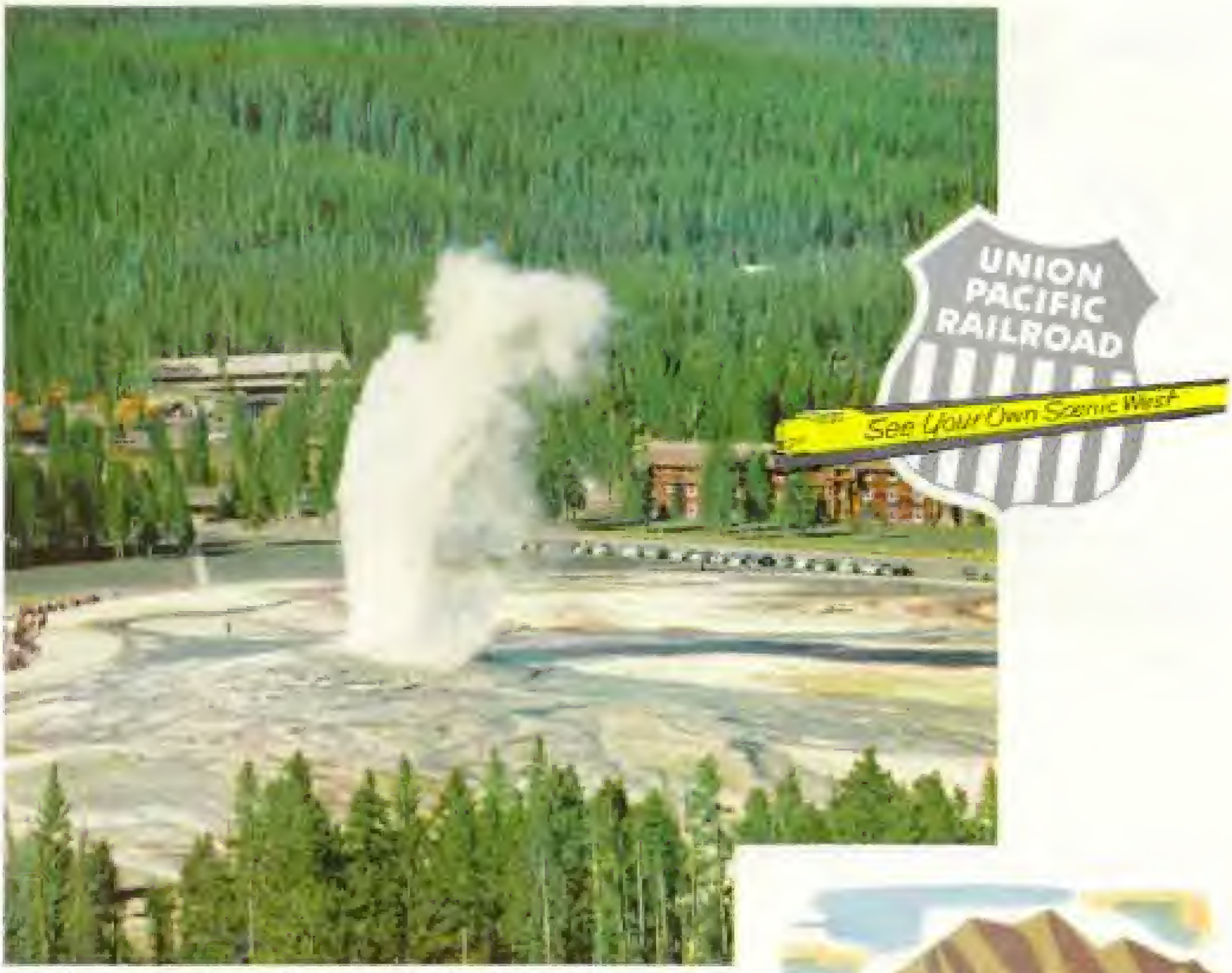
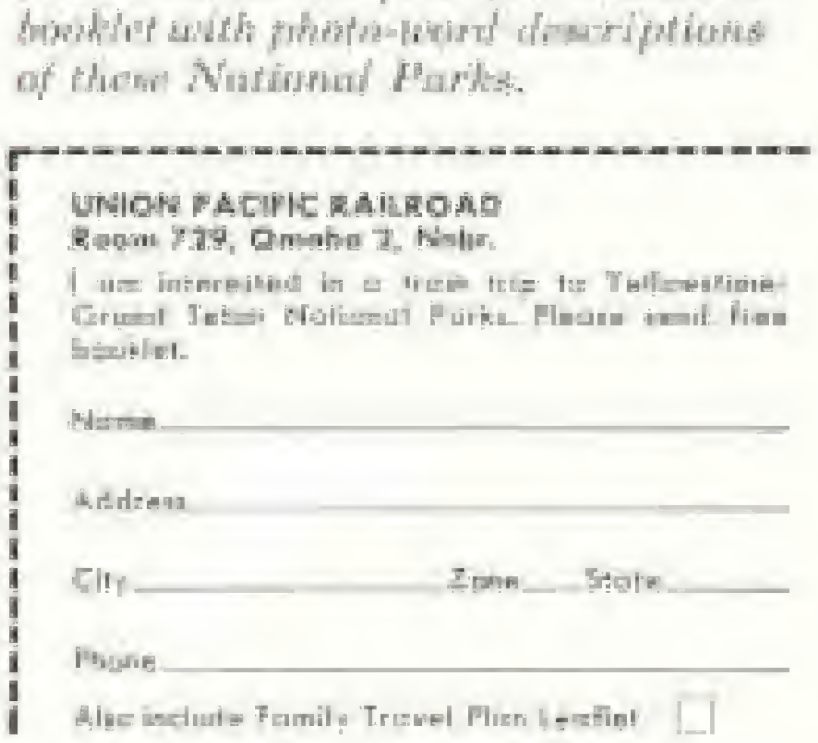


Most famous of all geysers—reliable Old Faithful with Old Faithful Inn in background.

YELLOWSTONE · GRAND TETON
NATIONAL PARKS

Every season Yellowstone is "discovered" by thousands. This nature-endowed wonderland has no counterpart anywhere. Here are geysers that send aloft pillars of steaming water . . . a waterfall twice the height of Niagara . . . boiling "paint pots" . . . and everywhere eye-delighting scenic beauty. Comfortable hotel and lodge accommodations are available.

When you "discover" Yellowstone this summer, visit its near-by neighbor, Grand Teton National Park, an area of scenic mountain splendor also known as the Jackson Hole country. A new, modern lodge, recently completed, will accommodate additional hundreds of visitors to this National Park. Go this year, in restful comfort, by Union Pacific.



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You travel first class at no extra fare


"Must try that Trigger-Torque Power"


"Ford's our next car"

...in the '55 FORD

Welcome aboard the '55 Ford. It's your passport to the smoothest sailing on the road.

Slip behind the wheel of any of the 16 new body styles. Surround yourself with beauty from the sweeping wrap-around windshield to the flat, ship-shape rear deck. Any Ford you fancy carries the flair of Thunderbird styling from stem to stern—and a score of other new features as well.

Put your foot down—and breeze away in a surge of Ford's Trigger-Torque power. Here's power with far more "wheel push". . . power so alert to safety's demands, that it responds with split-second alacrity. Three new and mighty engines are yours to command: The Y-block V-8; Y-block Special V-8 (available on Fordomatic-equipped Fairlane and Station Wagon models); and the I-block Six . . . the most modern six-cylinder on the road.

Don't mind if heads turn for another look at you. It's the compliment every first-class traveler receives. So don't miss the boat. Drop in at your Ford dealer's this very day!

Treat yourself to a Trigger-Torque Test Drive!

They're going to have a baby...

THIS COUPLE have recently learned that their baby is on the way. Already, with the help of their doctor, they are planning for the welfare of the mother-to-be . . . and the arrival of a healthy child.

Thanks to the safeguards with which medical science has surrounded pregnancy and childbirth, the chances are better than ever that prospective parents can now realize their great expectations. In fact, infant mortality today has been cut to 28 per 1,000 live births. Only 30 years ago, it was 71.7 per 1,000.

The record for mothers is even better. As recently as 1941, there were 29 maternal deaths among every 10,000 live births. Today, the rate has plummeted to less than seven deaths. These great gains have been made even though the number of births in recent years has exceeded three and a half million annually . . . an increase of almost 50 percent since 1941.

An important factor in achieving this proud record has been the growing awareness among expectant parents of the importance of medical care *started early and continued throughout pregnancy*.

So, if a baby is expected in your family, here are some of the things the expectant mother can do:

1. Take a calm, realistic and happy attitude about pregnancy. Should anything upset you, take your questions to your doctor. He wants to help you face pregnancy as a normal, joyous state.

2. Follow your doctor's advice about periodic medical examinations, special diagnostic tests and particularly about rest, exercise, diet and weight control.

3. Plan, if possible, to have your baby in a hospital where you will have the most modern medical and nursing care. It is wise to make hospital reservations promptly . . . for today, 9 out of every 10 mothers go to hospitals to have their babies.

The husband, too, can help his wife over the months before the baby comes. The arrival of a new child is a most important event in family life . . . as important to the husband as to the wife. When home duties are shared, many problems fade away.

Metropolitan has published, for all parents-to-be, a booklet about the important and wonderfully rewarding job of parenthood. The title is *Preparing for Parenthood.* Just fill in and mail the coupon below for your free copy.

Metropolitan Life Insurance Company

1 Madison Ave., New York 10, N.Y.

Please mail me a copy of your booklet 450-N.

Name_____

Street_____

City_____ State_____

Metropolitan Life Insurance Company

Smartest of the Smart Cars

the NEW DE SOTO

TAKE A TURN AT THE WHEEL of a De Soto, and it's certain you'll be spoiled for other cars. For here is a car that is really exciting to drive. Not only has its mighty V-8 engine the sheer power you need for instant response — but there is a smoothness, a sureness of control, a solid feel, that puts the De Soto in a class by itself among American cars.

So don't be content to just admire De Soto style in the showroom. Take a Firedome or Firelite out on the road. Try a stretch of cobbles, the steepest hill in town, a bit of heavy traffic, a road full of curves and dips. See if the De Soto isn't the finest car you've ever driven . . . the one car you want to live with in the years ahead. De Soto Division, Chrysler Corporation.

WITH THE FORWARD LOOK

DE SOTO-PLYMOUTH dealers present **GROUCHO MARX** in "YOU BET YOUR LIFE" on NBC Radio and TV

VOL. CVII, No. 4 WASHINGTON APRIL, 1955

THE NATIONAL GEOGRAPHIC MAGAZINE

Ohio Makes Its Own Prosperity

Busy Farms and Humming Factories Vie with Art Museums and Research Centers as Attractions of the Thriving Buckeye State

By Leo A. Borah

Assistant Editor, National Geographic Magazine

With Illustrations by National Geographic Photographer B. Anthony Stewart

"WE are practical men here in Ohio," Charles F. Kettering told me in his Dayton office. "When we get an idea for something the public needs and wants, we work it out by the use of science and experimentation. No invention is worth a penny unless there is a need, and the public must get profit from it. That's why the things we make sell all over the world."

Thus the famous Ohio engineer and inventor (page 467) explained why his native State ranks second only to New York in manufacturing.*

"But we are still an important farm State, among the top dozen in total value of crops," he continued. "A lot of our factory workers live on farms and divide their time between mechanical jobs and crop raising."

State Gave the World Light and Flight

Ohio proudly boasts that it gave the world both light and flight. Thomas Alva Edison, the electrical wizard, was born in the little town of Milan, and Orville and Wilbur Wright designed their airplane at Dayton.

Centrally located, and at the heart of a network of highways, Columbus, the capital, provided convenient headquarters for my survey of Ohio. I could go from there in a day's drive to the farthest corners of the State (color map, page 442).

Ohio House, on the State Fair Grounds, made an ideal starting point: it stands completely furnished from cellar to attic with Ohio-made goods. More, however, than a show place of local industry, it has historical interest as a replica of the home of William Henry Harrison, first Ohioan elected to the Presidency of the United States.

Eight Presidents from Ohio

"Old Tippecanoe," though a native of Virginia, went to the White House from Ohio. Born in the State were Presidents U. S. Grant, Rutherford B. Hayes, James A. Garfield, Benjamin Harrison, William McKinley, William Howard Taft, and Warren G. Harding.

The name Taft is one to conjure with in Ohio, for the Taft family of Cincinnati has been a power in the State for many years. William Howard Taft was the only man in history to hold both of the highest positions in American government (page 483).

His son, U. S. Senator Robert A. Taft, never achieved the Presidency but won lasting fame as a conservative leader. When "Mr. Republican" lost his last courageous battle to illness in 1953, the entire Nation mourned his passing.

Though traditionally Republican in national politics, the State has a Democrat for governor. Frank J. Lausche has been elected

* See "Ohio, the Gateway State," by Melville Chater, NATIONAL GEOGRAPHIC MAGAZINE, May, 1912.

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Skytop Diners Look → Out Over Their City

Terrace Plaza, one of Cincinnati's newer hotels, sits atop a 7-story business building; express elevators whisk guests to its 8th-floor lobby. Beds in the guest rooms are driven by motors into recesses under wall cabinets. An outdoor dining room (not shown) converts to an ice-skating rink in winter.

The Gourmet Restaurant, jutting out from the Terrace Plaza's 20th-story penthouse, seems suspended in space. Slanted glass walls, lighted from the outside to reduce reflections, give patrons an exciting panorama of Cincinnati.

In this view to the northeast, Holy Cross Monastery crowns Mount Adams (right). The Ohio River winds past the city at extreme right.

← Cincinnati Perches on Seven Hills Lapped by the Majestic Ohio

Steamboat trade helped build Cincinnati. When the first paddle-wheeler chugged down the Ohio in 1811 to tie up here, it opened a golden era for the backwoods village. By 1850 bustling Cincinnati was a commercial center for the entire Middle West.

With prosperity came notoriety. Gamblers, adventurers, and roistering stevedores jammed the port.

Today Cincinnati ranks high among American cities in culture (page 470). Barges and towboats still conduct a lively river trade, but modern Cincinnati concentrates on industry. Factories turn out soap, rubber, machine tools, men's clothing, playing cards, and other products.

Viewed from Kentucky bluffs, the 48-story Carew Tower and pyramid-topped Union Central Building dominate the skyline. Warehouses and terminals edge the 25-mile waterfront. Supplementing three highway spans farther upstream, the Chesapeake and Ohio Railroad Bridge (right) carries automobiles and trains across the quarter-mile-wide Ohio to northern Kentucky.

five times—more than any other man in Ohio's history.

On a 2,130-acre sylvan campus in north Columbus, magnificent Ohio State University has an enrollment of 20,349 students.

"About 2,800 do graduate work," President Howard L. Bevis told me. "We stress research here."

The other five State colleges—Ohio University at Athens, Miami University at Oxford, Central State College at Wilberforce, Bowling Green State University at Bowling Green, and Kent State University at Kent—offer fewer graduate courses, though all save Central State have graduate schools.

Among many special activities on the Ohio State campus, cancer research stands out. The new $18,000,000 Health Center there has a wing housing a $657,000 Cancer Research Laboratory, a haven of hope for sufferers from the dread disease (page 446). Nearly a hundred teachers and students attack the problem of cancer with the aid of elaborate equipment, including a 10-million-volt cyclotron.

With a staff of 2,100 research scientists, technicians, and service personnel, Battelle Memorial Institute, a privately endowed, not-for-profit organization in Columbus, solves difficult problems for industries and agriculture throughout the United States and in many foreign countries.

Touring Battelle's spacious laboratories, I saw molten metals being produced in roaring furnaces for study by metals scientists. In a smaller laboratory effects of radioactivity were under scrutiny. In another, chemists had just worked out a formula for acidproof paint.

Big Industries Even in Small Cities

Ohio has eight cities of more than 100,000 population, but they by no means monopolize industry. Some of the largest factories in the State operate in small cities and towns.

In Newark, population 34,275, I went through the sprawling plant of the Owens-Corning Fiberglas Corporation. Unknown commercially until the early 1930's, Fiberglas has vaulted into prominence as one of the most versatile manufacturing materials in the world. From it are made air filters for furnaces, insulation to control heat, cold, and noise; battery separators, insect screening, fine curtains and draperies, and (in combination with plastics) furniture, bathtubs, sports-car bodies, luggage, and a host of other items.

Necromancy could hardly surpass the wonders of the Fiberglas processes I watched. After sand and other ingredients have been melted in a furnace of 100-ton capacity, myriad tiny streams of molten glass flow out through sievelike bushings. Powerful jets of steam stretch these streams into filaments so fine that they are barely visible.

From smaller furnaces in the factory, millions of greenish glass marbles five-eighths of an inch in diameter pour out in constant streams. These are melted later to make fine glass yarns. One marble can be drawn out into 93 miles of microscopic fiber. The incredibly soft fluff is used for surgical packing.

Modern Pioneers Restore Old Land

Year before last, Ohio celebrated the 150th anniversary of its admission as the Union's 17th State—even though Congress had never got around to recognizing its entry officially. A congressional resolution in 1953 rectified the long-standing oversight.

The settlers who came into Ohio's wilderness just after the Revolution were farmers. Finding 90 percent of the territory covered with dense hardwood forest, they fell to clearing it for cultivation. The ring of axes, though often interrupted by Indian war whoops, swelled to a mighty chorus.

After more than 150 years of cultivation, large areas of Ohio are eroded and worn out. Conservation crusaders, using modern scientific methods, now lead the way to repioneering the country and restoring marginal and submarginal land to full fertility.

Although January had cast a wintry blight over a landscape that glows with beauty from spring till autumn, I enjoyed a tour of the Muskingum Watershed Conservancy District in eastern Ohio. The Muskingum watershed stretches from Akron on the north to Marietta on the south and from 15 miles west of Newark to hills near the Ohio River on the east.

Before the Conservancy District came into operation in 1933, periodic floods took lives, damaged property, and wrought havoc on fertile farm lands in the Muskingum River Valley. Dry years brought drought to soil gullied by floods. The whole area seemed doomed.

Today, fields once abandoned or cultivated with little profit produce bumper crops (pages 476-9). Rugged hills, only a few years ago virtually denuded of timber and eroded into arid wastes, now stand proudly clothed with thriving forest. Wandering about the summits, listening to the songs of the birds that

Akron Pilot from Akron Beacon Journal

Soap Box Finalists Give Their Cars a Last-minute Check Atop Akron's Derby Downs

Winners from cities in the United States, Canada, Alaska, and West Germany compete here annually. In 1954, 60,000 spectators saw a California boy outrace 150 others to win a $5,000 college scholarship. His homemade motorless car sped down the 975-foot asphalt course at about 26 miles an hour.

follow the valley, a visitor might easily imagine himself among lofty mountains, though the highest point in Ohio is 1,550-foot Campbell Hill, near Bellefontaine.

To protect areas of major value, 14 moderate-sized dams, mostly earth fill, stand at strategic points on tributaries of the Muskingum. They keep torrential rains from rushing into the big river and making it overflow.

"Behind 10 of these dams we have provided permanent recreational lakes, and the Ohio Division of Wildlife has stocked them with game fish," the District's secretary-treasurer, Bryce C. Browning, told me in his New Philadelphia headquarters. "Four of the reservoirs are dry except during floods."

The District pays taxes on the 65,000 acres it owns. Since the expenditure by Federal and State agencies for initial flood-control construction and land purchase, no tax money has been spent for either new dams or maintenance. The District obtains rents from tenants and profits from recreation.

"This is one conservation project that pays its own way," Mr. Browning declared proudly. "Levees and embankments can't prevent floods. They can only retain the water until it gets so high that it pours over them. But choke off excess water in enough little rivers, and the big rivers can carry the rest."

How One Man Beat the Depression

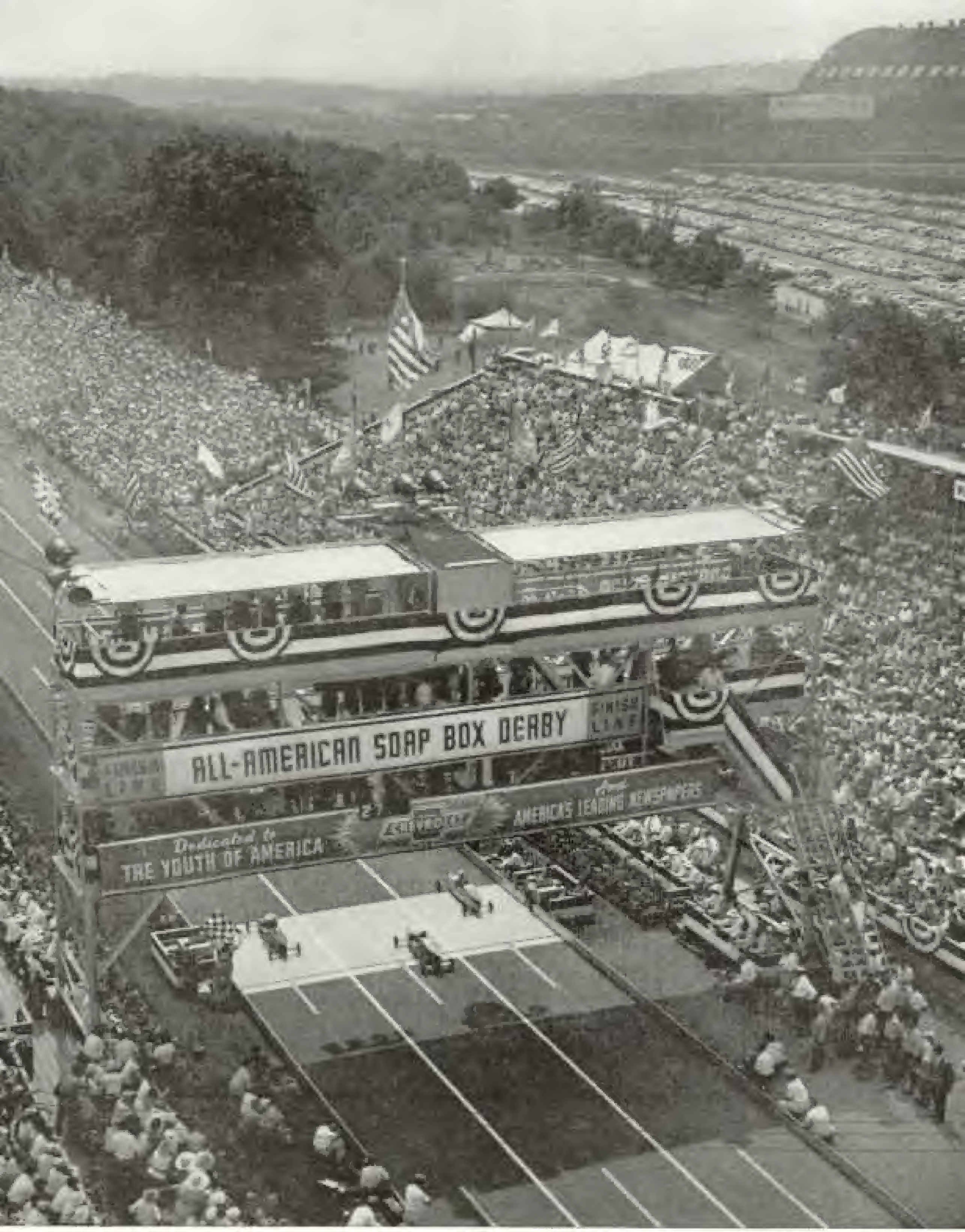
In Scio, a town of 1,150 people an hour's drive east from New Philadelphia, the Scio Pottery Company turns out a tremendous volume of inexpensive white ware—20,000 to 22,000 dozen pieces daily (page 465). The East Liverpool area is the pottery center of the State, and several other Ohio communities have thriving ceramic industries, but little Scio stands out for its dramatic story.

When depression was at its depth in 1932, the late Lew Reese, who had worked at the potter's trade in West Virginia, came to Scio on a hunting trip. He found the town on the verge of ruin; employment there had dropped to its lowest ebb. An old pottery, which had failed five years earlier, was for sale for taxes. Seeing a chance to try out ideas of his own in white ware manufacture, Mr. Reese borrowed $8,000 on his insurance and took over the abandoned pottery.

Reese and some friends cleaned up the clammy building, living in it to save money for repairs and equipment. Sixty days after they had moved in, the first cups and bowls came out of the kiln, and Lew Reese started a carload eastward. The only difficulty he faced was that a payroll of nearly $1,000 had to be met, along with other bills totaling almost $20,000. In cash resources he had exactly 11 cents!

How a check from a jobbing house and

(Continued on page 445)



441 Akron Beacon Journal

Cheering Thousands Witness a Thrilling Finish in the Soap Box Derby Finals

Automobiles and trucks are barred from Akron's flag-lined Derby Downs; the specially built raceway is used only for the Soap Box competition (page 439). Gravity alone carries the streamlined vehicles down the course. Combined weight of boy and car may not exceed 250 pounds. Contestants, 11 to 15 years old, pick up speed on the 10-percent grade at top of hill. Judges control the contest from the triple-deck overhead bridge at finish line. A succession of 3-car heats, waved off at 75-second intervals, determines the champion.

Navy blimps are made, tested, and serviced in Goodyear's mammoth air dock at upper right

OHIO AND HER NEIGHBORS

STATUTE MILES

WIS. Lake Michigan Milwaukee Chicago ILLINOIS Lake Michigan MICHIGAN Lansing Detroit Port Huron Lake Huron Toronto Lake Ontario Buffalo ONTARIO CANADA Lake St. Clair Lake Erie N.Y. Cleveland PA. Pittsburgh INDIANA Indianapolis OHIO Columbus Cincinnati MD. WEST VIRGINIA Charleston VA. Louisville Frankfort KENTUCKY

Hillsdale Tecumseh Hudson Adrian Raisin R. Monroe MICHIGAN Maumee Bay OHIO Toledo Ohio Turnpike (Under Construction) Montpelier Maumee Rossford Perrysburg Wauseon Fallen Timbers State Mon. Bryan Napoleon Portage River Bowling Green Hicksville Maumee River Defiance (Site of Ft. Defiance) North Baltimore Paulding Tuscarawas River Blanchard River Findlay Ottawa Carey Van Wert Delphos Bluffton Upper Sandusky Lima Ada St. Marys River Kenton Wapakoneta Celina St. Marys Grand Lake Indian Lake Fort Recovery Bellefontaine Campbell Hill 1550 Sidney Great Miami River Marysville Darke County Greenville Piqua Troy Urbana Tipp City Springfield London Richmond Fairborn Dayton Oakwood Yellow Springs Wilberforce Xenia Eaton Miamisburg Kettering Franklin Washington Court House Oxford Middletown Wilmington Lebanon Hamilton Fort Ancient State Memorial Greenfield Blanchester Cincinnati North Bend Birthplace of Benjamin Harrison Reading Norwood Newport Covington Hillsboro Brush Creek Reservoir Fort Hill State Memorial Serpent Mound State Memorial Peebles Point Pleasant Birthplace of Ulysses S. Grant Georgetown West Union Ripley Shawnee State Forest Falmouth Roosevelt Game Preserve Maysville Aberdeen Ohio River KENTUCKY

STATUTE MILES

Walter K. Morrison, Cartographer
Francis W. Sheppard, Compiler
© National Geographic Map

COLUMBUS

Worthington Riverlea Minerva Park Olentangy R. Scioto R. Griggs Dam Upper Arlington Ohio State University Stadium Ohio State Fair Grounds Mifflinville Gahanna Glen Creek Marble Cliff Grandview Hts. Battelle Mem. Institute Franklin Park Bexley Whitehall Valley View Fort Hayes State Office Bldg. State Capitol Capital University Hanford Schiller Park Scioto River Walnut Creek Urbancrest Obers Junction Grove City Franklin

STATUTE MILES

CINCINNATI

Lincoln Heights Lockland Reading Wyoming Mt. Healthy North College Hill Deer Park Silverton Elmwood Place Golf Manor Mt. Airy Forest Ivorydale St. Bernard Norwood Cheviot Xavier University Zoo Cincinnati Observatory Mariemont Ault Park Newtown University of Cincinnati Art Museum Music Hall Union Terminal Terrace Plaza Carew Tower Eden Park Taft House Museum Ft. Washington Monument Alms Park Lunken Airport Mt. St. Joseph College Ohio River Cincinnati Bridge Covington Newport Fort Thomas Coney Island KENTUCKY

Lake Erie
CANADA
UNITED STATES
Pigeon Bay
Ferry
Pelee Point
Pelee Island
Victory Memorial
North Bass I.
Middle Bass I.
South Bass I.
Put-in-Bay
Kelley's Island
Catawba I.
Port Clinton
Sandusky Bay
Sandusky
Lorain
Rocky River
Cleveland
Lakewood
East Cleveland
Cleveland Hts.
Euclid
Lyndhurst
Garfield Heights
Birthplace of James A. Garfield
Maple Heights
Fairview
Parma
Berea
Elyria
Strongsville
Brecksville
Oberlin
Milan
Edison's Birthplace
Norwalk
Wellington
Medina
Akron
Cuyahoga Falls
Ravenna
Kent
Tallmadge
Derby Downs
Portage Lakes
Barberton
Wadsworth
Willard
Fairport
Painesville
Willoughby
Chardon
Eastlake
Wickliffe
Geneva
Ashtabula
Conneaut
Jefferson
Meadville
Pymatuning Reservoir
Greenville
Birthplace of Wm. McKinley
Sharon
Mercer
Farrell
Warren
Niles
Girard
Newton Falls
Youngstown
Campbell
Struthers
Berlin Reservoir
Hiram
Ohio Turnpike (Under Construction)
Mosquito Creek Reservoir
Grand River
Shelby
Ashland
Mansfield
Crestline
Bucyrus
Galion
Orrville
Wooster
Charles Mill Res.
Mohicanville Reservoir
North Canton
Massillon
Canton
Cambrinus
Alliance
Sebring
Salem
Columbiana
East Palestine
Lisbon
Blooming Grove
Birthplace of Warren G. Harding
Melebar Farm
Loudonville
Tappan Res.
Hill Res.
Marion
Mt. Gilead
Millersburg
Sugarcreek
Dover
New Philadelphia
Atwood Reservoir
Carrollton
East Liverpool
Wellsville
Leesville Reservoir
Toronto
Weirton
Steubenville
Mingo Junction
Wellsburg
Mount Vernon
Kokosing
Gambier
Mohawk Reservoir
Delaware Reservoir
Delaware
Birthplace of Rutherford B. Hayes
Uhrichsville
Dennison
Scio
Tappan Res.
Cadiz
Coshocton
Newcomerstown
Dresden
Willis Cr.
Piedmont Reservoir
Martins Ferry
Bridgeport
St. Clairsville
Wheeling
Cambridge
New Concord
Barnesville
Bellaire
Shadyside
Moundsville
Zanesville
Buckeye Lake
Jonathan Alder
Jonathan Alder's Trace
Licking River
Newark
Granville
The National Road
Columbus
Bexley
Canal
Crooksville
Caldwell
Woodsfield
Lancaster
New Lexington
McConnelsville
Circleville
Logan Elm State Mem
Rock House
Logan
Hocking River
Glouster
Nelsonville
Conkles Hollow
Old Man's Cave
Mound City Group Nat. Mon.
Chillicothe
Zaleski State Forest
Waterloo State Forest
Marietta
Ohio River
Parkersburg
Blennerhassett Island
McArthur
South Parkersburg
WEST VIRGINIA
Waverly
Piketon
Wellston
Coalton
Jackson
Middleport
Pomeroy
Atomic Energy Plant
Sargents
Oak Hill
Gallipolis
Portsmouth
New Boston
Hanging Rock
Ironton
Ashland
Catlettsburg
Huntington
Scioto River
Ohio River
Scioto Trail
Route of Ohio and Erie Canal
1050
1290
1400
1660
1670
OHIO
PENNSYLVANIA
THE GREAT SEAL OF THE STATE OF OHIO
STATUTE MILES
Lake Erie
Euclid
Bratenahl
Nela Park
Rockefeller Park
South Euclid
Western Reserve University
University Heights
John Carroll University
Shaker Hts.
Newburgh Hts.
Warrensville Hts.
Brookside Park
Zoo
Brooklyn
Cleveland Hopkins Airport
Municipal Stadium
U.S. Coast Guard Station
Public Auditorium
Terminal Tower
Euclid Avenue
Health Museum
Severance Hall
Case Institute of Technology
Lakewood
CLEVELAND

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Ohio State Capitol at Columbus Took 22 Years to Build. Its Style Is Doric

The low-domed structure stands in a 10-acre downtown park. McKinley Memorial at the west entrance depicts the Ohio-born President delivering the address that preceded his assassination in Buffalo, New York.

money subscribed by 20 Scio townspeople who believed in him saved Reese and kept his pottery going reads like a fairy tale. Within a few years the man who at first took no more than $150 a month for his own services declined an offer of $3,000,000 for the business.

Then disaster struck again. A sudden fire on December 11, 1947, reduced the 7-acre plant to smoking ruins. It was uninsured.

Out of pure affection, Scio folk—men, women, and children—pitched in and helped Reese rebuild. The new plant, bigger and better by far than the old one, opened on February 13, 1948. Unskilled workers had put it up in two months. The faith and courage of a man who helped his neighbors had flowered into a miracle.

With James Wells, assistant director of the Ohio Department of Natural Resources, I went on a trip through southern Ohio, a region remarkable for geologic and economic diversity. Some parts of it produce abundant crops. Others, useless for farming, produce hardwood timber.

Where glaciated and unglaciated lands met, our road often took us between well-equipped, prosperous farms on one side and submarginal places with run-down buildings on the other.

"When the old ice sheets melted," Wells explained, "they deposited good soil over most of the valleys. South of the line of glaciation the sandstone hills, often steep, have thin soils and are best adapted to

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270-foot "Car Cracker" (Left) Soars Above Cleveland Refinery

This unit in the No. 1 plant of Standard Oil Company (Ohio) uses heat and a catalyst to break up, or crack, heavy oils into lighter products such as gasoline. Rising above the Cuyahoga River on the Cleveland flats, the refinery has operated continuously since 1870. Helmeted workers check safety valves on a gas plant.

University Hospital Glows at Dusk

The Nation's first free diagnostic cancer clinic was opened in Columbus in 1931. Today these new hospitals at the State Health Center on the campus of Ohio State University admit more than 7,000 cancer patients a year. Darkened fourth story marks the surgical floor. Its windowless, air-conditioned rooms are lighted artificially.

White-gowned Dr. William G. Myers helped develop this gamma-ray scanner, which aids in detecting thyroid cancers. Before examination, the patient drinks a radioactive iodine "cocktail" to outline the thyroid gland. Dr. Charles Austin Doan, of the College of Medicine, is the other physician.

Kodachromes by National Geographic Photographer B. Anthony Stewart

tree growth. That's why we are stressing reforestation and fire protection. In that way we hope to put a crop of merchantable timber back on these lands as soon as possible and, at the same time, reduce the loss of soil and water."

Around venerable Washington Court House lies the "Herefordshire of Ohio," so named because of the herds of pedigreed cattle it supports. The route took us south through this lush country to Fort Hill and Serpent Mound State Memorials, which preserve sites of an Indian culture centuries old before the discovery of America.

We paused for lunch in West Union, a county seat without a railroad. In a trim public square at the center of the little town stands an imposing courthouse. It seems the custom in the 88 counties of Ohio to build handsome courthouses; those I saw were all substantial edifices of brick or stone (page 459).

New Levee Defeats Flood Waters

Past Shawnee State Forest with its Roosevelt Game Preserve our road led to Portsmouth on the Ohio River. Because of a huge atomic-energy plant being built 20 miles to the north, this railroad and manufacturing center is enjoying a boom.

Located at the junction of the Scioto and the Ohio, Portsmouth has suffered repeated inundations. The flood of 1937 rose to a peak of 74 feet and engulfed it. Since that time, eight miles of new earthen levee and concrete flood wall, three feet higher than the 1937 crest, have held back the flood waters.

"Floods down here don't worry people too much," Jim told me as we drove along U. S. Highway 52 through Hanging Rock toward Ironton. "In 1937, 20 feet of water came over the highway here. After the water went down, somebody's house was resting contentedly in the middle of the road.

"When I asked the owner why she didn't move to higher ground, she said she didn't mind the floods so much; they usually came about the time of spring house cleaning!"

Near Ironton we examined the remains of old charcoal furnaces in which ore from nearby deposits was smelted a century ago. Many Union cannon in the Civil War were forged from the metal.

At Athens we visited distinguished Ohio University, oldest institution of higher learning in the State. Chartered in 1804, it graduated two students, its first class, in 1815.

In the Hocking parks near Logan I saw rugged wilderness I never suspected could exist in Ohio. We looked down into gorges at Conkles Hollow and Old Man's Cave as fearsome as many canyons among western mountains (page 462). At Rock House we gazed up at a pillared mansion carved by Nature in the face of a towering cliff reminiscent of storied Petra in the Holy Land.

"Fourteen kinds of warblers and many other birds raise families here every summer," my companion said. "A hundred and ninety-four species nest in Ohio.

"When redbud, laurel, and dogwood bloom, and when leaves turn in the fall, the whole area breaks out in gorgeous color."

A week after my southern Ohio journey, A. W. Marion, director of the Ohio Department of Natural Resources, showed me the parks, beaches, wildlife preserves, and conservation projects his department has created in northeastern Ohio. Recreation areas dot the countryside from Pymatuning Reservoir on the Pennsylvania line to the lovely islands north of Sandusky Bay in Lake Erie.

Winding along the Ohio River from East Liverpool to Cincinnati, a scenic shore affords views of many places famous in American history.* The bustling steel city of Steubenville, named for the Prussian general who helped Washington in the Revolutionary War, grew on the site of a fort built in 1787 for control of hostile Indian tribes.

House That Jack Built

At Bellaire stands a 3-story brick mansion with a small sculptured mule's head over its entrance. English Jake Heatherington put up "the house that Jack built" long ago and lived in it with Jack, the little mule that had been his constant companion and helper as he rose from penniless "doghole" miner to man of wealth.

Marietta, a gracious college town, was founded in 1788, the first permanent white settlement in Ohio. Here, enclosed in Campus Martius State Memorial Museum, stands the 2-story home built by Gen. Rufus Putnam, leader of the first settlers. The museum contains relics of pioneer times, including personal possessions of Harman Blennerhassett,

* See "So Much Happens Along the Ohio River," by Frederick Simpich, National Geographic Magazine, February, 1950

Few Railroad Stations Can Match the Size and Splendor of Cincinnati's Union Terminal

This $43,000,000 show place required nearly four years to build. The passenger station (above), one of 32 separate buildings, houses a bank, theater, restaurants, shops, offices, filling station, and a 1,000-car parking garage. Seven railroads, including the city-owned Cincinnati Southern, use the terminal's 52½ miles of tracks.

449 Kodachrome by National Geographic Photographer B. Anthony Stewart

Mosaic Murals Paneling the Vast Rotunda Trace America's Heritage and Progress

Winold Reiss, a German-born artist, fashioned the panorama from dime-size bits of imported tile. River-boat captain and dock hand (right) call to mind steamboat days on the Ohio. Steelworkers erecting a skyscraper symbolize modern industry. Corridor leads to the 450-foot-long waiting room.

at whose island home near by Aaron Burr hatched his conspiracy in 1805.

Lured by false advertising, a band of French aristocrats came to the site of Gallipolis in 1790, expecting to find a shining new city on "la Belle Rivière," instead of 80 miserable log huts at the edge of a swamp. Congress in recognition of their unfortunate plight awarded them 24,000 acres of good land elsewhere; but many of them chose to remain in Gallipolis, which became the third permanent town in Ohio.

Where Eliza Crossed the Ice

At Ripley, on the Ohio River 45 miles southeast of Cincinnati, the Ohio Historical Society maintains as a museum old Rankin House, where the Rev. John Rankin, an ardent abolitionist, hid fugitive slaves. Ripley folk say that this receiving station of the "Underground Railroad" was the haven to which the original of Eliza in *Uncle Tom's Cabin* fled when she crossed the ice from Kentucky. Much of the novel's background came from impressions gained by Harriet Beecher Stowe when she lived in Cincinnati.

From a frontier village built around old Fort Washington in 1789, Cincinnati has grown to a metropolis of more than half a million, next to Cleveland the largest city in Ohio. In 1791 it saw the pitiful remnants of Gen. Arthur St. Clair's expedition against Little Turtle and his Indian braves straggle back from bitter defeat at the site of Fort Recovery. It aided "Mad Anthony" Wayne when he trained his avenging army for the campaign that crushed the last Indian resistance in Ohio at Fallen Timbers in 1794.

Once seven-hilled Cincinnati was notorious for rowdyism. Rough, tough rivermen boasted that they were "half wild horse and half alligator." As traffic swelled to boom proportions before the Civil War, the town handled so many hogs that it was derisively called "Porkopolis."

Stormy times are now fading memories; once-uncouth Cincinnati ranks high among American cities in culture (pages 448 and 470). Touring municipal show places, I visited stately Taft Museum, the splendidly furnished home given to the city by the former President's half-brother; the Art Museum, repository of a priceless collection of paintings; the municipal University of Cincinnati and near-by Conservatory of Music; the Music Hall, home of Cincinnati's Symphony Orchestra and nationally acclaimed May Music Festival.

Former Ohio governor Myers Y. Cooper joined us for the high drive which winds atop bluffs through sylvan Eden Park and overlooks the Ohio River. Here are breathtaking vistas of the broad stream rolling between the Cincinnati waterfront and the city-crowned hills of Kentucky (page 436).

"Cincinnati ranks among the world's leading machine-tool manufacturing centers," our guide companion said as our car rolled past a humming industrial section in Mill Creek Valley. "I want you to see the new vocational high school where we train boys and girls for jobs in the shops." Going through the $5,500,000 building, we saw students working at machines like those they would operate later in the factories.

On a 190-acre tract far out Mill Creek Valley rise the gray stone factory and laboratory buildings of Ivorydale, one of the largest soap-manufacturing centers in the world (page 471). It was a going concern in 1861 when the proprietors, Procter & Gamble, took a contract to furnish soap for the Union Armies.

Accident Produced Floating Soap

Some years after the war came an epoch-making discovery. One day a careless workman permitted the mixing device, called a crutcher, to run during his lunch hour. This introduced minute air bubbles into the mixture. The resulting batch of soap went through the usual manufacturing process.

A few weeks later, orders came piling in for "the soap that floats." Thus was born Ivory Soap, an American product which observed its 75th birthday last year.

From Cincinnati I went with Erwin Zepp, director of the Ohio Historical Society, by a roundabout way back to Columbus. Near Chillicothe the society has furnished as a museum the Adena home of Thomas Worthington, who led the fight for Ohio statehood more than 150 years ago.

Chillicothe was the first capital of Ohio, 1803 to 1810; then the seat of government was moved to Zanesville for two years. It returned to Chillicothe, where it remained until, in 1816, the legislature met for the first time in Columbus.

Zanesville, platted in the late 1790's by Ebenezer Zane when he was surveying Zane's

(Continued on page 459)

Lights Flash On; Transparent Juno Reveals the Anatomy of a Woman

Juno talks with a tape recording at Cleveland Health Museum. Her arteries are wire and organs plastic.

↑ Giant Bulbs Glow in a Lamp Gallery

General Electric's Lamp Division at Nela Park in East Cleveland covers 85 acres and employs more than 2,000 persons. Visitors to the company's Lighting Institute see thousands of types and sizes of lamps. Here a 50,000-watt globe (left) burns with ebbing power. At peak load it blinds the naked eye. To celebrate the recent 75th anniversary of Edison's incandescent lamp, Nela Park engineers created the 75,000-watt specimen on the right.

Color Is Her Business →

Glidden Company paint specialists in their Cleveland studio design color schemes for new structures throughout the world. Here consultant Pamela Lynch prepares sample layouts for a new parking garage in Indianapolis. The Munsell hue circuit on the wall serves as her guide.

← Cleveland Buses Swing Through Public Square

Page 452: Civic and commercial buildings line wide Superior Avenue (left). Euclid Avenue, known a century ago as Millionaires' Row, angles off to the right. Soldiers and Sailors Monument honors Civil War veterans.

Cleveland, a Frontier Village That Grew to a Metropolis, Hugs Lake Erie's Shore

The marshy hamlet laid out by Gen. Moses Cleaveland in 1796 now ranks as the Nation's seventh city. A U. S. Coast Guard station occupies the point where Cuyahoga River empties into Lake Erie. Limestone for Ohio steel mills piles high beside the new Parcel Post Annex. Circular Municipal Stadium flanks ore docks.

455 Kodachrome by National Geographic Photographer B. Anthony Stewart

52-story Terminal Tower, Tallest Building West of Manhattan, Dominates the Skyline

Cleveland fans out for 20 miles along Lake Erie and 10 miles inland. Mills, factories, refineries, and warehouses sprawl beside the Cuyahoga. Lofty Main Avenue Bridge, part of a superhighway edging the lake, spans the stream near its mouth. An ore boat (right) heads out toward the lake.

Kodachrome by National Geographic Photographer B. Anthony Stewart

"On Target, Fire!" Airmen Stage a Mock Sky Battle Indoors

Wright Air Development Center in Dayton develops and tests equipment for the United States Air Force. This ground-operated gunnery trainer eliminates costly flight time. Gunner follows the projected shadow of a scale-model fighter from his swivel seat. Instructor at the electronic control panel records hits.

Paintings Circulate Like Books in Ohio

Established in 1922, Dayton Art Institute's lending library of paintings was the first of its kind in the United States. Original paintings, exchanged monthly, hang in homes, offices, and schools. A junior circulating gallery lends reproductions to youngsters.

Here a couple selects a modern work. Daughter favors a pastoral scene.

Cash Registers Ring Up Sales Around the World

A mechanism that recorded the revolutions of a ship's propeller inspired the cash register. James Ritty, a Dayton businessman, saw the machine while crossing the Atlantic in 1878; later he adapted its principle to the clocklike register in the center.

Founded in a one-room workshop, the National Cash Register Company now employs 15,000 Daytonians. They turn out machines containing as many as 22,000 precision parts.

Ritty's earliest design, never marketed, was soon replaced by a "paper roll" machine (on sill). Modern department-store register (left), accounting machine (bottom), and payroll machine (right) are other National models.

459 National Geographic Photographer Barry Bickelhaupt

Old Dayton Courthouse Was New When Abraham Lincoln Spoke from Its Steps

The 135-year-old building at Third and Main Streets houses the Montgomery County Probate Court. Jail (left rear) and "new" courthouse (right) were erected later.

Trace from Wheeling, West Virginia, to Maysville, Kentucky, eventually surpassed Chillicothe. Both towns were on the only passable trail across the State—a far cry from the Ohio Turnpike now being constructed from the terminus of the Pennsylvania Turnpike to the beginning of a similar road in Indiana.

Logan Elm State Memorial, south of Circleville, preserves the grand old tree pointed out by tradition as the one under which the Indian orator, Logan, made to his white conquerors the sad address quoted by Thomas Jefferson in his *Notes on the State of Virginia:*

"... Colonel Cresap, the last spring, in cold blood, and unprovoked, murdered all the relations of Logan, not sparing even my women and children. There runs not a drop of my blood in the veins of any human creature ... I have killed many: I have fully glutted my vengeance; for my country I rejoice at the beams of peace. But do not harbour the thought that mine is the joy of fear. Logan never felt fear. He will not turn on his heel to save his life. Who is there to mourn for Logan?—Not one."

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← A Scottish Piper Entertains in Cleveland's Cultural Gardens

Upper: Nationality groups have built in Rockefeller Park a remarkable chain of gardens where statues, busts, and plaques honor their cultural leaders. Dressed in national costumes, representatives of many countries gather in the German Garden.

Lower: The World Publishing Company of Cleveland prints and binds more than 3,000,000 Bibles a year. Here Darlene Perry (left) and Mary Stanley check galley proofs of a newly set Bible against the 13½-by-18½-inch Bruce Rogers World Bible, produced in 1949. Webster's New World Dictionary (left) took 12 years to compile.

© National Geographic Society
Reproduction by National Geographic Photographer Dean Conger

East of Lancaster, at little Bremen (population 1,190), the Erickson Glass Works turns out handmade glass in five colors. A workman demonstrated his technique by making a smoke-colored ashtray. Drawing from a furnace a ball of molten glass on the end of a long metal tube, he blew it into a fiery bubble which he shaped in an apple-wood mold.

"We use apple wood because its grain doesn't mar the surface of the glass," Carl Erickson explained.

"How do you get the colors?" I asked.

"That's a trade secret," was the reply. "We have our own processes for color and for putting raindrop patterns and effects of leaping flames into the glass."

Craftsmanship from Sweden

Carl and Stephen Erickson came from their native Sweden 49 years ago and later set up their unusual plant. Twenty-seven workers are now employed, mostly farm boys trained by the brothers in skills brought from Swedish crystal factories.

The Anchor Hocking Glass Corporation, which produces a big volume of machine-made glass and fireproof ovenware, employs about 4,000 people in Lancaster and vicinity.

One snowy day I drove to the reclaimed farms of C. D. Blubaugh and author Louis Bromfield in the Mansfield area, on the edge of the Muskingum Conservancy District. Mr. Bromfield has 1,000 acres in his Malabar Farm, including a portion rented from the Conservancy District. The Blubaugh place is smaller.

Laughing, Mr. Bromfield said to me: "The neighbors say C. D. Blubaugh keeps books on his farm and books keep me on mine.

"That's not quite accurate. I did spend a lot of money getting started, and C. D. earned his living from crops while he was building up his soil. But my place makes a good profit now. We both used the same methods: building soil by turning under several inches of compost, setting out trees on slopes, contour plowing to prevent erosion, and planting legumes to make humus.

"Our land is better than it was when it was first cultivated. There's no profit in spending millions to reclaim wastes remote from civilization when we can get worn-out land near our big cities back into top production at a small fraction of the cost."

Although three inches of snow had fallen the night before, roads were clear. Cheap salt from huge Ohio deposits is used by the Highway Department to melt the snow.

For a quick look at some of the State's leading industries, I made a swing through the area between the Muskingum Conservancy District and Lake Erie.

At Westerville, home of Otterbein College, the Anti-Saloon League established headquarters in 1909. Here Benjamin Russel Hanby, while a student at Otterbein, wrote the ballad "Darling Nelly Gray," which aroused sympathy for slaves before the Civil War. Daniel Decatur Emmett, famous minstrel who composed "Dixie" and "Old Dan Tucker," was born at Mount Vernon.

In prosperous Mansfield (opposite) we walked past a long assembly line in which newly fashioned Westinghouse refrigerator bodies were being lined with Fiberglas batts like those I had seen made in Newark.

Towns Have New England Look

With age-mellowed white frame houses on shady streets, Ashland looks like a New England town, as do many in this part of the Western Reserve. Children of Ashland have erected a shaft to the memory of John Chapman, "Johnny Appleseed" (1774-1845), who planted orchards throughout Ohio, Indiana, and Illinois.

Wooster, where manufacturing is developing rapidly, has an excellent private college and the Ohio Agricultural Experiment Station (page 465). There are 55 senior colleges in Ohio, so scattered that people throughout the State live within easy reach of at least one.

In Canton we visited the plant of Timken Roller Bearing Company, one of six it has built in Ohio. Others are at Gambrinus, Columbus, Wooster, Zanesville, and Mount Vernon. I was astonished to see 25 blind men working as inspectors where bearing cups come along the assembly line (page 473).

In North Canton hums the mother plant of the Hoover vacuum cleaner. Herbert W.

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Mansfield Residents Take Pride in Beautiful Kingwood Center

Charles Kelley King, long-time president of the Ohio Brass Company, left his estate in trust for the use of his fellow townsmen. Today Mansfield garden, nature study, and fine arts groups meet in Kingwood's terraced gardens and numerous exhibit rooms. Members of a flower club here decorate a table in Kingwood Hall, the estate's spacious Norman mansion.

An Ice Age River, Hollowing Sandstone Cliffs, Carved Old Man's Cave

Rock caverns and rugged hills of western Hocking County once sheltered Indian tribes. Today visitors explore the deep chasms and shadowy gorges in the region's six parks. Old Man's Cave, 200 feet long and 75 feet deep, is named for an old-time fugitive who lived here as a hermit. Queer Creek, snaking through the canyon, forms the crystal-clear pool at lower right. Inset: Indians carved the walls of near-by Rock House cavern.

Hoover, a Canton leather manufacturer, started making electric cleaners in 1908 when it became evident that the automobile was going to replace horse-drawn vehicles and the need for saddlery. The new enterprise was given a corner of the leather goods factory, but by 1919 it had grown to such proportions that leather was crowded out.

In the heart of the leading steel area in Ohio, the Youngstown district is one of the country's chief producers of flat-rolled and tubular steel products; but it does not stop with steel. Within recent years it has welcomed some 60 companies working aluminum into consumer goods. Youngstown's basic steel industry still employs 55,000 workers. Its steel fabricating mills have 25,000 more, compared with only 5,000 to 6,000 for aluminum fabricating plants. But aluminum is growing.

Night skies above Youngstown glowed with the flames of roaring furnaces as I approached. The city looked like a huge mill (page 466).

Akron Leads the World in Rubber

Youngstown was settled by Connecticut Yankees. That, coupled with the availability of coal and iron, accounts for the early beginning of manufacture.

Construction of the Ohio and Erie Canal from Cleveland to Portsmouth, completed by 1832, vitalized this part of eastern Ohio. Akron as well as Youngstown owes its earliest prosperity to the old canal, which carried freight and passengers between Cleveland and Portsmouth until railroads began to throttle the traffic in the 1850's.

The Akron area, "rubber capital of the world," has five major companies—Goodyear, Goodrich, Firestone, Seiberling, and General—making automobile tires and hundreds of other rubber products (page 484). There are also many smaller rubber manufacturing concerns.

To see how tires are made, I chose a plant of the B. F. Goodrich Company, whose Akron holdings cover about 125 acres. As we walked through the vast, complex factory, my guide pointed out Goodrich's new tubeless tires coming off the production line. "And tires aren't all we make," he told me. "In our 34 plants in the United States we manufacture some 30,000 different products, lots of them right here in Akron."*

This oldest of the Ohio city's rubber concerns dates from 1870, when Dr. Benjamin Franklin Goodrich persuaded 19 Akronites to subscribe $1,000 each for the erection of a plant to manufacture rubber fire hose, wringer rolls, and beverage tubing. From that humble beginning came a company that pioneered in the development of synthetic rubber for the vital needs of World War II. Goodrich's experiments with butadiene were a basic factor in helping to save the United States and its Allies from tire famine after Japanese forces had cut off the Nation's supply of natural rubber.

The newest triumph of rubber chemistry comes from a corporation jointly owned by Goodrich and the Gulf Oil Corporation. A research team assigned by Goodrich-Gulf Chemicals, Inc., has announced the chemical production of true rubber.

A method of making "natural" rubber has been the goal of scientists for generations. Though modern synthetics are better for many uses, true rubber is still preferred for truck and airplane tires, which make up about 30 percent of the national rubber production. The new material, supplementing crude rubber as well as butadiene and other types of man-made rubbers, could be of vital importance should war ever again cut off U. S. factories from their sources of natural tree rubber.

Throughout southwestern Ohio manufacturing flourishes. Springfield, still one of the national leaders in farm machinery, also has become a publishing giant. Here in 1877 appeared a cultivator-company house organ, *Farm and Fireside*. The little magazine marked the beginning of a printing business that has attained prodigious proportions. The Crowell-Collier Publishing Company now sends out from Springfield an average of 16 to 17 million magazines a month.

Dayton, Home Town of Flying

All the world knows about the Wright brothers' first flight near Kitty Hawk, North Carolina, on December 17, 1903.† Less well known, perhaps, is the story of their preliminary experiments at Dayton.

The Wrights started in 1899 making and testing a biplane kite, not as a toy but as a

* See "One Most Versatile Vegetable Product," by J. R. Hildebrand, National Geographic Magazine, February, 1940.

† See, in the National Geographic Magazine: "Aviation Looks Ahead on Its 50th Birthday," by Vice Admiral Emory S. Land; "Fifty Years of Flight" (31 historic photographs); and "Fact Finding for Tomorrow's Planes," by Dr. Hugh L. Dryden, December, 1953.

This Luscious Tomato → Weighs Almost 2 Pounds

Ohio produces nearly half the Nation's greenhouse tomatoes. The Ohio Agricultural Experiment Station at Wooster developed this wilt-resistant variety, called Ohio W-R Globe. Here Dr. Ira C. Hoffman slices a large specimen to show its juicy meat. Sharon Aber holds a bouquet of scarlet carnations, the State flower.

↓ Here Is the Pottery That Saved a Town

Depression-gripped Scio threatened to become a ghost town in 1932; then the late Lew Reese reopened its abandoned ceramic factory. Today the Scio Pottery Company's 1,050 employees produce 20,000 dozen pieces daily.

This worker applies handles to cups. Glazing and firing will turn the ware white.

Kodachromes by National Geographic Photographer B. Anthony Stewart

forerunner of heavier-than-air flying machines.

After the kite, they experimented with gliders. The problem of tailspins baffled them at one time. In the course of their studies they found little information available about screw propellers; therefore they developed a propeller of their own.

Meantime, they found it possible to leave their bicycle shop long enough to develop and test their gliders at Kitty Hawk.

On a cold December day in 1903, man's first successful powered and controlled flight in a craft heavier than air took place. Orville and Wilbur Wright had accomplished a magnificent advance in man's conquest of the air.

Dayton's 7,900-acre Airbase

Today the little bicycle shop on West Third Street, Dayton, where two determined men worked out what for centuries had seemed an impossibility, is gone. New buildings have taken its place, but its site has become a shrine.

In 1927 Dayton citizens gave the Federal Government a tract of 4,000 acres northeast of the city to be used as a flying field. The Government accepted the site and fittingly named it Wright Field.* Near by lay another Federal airport, Patterson Field, named in honor of a Dayton flyer killed there while making tests.

Today the two fields are combined in 7,900-acre Wright-Patterson Air Force Base, one of the largest air installations in the world. Here, in a vast industrial complex containing more than 1,000 buildings, the Air Force has clustered 32 separate units. Chief among them are the Air Materiel Command and the Wright Air Development Center of the Air Research and Development Command.

This vital base houses much of the Air Force's equipment-testing and research organization and is the headquarters for its globe-girdling chain of supply (page 456).

At the heart of the base, on the crest of a hill, stands a shaft erected to the memory of Wilbur and Orville Wright. Below, the Mad River Valley swings in a broad arc. Within that arc lies Huffman Prairie, the historic

* See "New Frontier in the Sky," by F. Barrows Colton, National Geographic Magazine, September, 1946.

meadow where the brothers Wright, after Kitty Hawk, continued to develop their planes.

The Wrights were not alone in putting Dayton on the map. Young Charles Franklin Kettering came to Dayton soon after his graduation from Ohio State University and took a position with the National Cash Register Company. Later, with E. A. Deeds, he formed the Dayton Engineering Laboratories Company—Delco—now one of five big operating divisions of General Motors in Dayton.

Dr. Kettering helped make the crank obsolete with his automobile self-starter and ignition system. Motorists are also indebted to him and his research staff for ethyl gasoline, certain types of high-compression engines, and improved automobile finishes.

In addition, "Boss Ket," as his colleagues call him, devised an independent electric generator that brought power and light to farms. His wide-ranging mind produced the electrified cash register and other business machines. Under his direction, associates discovered how to extract bromine from sea water, developed an important new refrigerant, and improved the diesel engine. Less well known among his interests were guided missiles, ready before the end of World War I, though not used then.

Colonel Deeds made the cash register one of the greatest aids to business in history.

↑ Steel Makes Youngstown Run; Giant Blast Furnaces Smelt Iron Ore Day and Night

Youngstown's first crude smelter began operations in 1803, less than a decade after the town was founded in the Mahoning River Valley. Today the Youngstown district is the United States' fourth largest steel producer; it is exceeded only by the Chicago, Pittsburgh, and Philadelphia areas (page 464).

Eight railroads serve the busy inland city. Freight cars here unload coal, limestone, and iron ore at a siding of the Youngstown Sheet and Tube Company.

Kettering Tree Farm Aids → Forestry Research

Charles F. Kettering (right) in 1948 dedicated a woodland on his Loudonville farm to the Ohio Tree Farm System for study and experimentation. Edmund Secrest, of the Ohio Agricultural Experiment Station, accepted for the State.

Dr. Kettering, a director of General Motors Corporation and a distinguished inventor in the automotive and other fields, has served as a Trustee of the National Geographic Society for 18 years.

↑ A Ton of Milk Must Curdle to Make 200 Pounds of Cheese

Farmers in the Swiss community of Tuscarawas County own and operate their own cheese factories. This plant at Sugarcreek turns out five wheels of cheese daily.

Manager Ernest Mueller cuts the curd in the heated milk with a "Swiss harp." Fritz and Rose Marie Mueller, dressed in Swiss costumes, watch their father.

← Elsie the Cow Beams on a Borden Employee

Sixty-three years ago an apprentice in a cheese factory accidentally discovered the formula for a tangy, soft-ripening cheese. He named it Liederkranz in honor of a New York singing society to which it was first served.

Today Liederkranz Brand cheese, an exclusive product of Borden Cheese Company, is made only at Van Wert, Ohio.

Here, in one of the world's largest cheese factories, Ehlen Hawk cuts 4-ounce cakes.

Kodachromes by National Geographic Photographers © Anthony Stewart
Takeover and Bacon Lithographs

The day I went through the National Cash Register Company's Dayton plant, every model of the machine was on display, from the small device invented by James Ritty and his brother in 1878 to amazingly intricate machines that all but think (page 457).

Frigidaire, a pioneer in the development of electric refrigeration, is another mainstay of Dayton's industrial life; since 1921, 17,000,000 refrigerating units, including air conditioners, have come from its five huge plants in Dayton and suburban Moraine City. Other Frigidaire products include electric ranges, washers, dryers, ironers, and dehumidifiers. A division of the vast General Motors Corporation, the company pumps an annual payroll of about $85,000,000 into the economic bloodstream of the area.

Rolling Mills Use Ohio Invention

In the Armco Steel Corporation plant at Middletown, John B. Tytus worked out on paper the first successful method of rolling steel sheets and strip continuously. Though he did not live to see all the uses to which the product of his years of toil would be put, he knew before his death that he had won. In 1924 Armco's Ashland, Kentucky, continuous mill started commercial production, and soon all the major steel companies adopted the Tytus method.

Diversified industry hums at Hamilton, on the Miami River, turning out diesel engines, stoves, safes, coated paper, automobile parts, tools, and woolens. Almost ruined by the flood of 1913, the city cooperated in the formation of the Miami Conservancy District, which was financed without State aid.

Water has always played an important role in the life of Hamilton. The old Miami and Erie Canal between Toledo and Cincinnati passed east of the town, but a wharf basin dug to the business center brought in the traffic. Here, as a boy, William Dean Howells, Ohio's most famous man of letters, ran errands for his father's print shop. He tells in *A Boy's Town* about the good swimming in the hydraulic races.

At Oxford the traveler steps from the bustle of big business into an atmosphere of academic calm. Old Miami University pursues its quiet, scholarly way as it did when it was founded in 1809. William Holmes McGuffey compiled here the first four of his famous *Eclectic Readers*.

Ohioans gave American school children a start in the three R's with McGuffey's readers, Platt Rogers Spencer's Spencerian penmanship, and Joseph Ray's arithmetics.

Retracing paths of frontier history, Richard Lawwill, director of the Anthony Wayne Parkway Board, took me to Greenville and thence north through the country where "Mad Anthony" Wayne subdued Indian tribes in a campaign culminating in the rout at Fallen Timbers, August 20, 1794.

The following summer General Wayne called his beaten foes to a parley at Fort Greene Ville (now Greenville); 90 chieftains and delegates headed by Tarhe the Crane, a Wyandot; Blue Jacket, a Shawnee; and Little Turtle, great Miami leader, came in with 1,130 warriors of 12 tribes to talk peace.

On August 3, 1795, around a council fire that had been kept burning for weeks, the Indian chiefs and Wayne signed the Treaty of Greene Ville, which opened two-thirds of Ohio and tracts as far west as Chicago to white settlement (page 480).

In Greenville died Annie Oakley, famous markswoman whose story provides a plot for the musical comedy, "Annie Get Your Gun." Complimentary tickets punched with holes have long been known as "Annie Oakleys." According to Annie's niece, Annie Fern Swartwout of Greenville (page 482), a newspaper reporter presented a free ticket at a New York ball park in 1921. The ticket taker remarked, "Why, that ticket looks as if Annie Oakley has been shooting at it." The newspaperman wrote a story about his "Annie Oakley," and the name stuck.

On the Trail of "Mad Anthony" Wayne

The Anthony Wayne Parkway Board has placed markers along the trails of the dashing general. Driving north from Greenville, Dick Lawwill and I visited Fort Recovery, built by Wayne on the site of St. Clair's tragic defeat; Fort Defiance, which Wayne set up before his victory, defying "the English, Indians, and all the devils in hell" to take it (page 482); and the site of the Battle of Fallen Timbers, where the Indians fled before the bayonet. The chiefs who signed the Greenville treaty never again waged war against the United States.

In Wayne's time and for many years thereafter that part of northwestern Ohio was a vast "Black Swamp," so densely timbered and mosquito-infested that it was unfit for human habitation. It is now some of the best

← Cincinnati Art Museum Plays Host to a Men's Rose Show

Each spring the Cincinnati Rose Society's 50 male members exhibit their prize blooms. In last year's show at Eden Park's Art Museum, 1,500 floral entries attracted 10,000 visitors.

Betty Vox (left) and Kathy Rothacker admire an award-winning cluster. The 400-year-old Spanish altarpiece depicts scenes chiefly from the Old and New Testaments.

Teen-agers Jam Ohio's Coney Island →

Cincinnatians claim one of America's finest amusement parks at Coney Island, edging the scenic Ohio River. Summertime crowds throng its pool, picnic grounds, and thrill rides. This party sits out a dance on the Sky Terrace of the Moonlite Gardens pavilion.

↓ Beauties Dunk Arms to Test Soaps

Procter & Gamble operates a soap research center in its vast manufacturing plant at Ivorydale, near Cincinnati. To test for mildness, these girls soak their arms in cleansing solutions.

472 Harris, Inc.

He Creates Beauty with a Master's Touch

John Donnan joined the Owens-Illinois Glass Company as a water boy when he was 11 years old. Eventually he became chief cutter in the Libbey Glass Division plant in Toledo. Now 78, he still designs and executes delicate patterns on crystal.

"My work will be a lost art in this plant when I'm gone," Mr. Donnan told the author. "Cut glass as I knew it is no longer in style, so there's less demand for the men who make it."

farm country in the State, with industry represented by prosperous cities such as Lima, the site of an 11-million-dollar oil refinery; Celina, home of Mersman Bros. Corporation, national leader in number of living room and occasional tables turned out; and Van Wert, whose Borden Cheese Company factory makes all the Liederkranz Brand cheese produced in the world (page 468).

Riding along U. S. Highway 24, which borders the placid Maumee River for many miles, I tried to picture in my mind's eye that peaceful scene when it was covered with dark forests where painted savages lurked, ready to leap out upon unwary travelers. We had driven in a few hours a distance that had taken Wayne and his troops weeks to cover on forced marches.

Coal Port and Glass Capital

Begun in 1794 as a tiny hamlet on the edge of the Black Swamp that crowded to the shore of Lake Erie, Toledo has grown to a metropolis of more than 300,000 and a great bituminous coal port and "glass capital" (opposite).

Huge coal freighters stood ice-locked at the wharves at the time of my visit. From a window in the business center of town, however, I could not even see the waterfront, which was hidden behind factories, warehouses, and smokestacks. But the clean, handsome residential section afforded me a commanding view of Lake Erie gleaming white under a vast sheet of ice.

In a factory of the Libbey Glass Division of the Owens-Illinois Glass Company we watched a continuous flow of tumblers as they were shaped in the molds of huge horizontal forming machines and passed on to heat-treating ovens. Here each tumbler is heated almost to the melting point, then cooled inside and out by jets of cold air. This simultaneous cooling of both surfaces makes the glass resistant to breakage.

After this process the tumblers are almost unbreakable. I saw one, thrown 10 feet into the air, come down on the wood-block floor and bounce up intact.

At the Toledo Scale Company I saw models retracing the history of scale making from the first simple balance to machines that deliver their answers on printed slips. Production of the fine scales combines modern assembly-line methods with the craftsmanship of highly trained experts.

Toledo is the home town of the rugged Jeep; Willys-Overland Motors, Inc., played an important role in its development and later turned out 368,714 of the sturdy little vehicles for use in World War II. Ford, a subcontractor, made additional thousands, using Willys blueprints.

Now a subsidiary of Kaiser Motors Corporation, Willys ranks as fourth largest U. S. exporter of automotive vehicles. In addition

Kodachromes by National Geographic Photographer B. Anthony Stewart

Lake Freighter Loads Coal in Toledo

Six huge loading machines rise beside Maumee Bay's south shore; each can empty a 100-ton coal car in one minute. They raise cars above ships' holds, turn them nearly upside down, and dump the coal. This vessel's loaded stern causes her empty bow to rise. The tug *America* heads in from Lake Erie.

A Blind Man Inspects Precision Parts

Twenty-five sightless workers prove adept testers at the Timken Roller Bearing Company in Canton. Jess Grund checks the outside diameter of a bearing cup to within one 25-millionth of an inch on this electronic gauge. In case of fire, fellow employees can quickly spot his red cap and lead him to safety.

to Jeeps, the Toledo plant produces station wagons, trucks, and Kaiser and Willys passenger cars.

At the Toledo Museum of Art a fabulous display of glass, ranging from pieces made soon after the dawn of civilization to outstanding examples of the modern glass blower's art, vies for popularity with a colonnaded auditorium having a huge stage and seats for 1,750 people.

In 1944 the U. S. Bureau of Labor Statistics listed Toledo as sixth city in the United States in frequency of strikes. Today the metropolitan area stands 24th.

A voluntary Labor-Management-Citizens Committee set up in 1945 accounts for the change. Since the organization started—totally without executive authority—it has settled 634 disputes and averted 159 strikes. Several other industrial cities have adopted the Toledo plan.

Edison Birthplace Preserved

History goes hand in hand with industry between Toledo and Cleveland. At Fremont, famous for cutlery, stands the mansion kept as a memorial to President Rutherford B. Hayes; at the little town of Milan the modest house where Thomas A. Edison was born is proudly preserved as a shrine.

The Edison family moved to Port Huron, Michigan, before Thomas was seven years old. His boyhood days and his career as an inventor are not a part of the Ohio story, though he was a genius who fulfilled the highest traditions of Charles Kettering's "practical men."

Driving out to the end of Catawba Island, I looked across an unbroken stretch of ice to the tall memorial shaft rising above Put-in-Bay where Commodore Oliver Hazard Perry won the Battle of Lake Erie in the War of 1812. It was from Put-in-Bay that Perry sent the famous message, "We have met the enemy and they are ours."

In summertime Sandusky entertains throngs of vacationers on its lakeside beaches. Commercial fishing, though not the big business it was in the 1890's, still flourishes. For miles around the city, particularly on Catawba Island and environs, vineyards grow luscious grapes to supply wineries.

At Lorain, steel manufacture and building of lake ships, chiefly ore carriers, are leading industries, though there, too, beach resorts do good business.

I went out of my way to see time-mellowed Oberlin College, first in the United States to admit women students continuously on an equal footing with men. The first four women were admitted in 1837; three were graduated in 1841.

Oberlin had enrolled women in precollegiate classes from its opening in 1833, but admission to courses leading to degrees was considered a radical innovation. Some girls wept when the president proposed that they read their papers before the men.

Among early graduates, Lucy Stone, who helped found the American Woman Suffrage Association, is perhaps the most famous. She took her degree in 1847. Charles Martin Hall, who discovered the electrolytic process of making aluminum in 1886, the year after his graduation from Oberlin, left a third of his estate to his alma mater. The bequest is now valued at some $20,000,000.

Cleveland, Ohio's biggest city, greeted me with a sudden snowstorm just as street lights winked on. Never in many visits to the magnificent city on Lake Erie have I seen it more beautiful. Lights glowing softly on gracious homes turned fine residential districts into a fairyland.

In 1796, Moses Cleaveland (the first *a* was lost, tradition says, when a newspaper shortened the name to save space) led a band of Connecticut folk to what the city now calls "the best location in the Nation." Apparently his followers did not agree with that sentiment. Only three people who came with him remained here to brave the hardships of frontier life.

Nation's Seventh City

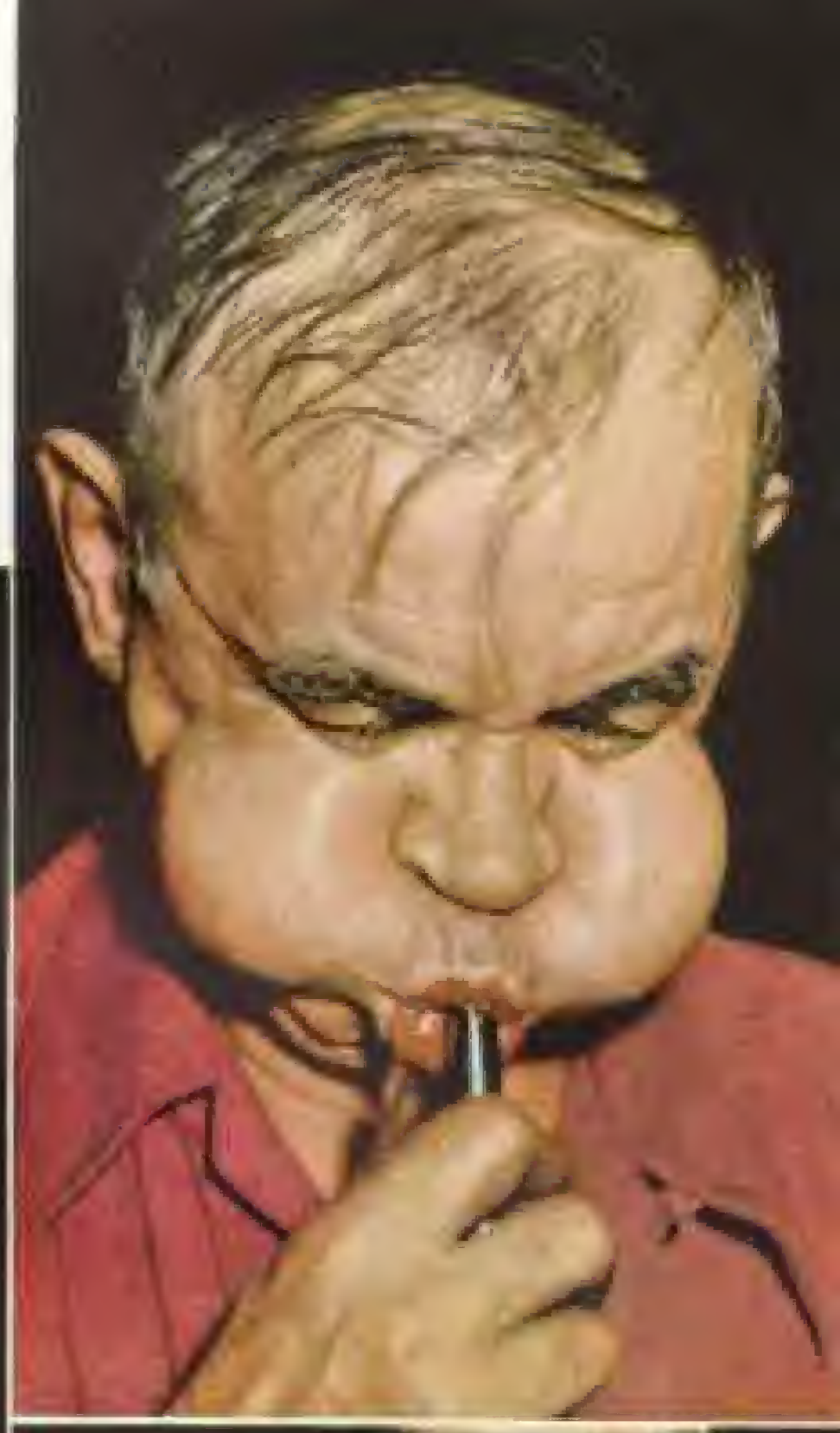
From an ague-cursed hamlet at the mouth of the Cuyahoga River, Cleveland has grown to a metropolis seventh in size in the United States. It leads the world as an iron-ore shipping port and ranks among the great industrial centers of America (page 452).

Its cosmopolitan population represents 46 nationalities; yet teamwork in civic enterprise is outstanding. The Terminal Tower, the country's highest building outside New York City; the renowned Public Auditorium, one of the finest in America; magnificent Severance Hall, home of the Cleveland Symphony; the Museum of Art, surrounded by exquisite gardens; five notable colleges, largest among them Western Reserve University; and miles

(Continued on page 483)

✦ Glass Blower's Puffed Cheeks Bulge Like Oranges ✦

August Heyman, employed by the Cambridge Glass Company for 32 years, learned the ancient art from his father at the age of 12. Here he rotates the 4-foot blowpipe as he creates a 15-inch bowl from a taffylike bubble of fiery glass.



✦ A Blob of Glass Takes Shape

Making a goblet, Mr. Heyman draws out the stem from the bubble in a precise operation that requires long training. Other workers will mold the goblet's foot, cut off the top, glaze the edges, and fire-polish the finished product.

Kodachromes by National Geographic Photographer B. Anthony Stewart

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Contoured Crops Weave Stripes Across Knox County's Rolling Hills

Floods and droughts once plagued the Muskingum watershed. Residents united in 1933 to dam tributaries of the lawless Muskingum River. Conservation practices converted an eroded basin into rich farm land.

Kodachrome by National Geographic Photographer B. Anthony Stewart

Hay and Alfalfa Raise Green Shoots Between Newly Plowed Strips

Thriving farms like these place Ohio among the top dozen States in value of crops. Strip cropping, protected wood lots, ponds, and improved pastures minimize the loss of soil and water (pages 478–91).

Inland Skippers Sail a Man-made Lake

Conservation leaders throughout the world have studied and imitated the Muskingum Watershed Conservancy District, one of Ohio's proudest achievements (page 476).

Fourteen dams control flood waters on the Muskingum River's three major tributaries and help assure a dependable water supply for public and industrial use.

Ten of the flood-control reservoirs impound permanent lakes that provide 365 miles of shore line for recreationists. Six million Ohioans living within 100 miles of the lakes enjoy year-round fishing, sandy bathing beaches, vacation cottages, and picnic grounds. Hunters find game and waterfowl abundant.

A community yacht club on 5-mile-long Atwood Reservoir sponsors weekly regattas. Spectators here lounge on a grassy knoll as trim Thistles and Lightnings skim the shallow lake.

Kodachrome by National Geographic Photographer Dean Conger

← Muskingum Reforests → Its Denuded Hills

This region was a luxuriant forest domain until woodworking industries stripped its cover. Now the Muskingum Conservancy District plants 20,000 pine and hardwood seedlings daily on lands adjoining the flood-control reservoirs.

← Several months prior to planting, double-bottomed plows cut terraces seven feet apart to slow the runoff of rains. Then the diesel tractor and planter go into action. Straddling the terrace, the planter's hydraulic-controlled wheels adjust to slopes as steep as 45 degrees. The machine plants 1,000 trees an hour. Better than 90 percent survive. This process halves the cost of planting.

→ Riding the planter, operator Clarence Hart roots a pine seedling in the hole made by the disk and shoe. Wheels flanking him repack the soil.

Photographs by National Geographic Photographer B. Anthony Stewart

Boy Scouts Enact Treaty of Greene Ville

Early settlers north of the Ohio River lived in constant fear of Indian attack. Clashes increased as they penetrated ever deeper into tribal grounds.

Three times the United States Government sent armies into Indian country to break the braves' resistance. Twice the Indians, led by Chief Little Turtle, inflicted costly defeats. But in the Battle of Fallen Timbers, near Maumee, Gen. Anthony Wayne led Federal troops to a decisive victory.

The Treaty of Greene Ville (now Greenville) was signed August 3, 1795. It opened the floodgates for settlers into the rich lands of the Northwest Territory. Ohio, Indiana, Illinois, Michigan, and Wisconsin, plus a part of Minnesota, were carved from the area.

These Scouts, representing Indians, soldiers, and woodsmen, kindle a council fire at the Altar of Peace near the spot where General Wayne signed the pact with the tribes. The 1954 camporee drew more than 4,000 boys to Greenville.

▼A befeathered Scout entertains campers with an Indian dance.

♠ Fort Defiance: Named for a Battle Cry

This stronghold at the junction of the Maumee and Auglaize Rivers served as General Wayne's base during the 1794 campaign. "I defy the English, Indians, and all the devils in hell to take it," he boasted. Today the city of Defiance maintains the site as a park. Here Scouts raise U. S. and Ohio State flags.

♦ Greenville Commemorates Annie Oakley

"Little Miss Sure Shot," whose marksmanship gained world fame, was born in northern Darke County, near Greenville. Mrs. Annie Fern Swartwout, a niece, shows her collection of mementos to a young woman costumed as Annie. Queen Victoria presented the opera glasses to the Ohio sharpshooter. The revolver is a Colt.

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Tafts of Ohio: Their Ancestors Served State and Nation for Generations

Alphonso Taft was Secretary of War under President Grant. William Howard Taft was the only American to become both President and Chief Justice. U. S. Senator Robert A. Taft was known as "Mr. Republican." Here State Representative Robert A. Taft, Jr., relaxes with his children at their Cincinnati home.

of wooded parks, uncrowded recreation areas luring thousands to enjoy their cool, green fastnesses—all these combine to make Cleveland great.

In Cleveland the oil-refining industry had its real start; the genius behind that vast enterprise was John D. Rockefeller.

As a young boy, John D. had saved $50. A potato farmer offered him seven percent interest for a loan. With his father's consent the boy lent the farmer the money, and when the potatoes were dug young Rockefeller took a job picking them up at 37½ cents a day. The farmer paid back the $50 with $3.50 interest.

"Lending that $50 and working in the field enabled me to be in two places at once," John D. gleefully told his father. "The money earned me $3.50, and my work got me more."

"Still, the farmer made more money out of the potatoes than you did," Rockefeller, senior, said. "Your $50 financed the potatoes you picked up for 37½ cents a day."

"That taught me a lesson," John D. Rockefeller said years later. "I resolved after that to be the man who plants the potatoes."

In those few words lies the secret of the fabulous career of the Oil King.

At Cleveland wharves on Lake Erie ore freighters lay winter-bound. To these wharves, too, when ice is out of the Great Lakes, come vessels from foreign countries. Opening of the St. Lawrence Waterway will make Cleveland a world port (page 454).

Less generally known is the role of Cleveland in another field of transportation—aviation. The lake-shore city is the home of the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics, where scientists seek ways to power planes at ever-faster speeds and higher altitudes.

Museum Stresses Health

Among the many interesting places I visited, the Cleveland Health Museum, first of its kind in America, seemed most unusual. The displays, many of them activated by push-button control, demonstrate to visitors how to enjoy better health (page 451).

When I walked past the charts showing correct posture and how to attain it, I involuntarily straightened my shoulders.

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Tires for Earthmoving Machines Dwarf Those for Airplane and Lawn Mower

B. F. Goodrich, oldest rubber company in the Akron area, makes 30,000 different products in its U. S. plants (page 464). These earthmover tires, 6½ feet in diameter, weigh 1,250 pounds each and can support 23 tons. Midget mower tire is Goodrich's smallest for machines. Aircraft tire is designed for high-speed jet landings.

"Everybody does that," Dr. Bruno Gebhard, museum director, said with a laugh. "And you should see the ladies moving the levers on the food chart to find out how many calories their favorite desserts contain."

To foster international good will, Cleveland maintains a series of gardens in Rockefeller Park, each honoring a different national culture (page 458). The project was begun in 1926. Thus far, 16 of the Cultural Gardens are finished; others are being added.

Initial cost of construction is borne by groups of Cleveland folk whose ancestry traces from the countries represented. The city takes care of the upkeep.

Leading off are the American Garden and the American Legion Peace Gardens. Then come Irish, Hebrew, Shakespeare, Hungarian, German, Lithuanian, Ukrainian, Greek, Italian, Slovak, Rusin (Ruthenian), Czech, Yugoslav, and Polish Gardens. Each memorializes persons or events famous in the history of the people it represents, and each expresses something characteristic of their culture.

Passing these symbols of friendship, which nurture the One World idea, I noted how many of them represent countries now behind the Iron Curtain.

The folk who gave them to the city were immigrants or sons and daughters of immigrants, to be sure; yet Cleveland remembers that many of these new Americans are in this country not by accident of birth but by their own choice. After all, I reflected, our own ancestors were foreigners once.

Isn't it possible, I wondered, that the ancient people who built the Ohio mounds thought of the later Indians as foreigners?

Spain's "Fortunate Isles," the Canaries

On Colorful Islands Near Africa's Desert Coast, Devout Canarios Pave City Streets with Blossoms at Corpus Christi Time

By Jean and Franc Shor

Foreign Editorial Staff, National Geographic Magazine

With Illustrations from Photographs by the Authors

THE narrow, winding streets of Las Palmas were banked with huge piles of flower petals. Spicy fragrance filled the air. Men and women, kneeling on the cobblestones, carefully formed the blossoms into a solid carpet of intricate design.

They sang as they worked. Children hurried with fresh baskets of blooms. Black-robed priests worked beside long-skirted housewives and farmers in brilliantly embroidered waistcoats. Nuns in white hats festooned streetside altars with tinsel.

A Bit of Spain Overseas

"It is good you have come to the Canary Islands during the season of Corpus Christi," said our friend Don Francisco Perez Naranjo. "Now people wear their gayest costumes, and there is dancing and singing night and day. The Canaries are always beautiful, but all that is most enjoyable is concentrated into these few days. I think you will like the Fortunate Islands."

We did. They are an ideal vacation spot. The climate is excellent, the scenery magnificent, the hotels comfortable and amazingly inexpensive. And from Las Palmas on lush, modern Grand Canary (Gran Canaria) to Arrecife on rainless Lanzarote, every Canario we met seemed to regard foreign visitors as personal guests and made us welcome.

Some 820,000 Spaniards live in the historic Canaries. The archipelago actually forms two provinces of Spain, although the islands lie off northwest Africa 640 miles from the motherland (map, page 488). Five climatic zones range from sea level to the snow-capped 12,162-foot peak of Teide on Tenerife. There are no seasons; tomatoes can be planted to ripen in January or July, whenever the foreign market is better.

The islands' economy has had rough shocks in the last hundred years. Until the 1850's the principal export was the famous Canary wine. Then a blight wiped out the vineyards. The islanders tore out the vines and planted cactus, on which cochineal, a scale insect, thrives (page 521). The brilliant carmine dye made by crushing the bodies of the bugs went all over the world for use in everything from lipstick to food coloring. The invention of cheaper aniline dyes ruined that industry.

Canarios imported the Chinese banana tree, and found themselves back in business. Land values boomed. Twenty-five years ago the famed botanist David Fairchild, writing in the National Geographic Magazine, told of irrigated land that could not be bought for $15,000 an acre. How long, he wondered, would it last?*

The same land is still producing bananas (page 517), and the Canaries are booming. There is work and food for all; both prices and wages are low.

The Canaries have a fascinating history. Some islanders believe they were the home of the fabled Hesperides, the nymphs who, with a fire-breathing dragon, guarded the golden apples. The Romans called the Canaries the Fortunate Islands, and Hesiod said they were the place where Jupiter sent the souls of dead heroes.

Normans Found Stone Age Natives

Juan de Bethencourt, a Norman knight, attempted the conquest of the Canaries in 1402. He found them peopled by a strange race, the Guanches, whose kings were 7 feet tall. These aborigines were gentle people, with a Stone Age culture. Nevertheless, they put up a stout resistance, and it was not until 1496, after the intervention of Henry of Castile, that the conquest was complete.

"Nobody really knows much about the Canaries before the 15th century," a Spanish friend told us. "Since that time they have belonged to Spain."

Not without a struggle, however. The British and Dutch tried in vain to seize the islands. Sir Francis Drake was beaten off at Las

* See "Hunting for Plants in the Canary Islands," May, 1930.

Canary Men Go to Sea for Business and Pleasure; Las Palmas Harbor Has Room for All

Fishing is an important industry in the Canary Islands. Most of the 820,000 inhabitants fish or farm; some do both. Having five climatic zones, the islands raise a wide variety of crops. Grand Canary Island (above) calls itself a continent in miniature. Here a racing yacht glides astern of a fisherman.

Palmas in 1595. And in 1797 Lord Nelson, an admiral at 38, stormed ashore with a landing party at Santa Cruz de Tenerife and suffered his only major defeat (page 502).

Raked by musket fire, Nelson led his gallant handful in a desperate charge. His arm was shattered by grapeshot. The survivors carried him back aboard the *Theseus*, where the arm was amputated, and the British fleet withdrew. Nelson's tattered battle flags still hang in the parish church at Santa Cruz.

Rivalry Strong Among Islands

Since that day the islands have known peace, and the Canarios are peaceful people. This is not to say, however, that there is no rivalry. The most populous islands are Grand Canary and Tenerife. They compete for trade, for shipping, and for tourist traffic. But this is a friendly affair, which no one takes very seriously. It is, after all, only a matter of money.

Not so, however, with flower carpets. Each year, at the time of Corpus Christi, the people of Las Palmas, on Grand Canary, and of La Orotava and La Laguna, on Tenerife, stage celebrations of astounding color and beauty. The streets are covered with petals worked into intricate patterns and ambitious designs. At dusk a great procession forms at the cathedral, and the monstrance and host are carried through the petaled streets, past thousands of kneeling Canarios, to be blessed by the island's bishop.

Hint to a native of Grand Canary that there might possibly be any beauty in a flower carpet on Tenerife, and he is your enemy for life. Intimate on Tenerife that you once saw a particularly lovely design in Grand Canary, and you become a social outcast. These are

things of importance, and are to be taken seriously.

Jean and I were fortunate. Usually the observance takes place on the same day on both islands, about two months after Easter. But at the time of our visit the bishop had moved the Grand Canary celebration forward to coincide with the World Eucharistic Congress in Barcelona, so we were able to visit both.

We were on the streets of Las Palmas early in the morning to watch the preparation of the carpets. The route of the procession was more than half a mile long, and every inch of it was being covered with a three-inch layer of petals. There were geraniums, dahlias, lilies, nasturtiums, roses, hydrangeas, and daisies (pages 491-495).

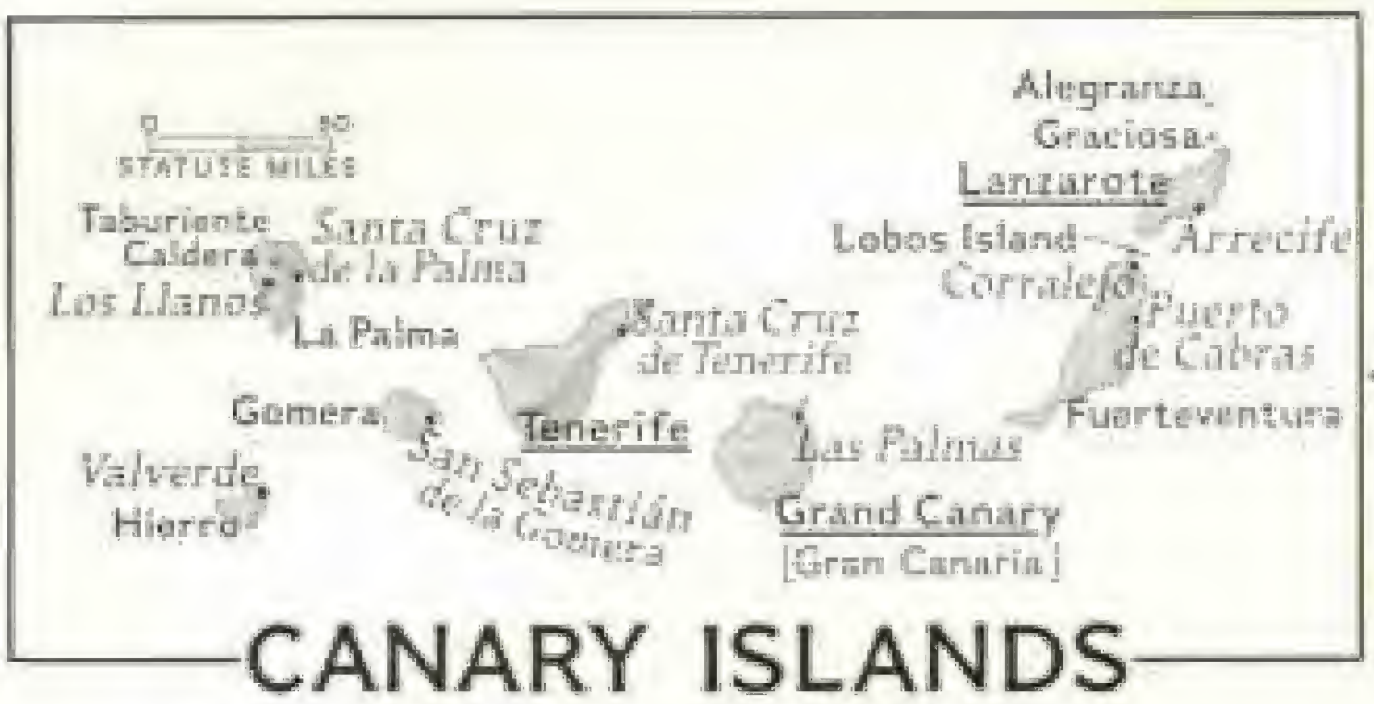
One block-long carpet was laid by city employees. Individual homeowners worked on smaller designs in front of their houses. Detachments from the army, navy, and air force labored on separate displays.

A white-haired old lady, kneeling in a voluminous black skirt, sketched in chalk upon the cobblestones a life-sized portrait of the Virgin in a flowing robe. Then she carefully filled it in with petals, outlining the folds of the robe with pine needles. Other displays showed doves, each feather a lily petal. There were portraits of the Saviour, pictures of the Cross, and one simple woodland scene.

Many of the artists had field glasses. As they finished each section, they would step back and study the job carefully through the wrong end of the glasses.

"It gives a better perspective," said Senor Naranjo. "Much simpler than running up

Cathedral Towers Dominate the Skyline of Las Palmas. Youth Haunts the Old Pier



CANARY ISLANDS

Lanzarote

SCALE FOR ISLAND ENLARGEMENTS
0 5 10 15
STATUTE MILES

Tenerife

Grand Canary

Island's . islas Mountains montañas
Peak . . . pico Point . . . punta

© National Geographic Map

Drawn by Douglas A. Strobel and Irene E. Alleman

Volcanoes Created the Canaries

The name Canary comes from the Latin *canis* (dog); early explorers found large dogs there. Canary birds, in turn, were named for the islands. Teide Peak, on Tenerife, is the archipelago's highest; snow often covers it. The islands, totaling 3,127 square miles, lie 60 to 300 miles off northwest Africa.

to a balcony each time you want to see how you're doing."

"The balconies would be good vantage points from which to take pictures," we suggested. "Do you know anyone who lives on this street?"

"It is not necessary to know them," Naranjo replied. "You are our guests. You will be welcome anywhere. Which balcony would you like to use?"

Hesitantly we selected an impressive house. A moment later Senor Naranjo was knocking at the door and explaining the situation to an attractive senora.

"You are most welcome," she smiled, inviting us inside. "Our home is yours."

She led the way through a central court filled with vines and flowers. A curving staircase led to an inner balcony, which ran around the four sides of the court. Off the balcony we passed through an enormous living room with gleaming pegged floors of Canary pine, not a board less than 24 inches wide. The furniture was heavily carved.

From the wooden balcony we watched the bustle in the streets below. A servant brought coffee. Our hostess insisted we stay for a cup.

Half a dozen times that afternoon we knocked on strange doors and asked to use the balcony. Every house had its inner court,

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↟ Day's Work Done, Tenerife Milkmaids Ride Home in Style

Hillside farms and villages rim the port of Santa Cruz, capital of Tenerife. Milkmaids in broad-brimmed straw hats walk down to town each morning, balancing cans of milk on heads and shoulders. Their product sold, they board a bus for the uphill ride home.

Usually the milk is warmed and mixed with grain meal to form a paste, mainstay of the islanders' diet.

Cows Deliver Milk ↠ on the Hoof

Americans who complain that processing, bottling, and delivery charges boost milk prices too high might find inspiration on the island of Grand Canary. Farmers daily drive cows through the streets of Las Palmas and deliver a warm, frothy bowl to each customer.

"It may be old-fashioned," this dairyman told the Shors, "but I've never had a customer complain that the milk wasn't fresh!"

balcony, and planked floors. Every hostess was gracious; five insisted we have coffee, the sixth brought sherry.

"These homes are lovely," we told Naranjo. "This must be the city's best residential section."

"Not at all," he said. "These are middle-class people. They are doctors, lawyers, school-teachers, and civil servants. But in the Canaries people are proud of their homes. Furniture is handed down from father to son, and most of the family income goes into the home. We don't have automobiles or television, but we try to have a nice place to live."

An hour before dusk the carpets were completed. Anxious artists occasionally tiptoed into the street to adjust a misplaced petal. The sidewalks were crowded with people moving slowly along the route, pausing to admire the designs, commenting in low voices. The artists stood beside their work, smiling at the compliments.

At 6 o'clock bells high in the tower of the great 16th-century cathedral began to peal (opposite page). Slowly the massive oak doors swung open, and forth came a group of small boys dressed in red and blue and gold robes, carrying gay silk banners bearing religious devices. Little girls followed, wearing white caps, veils, and long embroidered first-communion dresses. Then came city officials, military and naval officers, and church dignitaries, chanting as they walked.

Rain of Flowers Ends Pageant

In the center of the procession walked the bishop, an impressive figure in magnificent garments. Behind him, carried on the backs of a dozen men, was the huge monstrance, covered with white silk, decked in silver tinsel and gold thread. As it passed, the straining crowds dropped to their knees and made the sign of the cross.

For two hours the procession moved through the flower-covered streets. Then it turned into the plaza. The children and the minor officials and the military units formed ranks around the square, and the bishop and the mayor slowly mounted the steps of the town hall. In the gathering dusk they reappeared on a balcony overlooking the packed square. At that moment thousands of lights, strung across the face of the town hall, came on, and a solid rain of flower petals streamed down upon the bishop as he raised his hand to bless the kneeling crowd.

It was a scene of fantastic beauty, solemn and dramatic and immensely impressive. Then, as the bishop's hand fell slowly to his side after the blessing, it was suddenly all over. The tension broke, the crowds came to their feet and began to sing, and children started pelting each other with the crushed flowers.

An hour later Jean and I walked through the almost deserted square, alone but for half a dozen street cleaners, busy with brooms and shovels, sweeping up the petals. We paused to chat with a handsome old gentleman, white mustachioed, who wielded his broom with deliberate strokes.

"I've never seen anything so beautiful," Jean told him. "Isn't it a wonderful old custom?"

His broom moved steadily as he looked at her from under the brim of his black-felt hat.

"Si, Senora," he said. "A wonderful old custom." He glanced at the acre of petals still unswept. "A wonderful old custom, but I wish it would die out!"

Vintage Cars Throng Las Palmas

Senor Naranjo came to our hotel the next morning to take us on a tour of the island, and we walked to a line of taxis.

I had always wondered where old cars go when they die, and now I know. There, in a line, were battered sedans and touring cars bearing names long since gone from American highways. We chose a Lafayette, leaving such vintage makes as Reo, Moon, Star, Essex, Rockne, Chandler, Hupmobile, Cleveland, Stutz, and Elcar.

It was immediately apparent that the flower pickers had made not the slightest dent in the flowers of Grand Canary. Blossoms lined the roads, and every courtyard was ablaze. We climbed sharply past acres of banana plantations, winding through lovely countryside marred only by enormous signboards advertising sherry and brandy.

Near Santa Brigida we passed a series of impressive estates, the summer bungalows of Las Palmas's wealthier families. One particular edifice, set in acres of beautifuly tended garden, caught our eye.

"That's the home of one of the wealthiest men in the islands," Senor Naranjo explained. "He owns three wells."

"I didn't know there was any oil in the Canaries," I said.

"There isn't," our friend replied. "He owns

(Continued on page 499)

Kodachrome by Jean and Franc Shor, National Geographic Staff

A Year of Planning Yields an Hour of Glory: Las Palmas, Grand Canary

Corpus Christi is the year's big event for residents of Grand Canary. They gather blossoms for a week before the observance. On the holy day they weave petals into intricate designs, and for a few brief hours the streets blaze with color. Then processionists from the Cathedral of Santa Ana tread the carpet, leaving a crumpled path.

Las Palmas City Employees Pave a Street with Petals in an Intricate Design

Wooden frames are used to shape the central patterns; flowers of contrasting colors fill the spaces. Crushed pine needles will form borders to the curb. Watering pots keep petals fresh.

Spanish Airman Weaves a Propeller in a Floral Carpet

Spain's air force vied for the honor of producing the most beautiful display in the celebration at La Laguna, Tenerife.

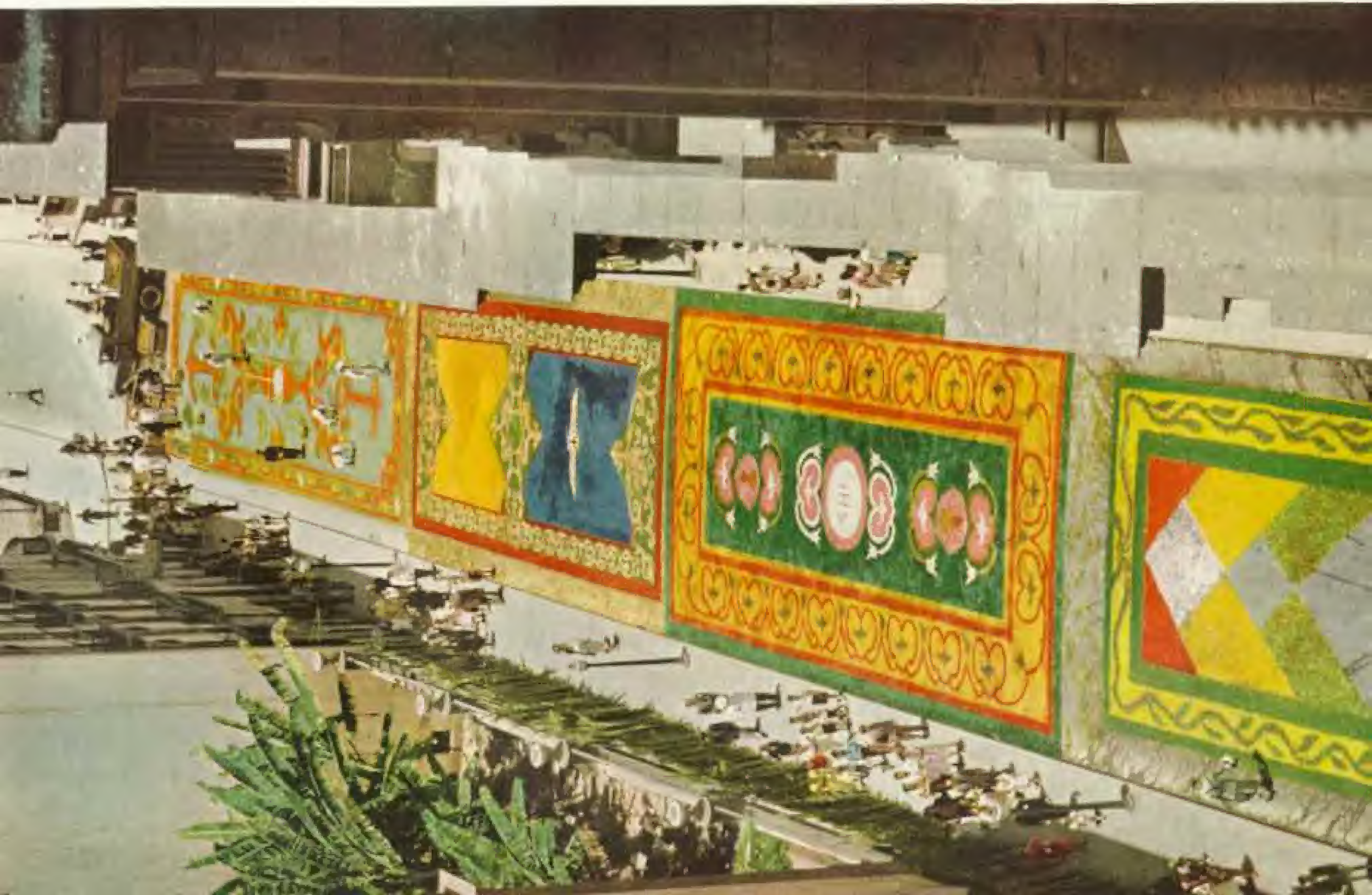
Burnt pine needles sprinkled from the paper cone outline the shiny green of eucalyptus leaves in this garland.

↓ Flying Fingers Sort Millions of Blossoms

Geraniums grow in incredible profusion in the Canaries. For a week before Corpus Christi every garden and roadside hedge yields its tithe of these blooms. Other flowers are gathered and sorted according to color.

On the day of the procession the patio of the town hall in La Laguna is turned into a scented clearinghouse of blossoms. Children begin arriving before dawn with hand-woven baskets and boxes of flowers.

These men strip petals from blossoms piled on the floor. Women perform the same task at long tables. As each basket is filled with a particular color, waiting children rush it to the streets, where other villagers arrange the petals.



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♠ Easter Lilies Form Angels' Wing Feathers

In a primitive style reminiscent of early Spanish paintings, this La Laguna carpet depicts angels holding the hands of a supplicant kneeling at an altar rail.

➔ A private family in Las Palmas worked all day on this striking portrayal of Christ with a lamb in His arms. The design was sketched on a straw mat, then painstakingly filled in with petals. While elders worked on the design, children held a woven straw screen to keep the wind from disturbing the composition.

← Sailors Spread Floral Rugs

Page 494: Seen from the bell tower of the Cathedral of Santa Ana, Las Palmas's main street displays a sea of beauty prepared by army, air force, and navy.

Soldier at lower left uses a watering pot. Sailors at end of the block complete the navy carpet. The truck carries petals and colored sawdust.

Flowers include geraniums, lilies, nasturtiums, dahlias, roses, daisies, hydrangeas, and irises. The bell tower's high, projecting ledge (right) frames sidewalk strollers below.

↑ **Camels Wear Flowers in Their Hair at La Orotava's Celebration**

The *romería*, or fair, of San Isidro attracts visitors to La Orotava from every island. These costumed Tenerife girls ride through cobblestone streets singing folk tunes. Linen drawn work, a Canary export, covers the camel's wooden saddle (page 519).

↓ **A Bower of Grain Shelters Singers in a Harvest Float**

Oxen, bedecked with flowers and ribbons, pulled decorated wagons through La Orotava's streets. Other carts represented farm huts, banana plantations, and bakeries (opposite). One had a family scene showing a girl pressing grapes, her sister doing laundry.

La Orotava's Ornate Balconies Look Down on a Street Filled with Costumed Merrymakers

Dancing and singing crowds parade through the streets, unmindful of threatening skies and occasional drizzle. Fine wrought-iron balconies on home at left are products of early Canary Islands architecture.

Sheep, Their Fleece Washed for the Occasion, Take Part in La Laguna's Joyful Fair

Corpus Christi is observed with dignity, but the islands' gay romerías are marked by Maypole dancing, singing, and wine drinking. This shepherd wears embroidered pantaloons.

water wells. They are just as valuable here as oil wells."

Banana cultivation, Naranjo explained, requires much water. Unirrigated land sells for as little as $10 an acre. With sufficient water for banana cultivation, that same acre may sell for $10,000.

A side road took us up the steep flank of an extinct volcano. It was too much for our venerable automobile, and we stopped at a resthouse to let it cool. Inside we found excellent sherry at 5 cents a glass. A sandwich of homemade bread and native cheese ran the bill up to 12 cents.

Oxen Toil in Dead Volcano

Two attractive teen-age girls, seated at a table, were working on the drawn-linen handkerchiefs for which the islands are famous (page 519). We bought a few for gifts, and chatted with the makers.

"If I work from morning until the light fails," one of the girls told us, "I can finish one in a day. It sells for 50 cents. Linen and thread cost 15, so my wages for a day's work are 35 cents."

"It isn't very much," I suggested.

"It's enough," she laughed. "My father works all day in the banana groves for only 50 cents. But of course he also gets medical and old-age insurance. And when he's too old to work, he'll get a pension of nearly 20 cents a day."

The driver came in to announce that our car had cooled, and we chugged slowly to the 1,640-foot summit. Before us Bandama Caldera yawned into the distance, its mouth more than 3,300 feet across. At the bottom, where lava once boiled in torment, tiny farms dotted the crater bed and farmers followed straining oxen through the fields.

We lunched at the Government hostel, or *parador*, at Cruz de Tejeda, nearly 5,600 feet above sea level. The paradors, owned and operated by the Spanish State Tourist Bureau, are among the finest travel bargains in the world. In these new and attractive buildings, decorated in typical Canary fashion, one can have a good-sized bedroom with private bath and three meals for $3 a day. If two share the room, the cost is $2.50 per person.

Parador meals drive a waistline-conscious American out of his mind. A simple breakfast offers fresh fruit, juices, ham and eggs, fish, fried potatoes, hot breads, and coffee. Lunch and dinner begin with an assortment of hors d'oeuvres, proceed leisurely through soup, fish, roast, fowl, vegetables, salad, and dessert to coffee. They usually conclude with an old Spanish brandy; if the tourist is careless of his money and chooses the most expensive bottle, the drink may cost as much as 10 cents.

We started lunch at noon, having told our driver to return in an hour. When 1 o'clock came and we were barely through the soup, I began to worry. Senor Naranjo quieted our fears.

"Don't worry," he said. "Miguel knows about parador meals and Spanish eating habits. He won't return before 3."

He didn't. We finally struggled back into the car and dozed fitfully over winding roads to Artenara, the village of the cave dwellers.

The homes of Artenara, a couple of hundred of them, are dug into the sides of a deep gorge. The nearest cave is half a mile from the motor road, down a precipitous path. This is not important, as Senor Naranjo pointed out, since nobody in Artenara owns a car.

The cave dwellers were every bit as hospitable as the owners of the attractive homes in Las Palmas. Our first stop was at a whitewashed door, set into the conglomerate hillside. Geraniums grew in a tiny whitewashed patio, and down the hill a terraced acre was green with new wheat. Manole Godoy answered our knock, stepped nimbly aside as three chickens dashed from his living room through the open door, and invited us in. Senor Naranjo explained that we wanted to see how the Godoy family lived, and Manole bowed graciously.

"Make my home your own," he smiled. "Forgive me that I do not offer you wine. I have none. But later there will be fresh bread, and you must have a bite with us."

Pick and Shovel Enlarge Cave Home

We stepped into a long hall hollowed from the hillside. To our left was a small kitchen, with a stovepipe burrowing through the rocky ceiling. Five doors opened off the hall—a dining room, three bedrooms, and a living chamber. The dining room and bedrooms were each about 8 by 10, filled with simple handmade furniture. The living room was a bit larger. Oil lamps brightened the rooms. Religious pictures hung from the walls, and crucifixes were in every bedroom.

"A cave makes a good home," said Manole. "It's warm in winter and cool in summer. When the family grows and you need another

Kodachrome by Jean and Franc Shor, National Geographic Staff

Tenerife Oxen Drag a Grain-laden Wagon Down a Geranium-decked Lane

Travelers are a principal source of revenue for Canary Islands' seaports, but farming supports the interior. Irrigated areas produce lucrative crops of bananas; drier lands yield wheat, corn, and barley. Agricultural methods remain primitive among small landholders. This load will be threshed by trampling horses.

room, a pick and shovel will quickly produce it.

"My three daughters embroider and make a few pesetas each week. One of my sons works in a banana-packing shed, another picks tomatoes, and the third helps me farm. I have only an acre and a half, so we can't grow everything we need. But with everyone working, we have nearly $30 a month in cash, so we manage to buy enough *gofio* for all."

Gofio is the staple of the Canary diet. Ripe maize is roasted, salted, and ground, then mixed with water or, in good times, milk, and eaten as a paste. The Government-controlled price is kept low, so that even on the minuscule wages of Canary workers most families keep a few bites ahead of hunger.

Outside the door of Manole's cave was a beehive oven, from which drifted savory odors. His wife, Carmen, left the house and returned with an armful of smoking brown loaves (page 506). She sliced one, insisted we all have a piece. It was coarse but excellent.

We spent a pleasant week driving about Grand Canary, which the Canarios call a "continent in minature." And with some justification, for its 634 square miles, on which more than a quarter of a million people make their homes, embrace an amazing assortment of real estate. The island is shaped like an enormous inverted saucer, with a mountain range, known as the Cumbres, towering to 6,483 feet in the center of the island.

There are places where tropical plants—avocados, mangoes, oranges, and palm trees—grow in wild profusion, and there are vast expanses of cactus-strewn desert where even the vultures go hungry. There are rugged mountain peaks, magnificent bathing beaches, modern cities, and mud huts clinging to steep hillsides.

Aborigines Mummified Their Dead

The Canarios are a happy people. Anthropologists find Guanche characteristics surviving in present-day islanders, and that strange and forgotten race seems to have made a specialty of happiness.

"The Guanches of Grand Canary put personal honor and bravery above all other ideals," we were told by Don Antonio de la Nuez Caballero, the secretary of the Canary Museum of Las Palmas. "Their material culture was still in the Stone Age when the Spaniards conquered the islands. But their religious and social customs followed the purest traditions of primitive humanity.

"They worshiped a supreme god and were monogamous. They were governed by a king and a council of nobles, but a plebeian could rise to noble rank through personal merit. And their artifacts were beautiful."

The Guanches mummified their dead, treating the bodies with the dark-red resin of the dragon tree, still found on the islands (page 513). One mummy in the Canary Museum is 6 feet 6 inches tall. The bodies were sewn in finely cured kidskins; the tiny stitches, made with fishbone needles, are almost invisible.

First Islanders Were Landlubbers

"The Guanches never learned how to sail," Don Antonio told us. "They could see one island from another, but there was no communication between them. And there is no record of any intertribal warfare. Yet, when the Spanish came, they defended themselves with surpassing bravery."

Some enthusiasts hold that the Canaries are remnants of the sunken continent of Atlantis. They regard the fact that the islanders did not know the use of boats as evidence supporting their belief. If most of the continent disappeared beneath the waves, they assert, only the people dwelling in the high interior would have survived. And such hill folk would be ignorant of sailing techniques.

Modern Canarios more than make up for their predecessors' ignorance of sailing (page 486). The Nautical Club is a favorite resort for Las Palmas residents, and Sunday regattas bring scores of pleasure craft to the waters of Puerto de la Luz. The island has a number of fine bathing beaches. The most popular, Canteras, is only a few hundred yards from the port; on Sundays and holidays its half-mile crescent of smooth sand is crowded.

A venerable touring car took us south along the coast to Hoya de la Plata, a fishing village that is a collection of huts set only a few yards from the ocean. A hundred yards back a hill, some 600 feet high, rises abruptly.

"The fishermen keep a lookout stationed on top of the hill," our guide explained. "When he sees a school of fish he yells a warning, and the people on the beach take out their net."

The 20 families in the village work together, and all get a share of the catch. "I get a double share, because I own the net," Jose Cruz Mariano told us. "In a good month I make perhaps $10."

A shout from the lookout interrupted our

Britain's Lord Nelson Lost a Battle and an Arm in Santa Cruz's Now-peaceful Harbor

Fishing boats lie at anchor in waters where the admiral launched a futile attack in 1797. His captured battle flags hang in the parish church.

Brilliant Canary Sun Dries Hake for Export; Broad-brimmed Hats Protect the Girls

Salt and sun and willing hands turn the fleet's catch into profitable exports. Most fish comes from the African banks; it goes to the Belgian Congo in 110-pound bales. "When looking for a fish-drying yard," writes Jean Shor, "never ask directions. Just follow your nose!"

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conversation. The villagers sitting about the beach erupted into furious action. Three men rowed vigorously to sea, guided by shouts and arm waving from the lookout. They spread the net in a 100-yard arc. Men and children seized the ends and hauled it in to shore.

The women of the village crowded anxiously around their menfolk as the long net came in, yard after yard of empty mesh.

"We need a good catch," Jose gasped as he stood knee-deep in the surf and tugged. "For two days we've had nothing but a few blowfish. Maybe you have brought us good fortune. The net is heavy."

A shout went up as the center of the net appeared, boiling with activity. Children grasped the edges of the pocket and dragged the squirming mass ashore. A bushel of rockfish and a larger haul of shining squid poured out onto the beach.

"The best luck we've had in weeks," cried Jose. "We have at least 50 pounds of squid, and they bring 15 cents a pound. And the rockfish will fill our own stewpots."

Housewives from near-by settlements came to the beach, market baskets on their arms. They bought sparingly. One woman bought a single squid, about six inches long. It cost a nickel.

"I will stuff it with rice," she said. "For my husband and me it will mean a good meal."

Another woman carefully selected five small rockfish, none more than six inches in length. She told us she had a husband and seven children, and that her 20-cent purchase would feed them all for two days.

"Squid is a delicacy here," our guide told us. "The Canarios cook it in a sauce of its own ink. It comes out black and forbidding, but it tastes wonderful on rice."

Mouth-watering Kettle of Fish

That evening Senor Naranjo and Don Domingo Cardenas Rodriguez, of the island tourist commission, took us for a typical Canary meal of *caldo de pescado*—literally, "kettle of fish." The fish stew, we decided, was worthy of a place beside the famous bouillabaisse of Marseille.

An apéritif of Canary rum, crude and potent, began the meal. Then the waiter in our seaside cafe staggered in with a huge platter on which rested a five-pound whitefish, cut into sections, surrounded by boiled potatoes. The fish had been boiled with onions, tomatoes, garlic, *comino*, and half a dozen other native spices. With it came bowls of *mojo*, and dishes of gofio mixed with the fish stock. The gofio tasted a little like Mexican refried beans.

The mojo tasted like liquid flame. Made of olive oil, crushed garlic, peppers, and chopped coriander, it was poured over the fish and potatoes in generous servings. I took a bite and grabbed a glass of water. Tears welled from my eyes, and my face flushed scarlet.

"Perfect," cried Don Domingo. "We have a saying: 'If you do not first weep, and then swear, it is not good mojo.' This sauce has passed the test."

Taken in proper proportion, the dish was superb. After the platter of cleanly picked bones was carried out, we were served soup made of the stock, flavored with garlic and spices. Each bowl was filled with toasted slices of bread.

Volcanic Crater Crowns La Palma

We traveled by interisland boat to La Palma, greenest of the Canaries. The manager of the island parador met us in a Willys-Knight. His driver was proud of the venerable vehicle.

"My Wee-ées," he said, giving the word its Spanish pronunciation, "has been at labor 28 years."

Scenically, La Palma is the best of the Canaries. Here are heavy pine forests, waterfalls, and miles of excellent roads. In the center of the island lies the famous Taburiente Caldera; this enormous extinct volcano is more than three miles across and a mile deep.

Driving back to the parador, we stopped to visit a family weaving raw silk. They were, as usual, hospitable, and insisted we stay for coffee. I took pictures of the oldest daughter at a hand loom. She wore a white cloth that passed under her chin, up both cheeks, and was tied in a knot on top. As we left, Jean asked if the scarf was typical of island dress.

"Not at all," said the mother. "My daughter has the mumps."

Neither of us is immune—and the next few days were anxious ones.

Folk dancing is a favorite pastime of La Palma. Members of a group that were dressed in colorful costumes, representing each of the island's villages, entertained us. One boy wore

Father Balances Mother and Child Riding a Camel Home from Work in Lanzarote Fields

Scarf and wide hathrim protect the mother from the sun and the volcanic ash that swirls from most Lanzarote farms (page 510). Woman and baby ride a cushion of cornstalks. A muzzle prevents the animal from eating the fodder. Imported from Spanish West Africa, camels carry many of the Canaries' burdens.

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Camels, Having Plowed the Fields of Lanzarote, Tread Out a Harvest of Chick-peas

← Canary Cave Dweller Lets Her Bread Rise Beneath Warm Bedding

Visiting a home hollowed out of a hillside in the village of Artenara, Grand Canary, Jean and Franc Shor were offered slices of warm bread fresh from a beehive oven (page 501).

When Jean complimented the housewife on the delicious loaf, her hostess delightedly offered to show how it was made. Leading her guests through a tunnellike hall, she entered a windowless bedroom, stripped back the heavy covers, and revealed dozens of unbaked loaves rising beneath the bedclothes.

"It's the perfect place for the dough to rise," she said. "I always put it in just after we get up in the morning, while the bed is still warm."

Pygmy Stalks Yield Full Ears of Corn →

Opposite page: Rainfall is scanty on volcanic Lanzarote Island. Though a cornstalk seldom rises more than two feet, the single ear attains ordinary size. Jean Shor inspects this field (page 510).

a high silk hat; a girl had one bare foot. Many of the rugged men wore lacy pantaloons beneath short trousers.

Each dance had a name, each told a story. The Romance del Trigo acted out the harvest, concluding with the dancers eating imaginary pieces of bread.

After the dancing came a light meal and bottles of La Palma wine. Everyone sat around a big table. Half a dozen guitars lay on the floor, and every few minutes one of the men would jump to his feet, seize an instrument, and strike up a gay tune. Frequently a girl would join him, singing chorus after chorus of old Spanish tunes. It was after midnight when we walked back down the steep cobblestone street to the parador, and the night was full of music as our new friends made their way home.

The harbor of Santa Cruz de la Palma, capital of the island, is small but colorful. We walked along the waterfront, watching the fishermen sell their catch directly from the boats. Great baskets of pink, yellow, and blue fish were laid out on the beach. An old lady with a basket of squirming eels made her way along the waterfront, offering her wares to passing shoppers.

We took a boat for Hierro the next morning. A plump Spanish gentleman sat opposite us at lunch.

"Are you enjoying the trip?" he asked, pronouncing each word carefully.

We said we were.

"Have you been long in the Canaries?"

"Three weeks," we answered.

"And how much longer do you plan to stay?"

"Another month."

His face broke into a delighted grin.

"You understand me," he cried. "You understand me!"

"Certainly," I said. "Your English is excellent."

"But it is the first time I have ever spoken English," he said. "I am the tax collector on Gomera, and I have very little to do. So I bought a set of English lessons on phonograph records, and I practice an hour a day. But this is the first time I have spoken with English-speaking people. You understand. And I understand you. I speak English! Amazing!"

Fig Trees Are Island Mainstay

Hierro, southernmost of the Canaries, is distinguished principally by its fig trees and by the volcanic hills that dot its rugged surface. Don Cesar A. Padron Espinosa, president of the island's *cabildo*, or town council, met us at the dock and took us for a drive about the island.

"Fig trees are a principal source of food," he said. "They are so important that a father frequently leaves specific branches of a tree to each of his children.

"Hierro is very poor. We have few wells and depend largely on rain for our water. But General Franco has 'adopted' the island and

Housewives Carry Head-balanced Bundles Past the Flatiron-shaped Town Hall of La Matanza

Too small to have its own Corpus Christi flower carpets, the town is content to provide petals for nets by La Orotava (pages 496-7). These men wait for a truck to pick up a fragrant cargo.

is helping us build up our economy. Crews from the mainland are digging deep wells and the Government is improving the harbor."

The fig trees of Hierro are low and sprawling, frequently covering an area 20 yards in diameter. They are set in fields of lava, surrounded by low stone walls to protect them from goats. Vines are also grown in the lava fields, carefully tended in holes scooped from the rocky covering.

The children of Hierro make good use of the lava fields. We saw dozens of them sliding down the steep slopes on toboggans made from old sheets of galvanized roofing.

We returned to our boat for the trip to Gomera and found the deck a scene of wild confusion. A herd of goats, half a dozen horses, and two milk cows were tethered forward, and the crew was busy hauling pigs and sheep aboard. When the loading was finished and we went aboard for our midnight sailing, the boat looked like a modern version of Noah's Ark.

We docked at 6 and were met by Senor Hermigua Valle, president of the Gomera cabildo. Don Hermigua had brought most of the officials of the island Government, and we shuddered at the responsibility for getting them up at that uncivilized hour. They laughed off our apologies and invited us to breakfast at an outdoor cafe.

The waiter brought bread and coffee. Our friend the tax collector whispered to the president. The president whispered to the waiter, who dashed off for the kitchen.

We sat while the coffee cooled. Then the waiter appeared and with a sweeping gesture revealed a plate heaped with small slices of raw bacon.

"I know about you Americans," smiled the tax collector. "You must have bacon with your breakfasts. Eat well!"

Birdlike Language Still in Use

Gomera is small but prosperous. Its steep hills and lush valleys hold some of the most productive banana plantations in the Canaries. And those same steep hills have brought about the development of an astounding language—one that is not spoken but whistled.

We had heard of the birdlike language and asked Don Hermigua if it was still in ordinary use.

"Of course," he said. "The terrain is so steep in portions of the island that walking is difficult. The people must communicate across long distances. Whistling carries better than shouting. Come with me—we will visit some of these whistlers."

A Pierce-Arrow touring car carried us over winding mountain roads into a valley where banana groves lined each side of the steep ravine. A sturdy village lad introduced himself as Jaime Perez. Don Hermigua explained our quest.

"My friend Jose is across the valley," Jaime said, pointing. "The one with the white hat."

We could make out the boy he meant, a quarter of a mile away.

Whistlers "Talk" from Hill to Hill

"I will call him by name," said Jaime, "so that you can see he recognizes the word."

He pursed his lips and a loud, melodious whistle emerged. There were half a dozen men on the opposite hill, but only the white-hatted lad looked up. He answered with a shrill blast.

"Explain that we are foreigners who are interested in your language," I said to Jaime. "Ask him to wave his arms if he understands."

Jaime cupped his hands over his lips. There was no mistaking that his whistling was a language. The tones rose and fell; there were pauses and intonations and stresses. Across the valley his friend removed his hat and made a sweeping bow. Then he moved both arms in great windmill circles. His hands came up to his face, and a series of notes drifted across the valley.

"He asks if you will have a glass of sherry," said Jaime. "He will bring it if you desire."

"I don't like to bother him," I said, "but I'd like to see it happen, just to prove that this is really intelligible."

Jaime sent a series of high notes drifting across the valley. His friend dropped his hoe and ran to a little whitewashed hut. In a moment he was loping down the hillside, a bottle in one hand and a glass in the other.

Five minutes later he stood panting at our side.

"We do not simply signal with our whistles," Don Hermigua explained. "It is a real language. People can't discuss abstract subjects, but they can convey most of the information necessary for day-to-day existence."

We returned to the port. The houses of Gomera are nearly all white, with pink-tile roofs and courtyards full of flowers. The terraced fields between the banana groves were heavy with corn, maize, dates, and melons.

Lanzarote's Volcanic Landscape Presents a Vista as Dramatic as the Moon's

Studded with volcanoes and strewn with cinders, the northern half of the island yields corn, grapes, figs, chick-peas, and alfalfa. Village of Haria (center) produces a dry muscatel.

Soil Is Terraced and Farmed up to the Brims of Long-dead Craters

Planters cover seeds with volcanic cinders. Moisture from sea winds, condensed by this porous blanket, supplements annual rains of as little as two inches. The road, which rarely sees a car, leads from Arrecife to Haria.

In San Sebastián de la Gomera we visited a venerable 15th-century church where Columbus said his last prayer on Spanish soil before setting sail for the New World. And a plaque records that Hernando Cortes knelt here to worship before departing on adventures that changed the course of history. Beneath the mellow wooden beams and the serene arches we sat in a battered pew, lost in contemplation, until the sudden whistle of the boat recalled us to modern times. Regretfully we went aboard to sail for Tenerife.

Tenerife is the largest of the Canaries, covering 919 square miles. The island is shaped like a short-necked bird, with the head pointing northwest. Santa Cruz de Tenerife, the capital, is a bustling, modern city of 140,000. Its busy port is an important refueling center for Atlantic vessels and a haven for cruise ships.

We breakfasted at a sidewalk cafe on the waterfront. Ragged children sidled up to our table and asked for pennies. We paid our check and left. Before the waiter could clear our table, a thin girl dashed up, emptied the sugar bowl into her hand, and raced off, stuffing sugar into her mouth.

We visited La Orotava for the Corpus Christi observance. Jean and I borrowed a ladder from the Taoro Hotel and walked the petal-covered streets, mounting the ladder every few feet to take pictures.

La Orotava is proudest of the huge carpet which is laid every year in the plaza. The whole town joins in its preparation, and work begins a month before the festival. The 1,000-square-yard production was made of cane sections, pieces of corn cobs, date pits, and gray, orange, and black soil, with a background of powdered wine bottles. Completed, it looked like an enormous oil painting.

Children Gather Iodine-rich Weed

The world-famed Orotava Botanical Gardens proved to be five acres of natural wonder. Founded in 1788, they were one of a chain through which the Spaniards hoped to acclimatize tropical plants for introduction into the motherland. The experiment was a failure, but the gardens stand as a monument to the attempt.

At Puerto de la Cruz we found dozens of children wading in the shallow surf, gathering green-and-yellow and black seaweed. The green-and-yellow weed, they told us, is dried and sold as fertilizer. But the black is *yodo*, a source of iodine. The wharf, where great piles were drying, had a medicinal reek.

In Icod we visited the largest dragon tree in the world, reputed to be 3,000 years old. It is nearly fifty feet in circumference at the base of the trunk (opposite page). A friendly gardener presented Jean with a tiny dragon tree, little more than an inch tall.

"It is a son of the great one," he said with a courtly bow.

Gay Fair in La Orotava

Four days after Corpus Christi, La Orotava holds its annual fair—the Romeria of San Isidro. This we found even more attractive than the flower display. Countryfolk from miles around, dressed in colorful costumes, crowded the streets. Families, social clubs, and church groups entered floats, each portraying some aspect of village life (pages 496, 497). A four-hour parade wound through the downtown section, with a great deal of music and dancing.

One float represented a farmer's hut, with a fire burning on the floor. A sheaf of wheat lying near by caught fire, and a serious blaze threatened. But a happy farmer walking behind the float with a huge wineskin made the supreme sacrifice. A ruby stream quenched the flame, the crowd cheered lustily, and the hero stood looking disconsolately at his limp leather bottle.

Jean paid a visit to the coast north of Santa Cruz de Tenerife, where hundreds of women were busy drying acres of fish for shipment to French Morocco and the Belgian Congo (page 503). The fish, mostly hake, are spread in the hot sun for 10 to 12 days. Then they are baled for export.

"Girls very friendly," Jean wrote in our notes that night. "Very interested in my cameras. Also very interested in my dress. Liked to feel material. Most of them spent morning with a fish in one hand and me in the other. By time I left, person going solely by sense of smell couldn't tell me from fish."

North and east we sailed, to Lanzarote, the Volcano Island (pages 505 and 510). At the port of Arrecife we were greeted by Don Mariano Lopez Socas. With him we toured the lava fields from which the farmers extract a meager living.

"We have a very unusual type of farming here," said Don Mariano as our ancient Reo ground over the steep hills. "The annual rainfall may be as little as two inches a year, and

Kodachrome by Jean and Franc Shor, National Geographic Staff

Fifty Feet Around the Base, a Weird Dragon Tree Mushrooms in Icod, Tenerife

The strange trees are native to the Canaries. Guanches, the islands' aborigines, used the dark-red resin, called dragon's blood, to mummify the bodies of their kings and nobles. The trees have all but disappeared; survivors now get protection. Dragon trees attain great age; tradition says this one has lived 3,000 years.

there are no wells for irrigation. So the farmers extract water from the air.

"They spread their seeds on arid ground. Then pack camels bring lava from the slopes of the Mountains of Fire. This lava is spread over the seeds to a depth of four or five inches."

The lava acts as a condenser, extracting moisture from the sea air. Corn, alfalfa, chick-peas, and grape vines all grow under these conditions. The plants are stunted but hardy. Cornstalks little more than a foot tall bear fully developed ears (page 507).

Cochineal is still cultivated on Lanzarote. We saw women with pails and curved iron spoons carefully scraping the little white insects from cactus plants.

Eggs Cooked on Volcanic Stove

A doctor, a lawyer, and a newspaper reporter invited us to accompany them to the awesome Montañas del Fuego—the Mountains of Fire. This volcanic area emits a sulphurous odor that fills the air for miles, and its sides have a yellow sheen. You can warm your hands over a hole a foot deep in the lava, and many of the blowholes are so hot that it is possible to cook above them (page 522).

"Everyone is always frying eggs in places like this," Jean said. "I'm going to be different—I'm going to make an omelet!" We had brought pan and eggs, but when Jean bent over the fuming orifice she changed her mind.

"Too hot," she said. "No place to be funny. I'll fry the egg quickly—and you take the picture."

"Sissy!" said I, bravely. "You take the picture. I'm not afraid to get close."

I bent over the hole. There was a sudden blast of hot air, the pan flew out of my singed hand, and I jumped back—my eyelashes completely gone and my mustache and hair singed a sulphurous yellow.

"Hail, the conquering hero!" said my helpmeet.

We drove to the southern end of the island, past the huge open salt-drying flats of La Salinas, to El Golfo, a magnificent beach set in an amphitheater of deep-red cliffs and eroded lava. Our hosts took us north to Jameo del Agua—a strange underground lake where blind white crabs and fish grope through crystal water. With Don Mariano we toured island vineyards that produce a crisp muscatel which the Canarios claim is the only dry wine of its type.

In an open motor launch I went across 30 miles of open sea to Fuerteventura, second largest of the Canaries, and found a lava-swept and barren landscape where farmers struggle for a bare living under forbidding circumstances. Don Lorenzo Castaneiras, president of the cabildo of Corralejos, took me to lunch at a seaside inn, where the cook and waitress worked in their huge straw hats.

These hats, common to Lanzarote and Fuerteventura alike, have double crowns and brims to keep off the broiling sun, and weigh nearly five pounds. Each time our little waitress bent over the table—the lunch consisted of fresh mussels cooked in three different ways—the heavy brim caught me a lusty whack on the ear.

I returned to Lanzarote through a heavy sea that kept our open craft awash during most of the journey, to find Jean suffering from a bad case of Canary hospitality.

"I stopped to take a picture of a farm woman feeding her goats," she said ruefully. "She offered me a glass of milk. I refused. She offered me some corn. I declined. Then she offered me this little brown kid. I explained I couldn't use it. She insisted. When I still refused, she put the kid in my arms and ran off. And our hosts say she'll be mortally offended if I return it. What do we do with a baby goat?"

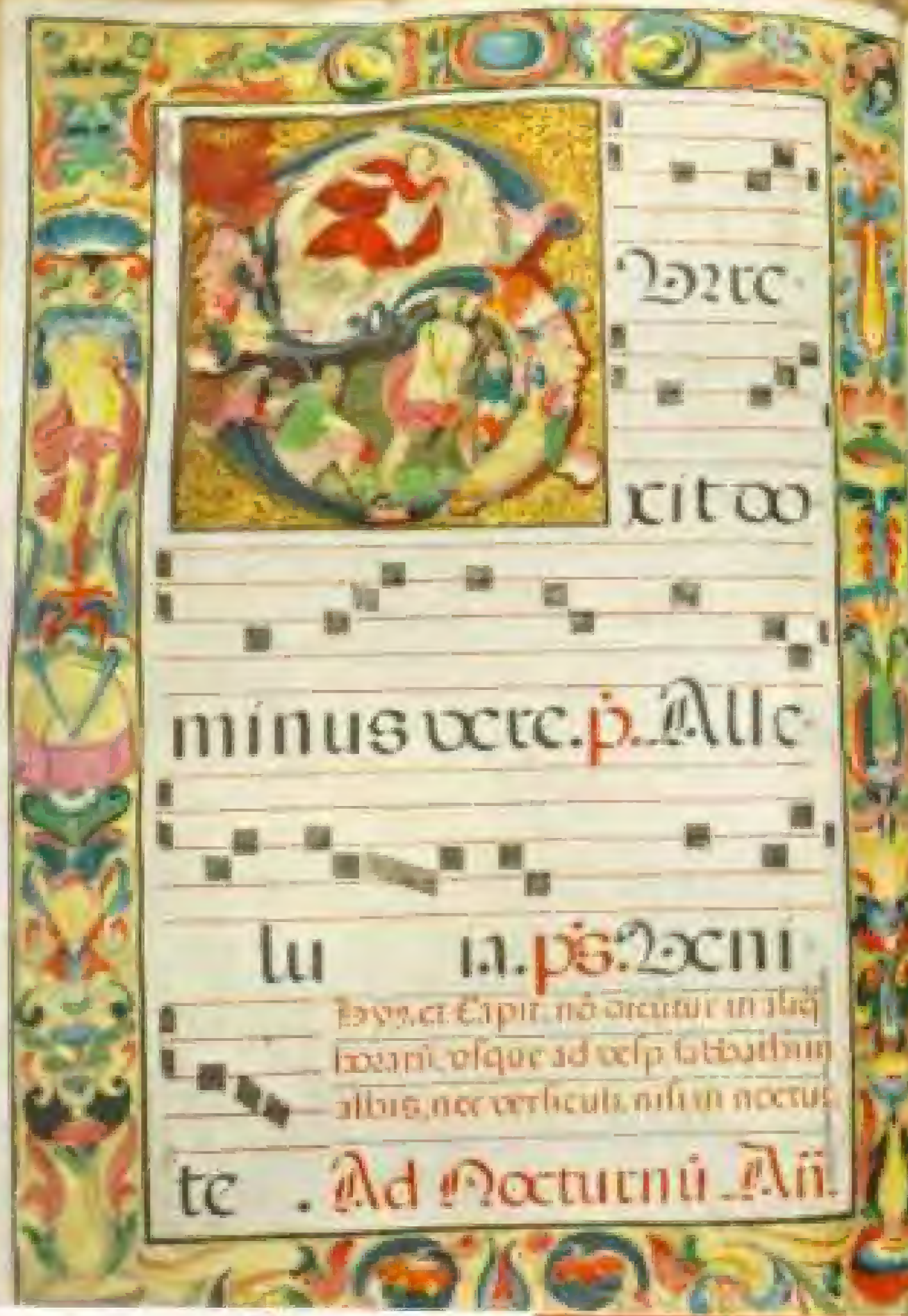
We persuaded our friends to return the kid after our departure, and left a present for the generous wife. But it was with real reluctance that we boarded the boat to return to Tenerife. Lanzarote's crops may be stunted by lack of moisture, but the milk of human kindness flows there in abundance.

Authors Leave on a Tide of Merriment

Back in Tenerife Senor Naranjo and Don Domingo gave a farewell party for us at a lovely pueblo known as the Canary Village, a perfect copy of a 17th-century Canary home. We were entertained with songs, guitar playing, and folk dancing. There were flowers and music and beauty, and we left the Canaries as we had come—on a tide of merriment.

The dancers were beautiful. As we boarded our plane Jean complained that I was humming with too much enthusiasm an old Canary folk song. It goes:

"All the women of the Canaries
Are like that great mountain, Teide;
Much snow on the face—
And fire in the heart!"



Songbook 300 Years Old Remains in Daily Use

This illuminated manuscript, dated 1641, spreads open in front of the choir in the Cathedral of Santa Ana, Las Palmas (page 491). Singers stand on elevated benches, and a choirboy in crimson vestments turns the parchment pages.

Did Benvenuto Cellini Create This Treasure?

Called a *portapax*, the gold-and-enamel object is carried by a church dignitary to be kissed by the faithful. Three canons, each with a key to a separate lock, must be present whenever it is removed from its vault in the Cathedral of Santa Ana.

The sculptured head is reputed to be Cellini's signature, a representation of the artist himself. The opposite side shows a magnificently colored replica of a cathedral's façade. The portapax was presented to Santa Ana by a bishop who had been confessor to the king of Spain.

Reduced to Jack and Pixie Size,
National Geographic staff

↑ Terraced Fields Weave a Varicolored Pattern Around Las Laguneras

Corn grown in these tiny plots is roasted and ground to produce *gofio*, a staple food on Grand Canary Island. Mixed with water or hot milk, it is eaten as a gruel. Farmers also produce a cheese called *queso de flor*. They curdle the milk by adding flowers of the wild artichoke.

→ Mountains of Tenerife, once famous for their blanket of Canary pines, have been denuded by centuries of careless cutting. Today the Government reforests vast areas. Here women carry seedlings from a nursery to waiting trucks.

↓ Bananas are the Canaries' principal export. These women work at a cooperative packing house in the Orotava Valley. Mere girls carry 60-pound bunches from wrapping tables to trucks for about 50 cents a day. This 119-pound stem holds 439 bananas.

Canary Village, in Modern Stucco, Recaptures the Romance of a Bygone Day

Eye-catching patios, fountains, tiled galleries, iron-grilled windows, and hand-carved doors attract visitors to this block-square center of Las Palmas. Costumed musicians and singers offer folk dances and songs.

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↑ Grand Canary's Daughters Sew a Fine Seam in a Sunny Patio

These Las Palmas girls put the finishing touches on a linen cloth of drawn work in Canary Village (opposite). The shadow pattern on the stone floor reveals the delicacy of their intricate design.

White blouses, aprons, and overskirts worn by the girls show the same workmanship and pattern.

Designs of Ancient Guanches → Live Again in Canary Costumes

Others may dress in gaudier colors, but the girls of Grand Canary boast that their handwork is the finest in the Fortunate Islands.

These delicately embroidered overskirts are worn gathered at the sides, the better to reveal brilliant homespun petticoats. Geometric patterns on the borders of the underskirts have been handed down for generations. Early Spanish conquerors copied them from Guanche designs.

Tall and fair, Guanches were the island's original settlers. Strangely for an island people, they did not understand the use of boats. As a race they are extinct, but many a Canary Islander claims a remote Guanche ancestor.

↑ **Lowering Clouds and Dashing Sea Accent the Beauty of a Tenerife Village**

Trade winds, blowing almost constantly from the northeast, form a heavy cloud layer over the island nearly every morning.

This surf breaks beneath the pink church of San Telmo in Puerto de la Cruz. Children often venture into the swirling waters to gather seaweed for fertilizer and processing into iodine. They also collect tiny mussels that go into fish chowders. Fishing boats use the sheltered side of the harbor.

← **Barefoot Children Play amid Cactus**

The crimson dye that comes from the cochineal, a tiny scale insect, was once the most valuable export of the Canaries. Fields of grain and vines were plowed out and lands replanted with cactus, on which the cochineal thrives, as in Mexico. Then cheap aniline dyes broke the market, and the industry waned. Now only a few farmers cultivate the parasites.

This house stands near the village of Los Llanos on the island of La Palma. Like Tenerife (above), La Palma has a persistent cloud bank.

A Fisherman, Home from the Sea, Gulps a Cooling Draught

The island of Fuerteventura is hot and dry, and crops are scanty. Most of its residents get a living from the sea. This sturdy fellow has beached his boat after a day's fishing. His pottery vessel is filled from one of the island's few deep wells. Water, hard to find, is carefully husbanded.

Fuerteventura, conquered in 1404, was the second of the Canaries to come under Spanish domination. The last, Tenerife, did not surrender until 1496.

Today Fuerteventura's principal export is limestone, which the other islands use as building blocks.

Eggs Cook Quickly on a Volcanic Stove

Jean Shor fried eggs over a blowhole on Lanzarote's Montañas del Fuego (Mountains of Fire), but the sulphurous fumes ruined their flavor. Franc Shor, cooking an omelet, had hair, mustache, and eyelashes singed by a sudden blast of hot air. Both suffered blistered feet by standing too long on hot cinders.

Photographing the Sea's Dark Underworld

Ocean Depths Surrender Their Secrets to Cameras Towed on Sleds, Dangled on Cables, and Borne by the Bathyscaphe

By Harold E. Edgerton

DOWN to the uttermost depths of the sea plunged the *Nautilus*. The Frenchman, Captain Nemo's unwilling but ever-astonished prisoner, gazed through the porthole and exclaimed:

"Look, Captain, look at these magnificent rocks, these uninhabited grottoes, these lowest receptacles of the globe, where life is no longer possible! What unknown sights are here! Why should we be unable to preserve a remembrance of them?"

"Would you like to carry away more than the remembrance?" said Captain Nemo.

"What do you mean by those words?"

"I mean to say that nothing is easier than to take a photographic view of this submarine region."

Nothing easier? Well, that was Jules Verne speaking in his fabulous *Twenty Thousand Leagues Under the Sea*. The year was 1869, and scientific miracles (on paper, at least) seemed not too difficult to perform.

Deeper Into the Unknown

Unfortunately, in the succeeding years, we humdrum technicians operating in the field of reality, not fiction, have found it somewhat less simple to set up our studios in the great depths and take the sea floor's portrait. Men have dived to the limit of endurance with diving suit and Aqualung; they have lowered solitary cameras to 20,400 feet and dangled observers in spheres to 4,500; French Navy men have descended to 13,287 feet in the new bathyscaphe, the dirigible of the sea (page 524). But coverage of even these strata has been no more than a pinprick upon so vast a canvas.

A young man, impatient with our progress, once said to me: "Let's grant that someday you'll design a camera which won't collapse under the pressure of extreme depths. Let's grant, further, that you find a way to lower it safely into position and start shooting. What do you expect to find? Giant squid? Minerals? Buried cities? Sea serpents?"

I could only reply: "If I knew what we'd find, I wouldn't bother to find it."

It was this curiosity (and the generous aid and encouragement of the National Geographic Society) that led me in the summer of 1954 to join forces again with Capt. Jacques-Yves Cousteau of the *Calypso* and Lt. Comdr. Georges S. Houot of the deep-diving bathyscaphe *F. N. R. S. 3*.*

Destination: the Mediterranean's Floor

I had been of service to these officers in previous years, adapting to their marine requirements the high-powered electronic flash equipment I had developed for use on land. I designed watertight cameras with electronic flash lamps able to resist the great pressure of the depths, which assisted in the analysis of the "deep scattering layer"—the baffling sound-reflecting stratum that lies beneath the ocean's surface (page 528).

This time I had two major objectives: to perfect photography from the bathyscaphe, testing our new cameras and flashes; and to cruise on *Calypso* between Tunisia and Sicily with a party of French marine scientists, experimenting with cameras and lights dangled from a cable.

Accompanied, then, by my son Bill and half a ton of photographic equipment, I took ship from New York on July 1.

Nine days later we faced our first major

* See, in the National Geographic Magazine, "Two and a Half Miles Down," by Lt. Comdr. Georges S. Houot, July, 1954; and, by Capt. Jacques-Yves Cousteau, "To the Depths of the Sea by Bathyscaphe," July, 1954; "Fish Men Discover a 2,200-year-old Greek Ship," January, 1954, and "Fish Men Explore a New World Undersea," October, 1953.

The Author

Dr. Edgerton, Professor of Electrical Measurements at the Massachusetts Institute of Technology, is co-inventor of the high-speed electronic flash lamp, which is capable of brighter-than-sun exposures as brief as a millionth of a second. Widely used in science and industry, it enables the camera to "see the unseen," stopping a hummingbird's whirring wings or freezing the motion of high-speed machinery. In 1953 Dr. Edgerton was awarded the National Geographic Society's Hubbard Medal for extraordinary contributions to science in cooperation with The Society.

When Dr. Edgerton turned his brilliant mind to problems of deep-undersea photography, with National Geographic Society support, The Society's Research Committee coordinated his work with that of Captain Cousteau, distinguished leader of the National Geographic Society–*Calypso* Oceanographic Expeditions.

obstacle, the customs officers of Cannes. Blithely *Calypso*'s protocol expert, D. P. Cousteau, came aboard from his son's vessel to usher us through the morning's formalities.

"All these," he declared, waving at our heaped-up luggage, "are scientific instruments."

Politely skeptical, the customs men opened a box. It contained, unfortunately, six jars of peanut butter. Prying open a second crate, the officials discovered a cache of paper hats I had picked up for *Calypso*'s occasional parties. Then they examined my sonic transmitter, which looked and ticked like a time bomb, and the heavy cylindrical objects that I called cameras, but which looked like no cameras they had ever seen.

That was enough. It took Cousteau senior another six hours of steady debate to extricate us and our belongings.

George F. Bond

← **Bathyscaphe Makes Ready to Plunge 6,000 Feet for Picture Taking**

The French Navy's record-breaking submarine *F.N.R.S. 3* is buoyed up by a thin hull filled with lighter-than-water gasoline. The boat dives by flooding its central air lock with sea water.

Above: Young Bill Egerton, in Aqualung, polishes the reflector of an electronic lamp designed by his father (below) and suspended outside the bathyscaphe. ↓ The author checks his 800-exposure camera before inserting it in the watertight stainless-steel housing at right. This cylinder will resist the sea's pressure down to 6,000 feet. A new one being designed by Dr. Egberton with the National Geographic Society's support will be able to descend to far greater depths.

Once safely aboard *Calypso*, I lugged our new equipment down to the ready room and set about explaining its use to Cousteau's divers and technicians. There was little space for maneuver; into this one cabin were crowded the ship's Aqualungs, cameras, flashes, flood lamps, batteries, power lines, work benches, a sink, a bunk, and other paraphernalia.

I did not have much of a linguistic

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The Society's Flag Descends with an Edgerton Camera

Winch operators, unreeling thousands of feet of cable, cannot easily tell when a dangled camera has reached the sea floor. To answer their need, the author devised a transmitter that sends electrical ticks every second until a switch hung below the camera touches bottom (diagram, page 530). Here, aboard *Calypso*, Captain Cousteau, François Sarrat, and Bill Edgerton observe the instrument's first trial.

bridge: these fellows knew little English, and I less French. I had to make out as best I could with the supranational jargon of electricians and photographers, plus the graphic use of my hands. Luckily my French colleagues were quick-witted and enthusiastic. Bill and I became "Petit Flash" and "Papa Flash," members of the ship's company in good standing.

This was important, for on the cooperation of these crewmen depended the success of our picture-making. It is a complicated and exhausting job to rig, launch, and retrieve our heavy cameras; often it takes three hours to complete the operation. Yet these men would turn out in all kinds of weather for as many as four launchings a day—or night.

By July 19 we were ready for the bathyscaphe's first plunges of the summer. Aboard the squat French Navy research ship *Elie-Monnier* we steamed out of Toulon toward the deep trench off Cap Cépet.

The diving site was peaceful and serene. Our little flotilla danced on the calm blue Mediterranean; divers busy with their launching tasks hovered about the bathyscaphe's yellow flanks or suddenly upended and disappeared beneath the surface with a flick of their rubber fins.

Yet I knew the dangers implicit in this whole operation. Houot and his colleagues are aware that a ballast box left locked, a crash against uncharted crags in the midnight recesses of the sea floor, a bogging down in some mudbank, could mean a lonely death, forever cut off by water from the world of men.

After one shallow test dive, Houot and Comdr. Philippe Tailliez took the bathyscaphe down to the floor of the Toulon canyon. At 30-minute intervals messages came up to us from the slowly descending craft—4,265 feet by 9:30 a.m.; 5,250 feet by 10 o'clock; bottom at 6,890 feet by 11:03. Having our lunch aboard the *Elie-Monnier*, we wondered what our friends were seeing and experiencing in the primeval darkness more than a mile below us.

We cruised around the buoy in widening circles until at 5:03 p.m. came the message, "M, M, M," for "*Je monte*." The boat was coming up. An hour and a half later, one of our divers spotted the yellow conning tower of the deep-boat protruding above the sparkling waves.

Fish That Hops Like a Cricket

At dinner, Houot and Tailliez told an attentive wardroom audience what had occurred below. For the first time they had hung from the sphere several hooks baited with mackerel. Almost as soon as the bathyscaphe touched bottom, sharks appeared. One of them struck at the bait, felt the bite of the hook, tore out the side of his mouth, and escaped. Another gnawed on the mackerel but managed to blow out the hook. A third fish, bulbous-eyed, with an antennalike dorsal ray, sniffed at the bait but refused to be taken in.

"Did you see any other fish?" I asked.

"A few. And we may have gotten some wonderful pictures of a small, quite motionless 'tripod fish,' or *Benthosaurus*. They'll be the first ever taken if they turn out well.

"Incidentally, the scientists have been wrong about this tripod fish. They thought those two

↑ Hovering at 2,600 Feet, the Camera Portrays Delicate Sea Fans, a Form of Coral

spines trailing from its flanks and that long wire-like tail were just filaments floating behind it. They're not. They're almost legs; at any rate, props or crutches. When we steered the bathyscaphe over toward the fish, it suddenly took off like a frightened cricket and landed a dozen yards away on its odd supports" (page 536).

Encouraged, we made some rather drastic modifications in the photographic installation, hooking our external camera up to our four flash lamps and rigging it for push-button control from inside. In three feverish days we put the new system in operating order, just in time for Cousteau's July 24 dive to

↓ Ever since bathyscaphe observers reported the ocean floor pitted with mysterious burrows, biologists have wondered what creatures inhabited them. Scanning thousands of pictures captured by *Calypso*'s cable-suspended camera (opposite), the author finally came upon one candidate, the shy little animal resting beside the mud crater at top center. The depth is 1,760 feet.

Jacques-Yves Cousteau

Deep-diving Bathyscaphe Rides High in Toulon Harbor

Without gasoline and ballast, the "deep-boat" bobs helplessly with its twin propellers six feet above water. Here two harbor boats jockey *F. N. R. S. 3* into position for towing to sea behind the research ship *Elie-Monnier*. Only the steel ball in which observers ride is below the surface (page 534).

Bathyscaphe's skipper, Lt. Comdr. Georges S. Houot, directs operations from the platformlike entrance to the central airlock. Along the shore, French naval vessels ride at anchor beneath the bald foothills of the French Maritime Alps.

When bathyscaphe's hull fills with gasoline, and iron pellets pack ballast silos, the craft will settle into the Mediterranean almost to deck level.

Cousteau Scans a Graph of Subsea Crags Measured by *Calypso*'s Echo Sounder

Shaded zigzag lines draw an exaggerated profile of the bottom as the ship passes overhead.

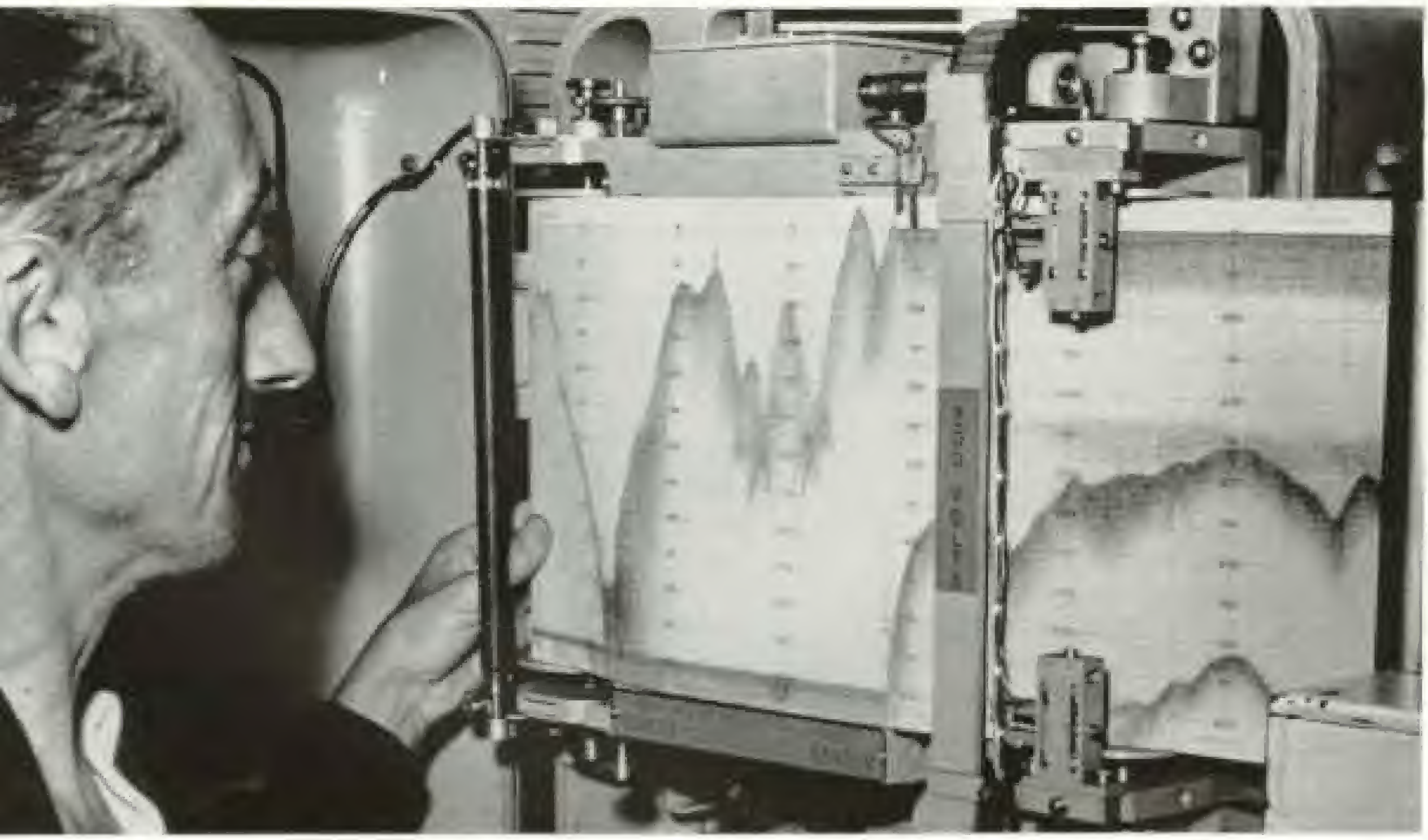
Calypso's sounder measures the time required for a sound pulse to leave the ship, bounce off the ocean floor, and return. Half of this round-trip time, multiplied by the speed of sound in water, gives the depth.

Here, on a graph scaled at 600 to 1,200 fathoms, the sea floor is shown to be rising steeply from the 1,100-fathom trough near Cousteau's thumb. As peaks break above the top line, Cousteau shifts the scale to zero-to-600 fathoms and continues the graph on his right. Shaded band at top represents the pings of the outgoing sound pulse. Next horizontal band indicates the "deep scattering layer," a curious acoustical barrier apparently composed of marine creatures. Third band shows the bottom, and the fourth—virtually duplicating it—simply traces the sounder's double echo.

5,250 feet. That descent turned out to have more exciting consequences than any of us expected, for the bathyscaphe started a fantastic undersea avalanche (page 538).

Churning mud prevented effective photography of the bottom, but the plunge proved fruitful in a very different respect. Cousteau reported to us a zone at about 2,300 feet which held, he assured us, a teeming concentration of tiny marine life. Promptly we low-

Harold E. Edgerton



ered into this stratum our silhouette camera.

There was a reason for our eagerness to photograph this "soup." Earlier, on a cruise to the Persian Gulf, Cousteau had repeatedly sent a camera down into the deep scattering layer and recorded on his graphs how the sound-reflecting stratum seemed to sink away from the lights and camera, as if determined to avoid them, then rise as they were raised.

Does this, he asked himself, finally prove what oceanographers have long believed: that the deep scattering layer, rather than being a mere phenomenon of density differential due to temperature or salinity, is really composed of living organisms?

Very probably. But to prove it, we would need good pictures of whatever existed, dead or alive, in this critical zone. As our camera emerged from the water, we rushed the film to *Calypso*'s cramped and stifling darkroom and began the tedious work of development.

What did we find? Only one small copepod and some undecipherable dots.

Why this discrepancy between what Cousteau saw from the bathyscaphe's porthole and what the independent camera caught? An explanation which suddenly occurred to us was that the undersea creatures were avoiding the focal space between light and lens, perhaps because this aperture resembled a mouth!

At once I set about redesigning the mechanism. Now the electronic flash cylinder no longer confronted the camera, head on, but threw its beam of light sidewise across the lens's short field of focus. This eliminated the threatening gap or maw that had apparently so frightened the minute organisms.

Testing this new weapon at 800 feet, I was excited to discover on our negatives that we had not only picked up many more objects but that a lot of them were blurred, so that they resembled little comets with streaky tails.

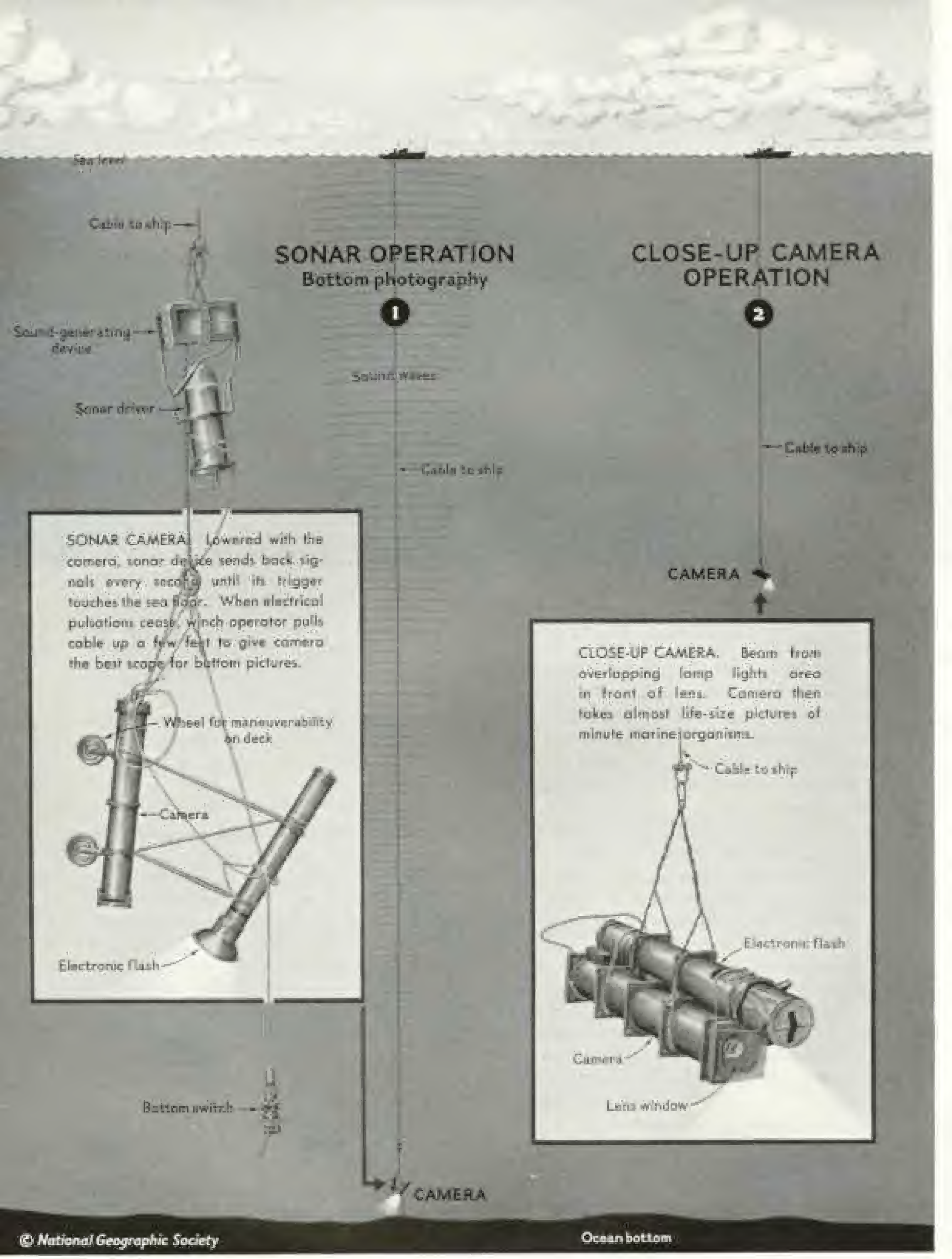
Probing the Acoustic Barrier

Now, that blur could have been caused by optical distortion. It seemed more likely to me, however, that it stemmed from the speed at which these tiny beings were traveling. Since my flash lasts about 5/1,000 of a second, and the "bugs" were 1 to 4 inches from the lens, I could estimate that they must have been going at a velocity of 3 to 10 feet per second. This is not exactly slow motion.

Intrigued, I cajoled the radar department of the Toulon Navy Yard into furnishing some smaller capacitors that would let me increase the speed of my flash nearly sevenfold. I also opened the aperture from f/16 to f/11. With this new combination I sent the camera down at noon the next day to about 700 feet.

Our results, with the blurs evident again, showed that we still have some work to do on the problem of optical resolution and light-flash duration. But I remain confident that before long we shall break through this barrier and use photographs to study these minute objects.

Shall we at the same time be solving the mystery of the deep scattering layer? It's a



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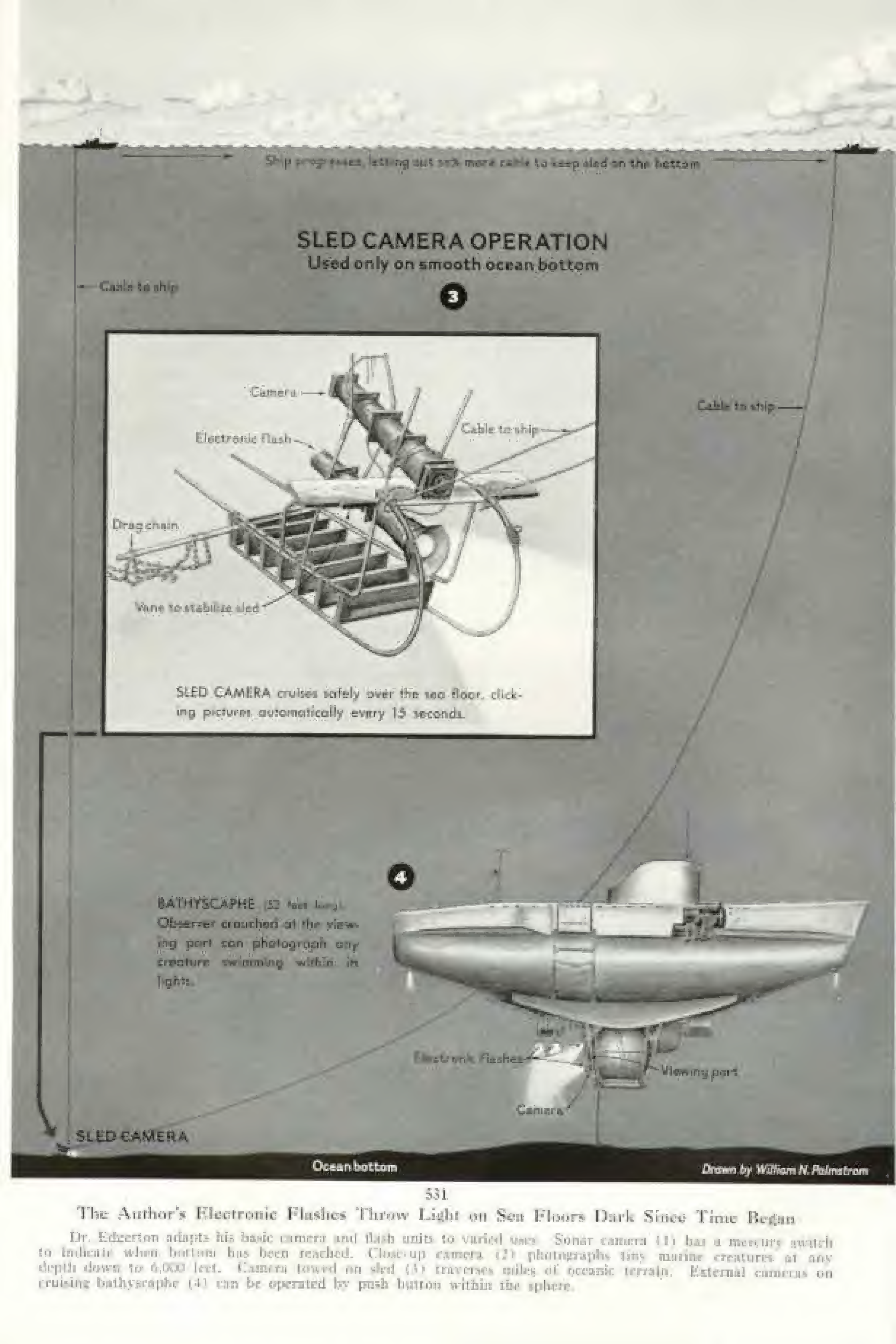
Steel-encased Cameras Explore Mediterranean Depths from Cables, Sleds, and Bathyscaphe

Aqualunged photographers cannot safely penetrate the ocean's vast realm more than 240 feet beneath the surface. The bathyscaphe (right) has made it possible to send men and cameras 13,287 feet down to the bottom. Cable-suspended units lowered by recent *Calypso* National Geographic expeditions have obtained effective and automatic photographic coverage of marine life in the vast intermediate zones. More than 20,000 pictures form the haul so far



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The Author's Electronic Flashes Throw Light on Sea Floors Dark Since Time Began

Dr. Edgerton adapts his basic camera and flash units to varied uses. Sonar camera (1) has a mercury switch to indicate when bottom has been reached. Close-up camera (2) photographs tiny marine creatures at any depth down to 6,000 feet. Camera towed on sled (3) traverses miles of oceanic terrain. External cameras on cruising bathyscaphe (4) can be operated by push button within the sphere.

tantalizing possibility. It may turn out that the layer is actually composed of larger marine forms which sense the presence of our equipment and avoid it. But it is at least conceivable that our shy, elusive little particles form, in their packed myriads, the fluctuating "false bottom" of the echo sounders.

Another camera technique developed aboard *Calypso* for deep-sea work is the photographic sled, a purely impromptu invention (opposite). Cousteau approached me one day and with deceptive casualness asked, "Would you mind very much losing a camera?"

"No more than my right arm. What do you have in mind?"

"I think we ought to build some sort of gadget on which we can mount a camera and tow it along the ocean floor."

"Shoot the works," I said.

In no time, with the enthusiastic connivance of the ship's company, we had assembled a most peculiar contraption. The basic unit was a portable light-metal ladder designed for diving from a launch; its upcurved handrails made excellent runners, and the camera could be strapped on the rungs.

Everyone contributed something. François Saoût, the executive officer, insisted on inserting a plank crosswise, as a hydrofoil, he said, to help the craft plane through the water. Someone else loaded it down with chains for a lower center of gravity. Simone Cousteau, the captain's vivacious wife, appended the flag of the National Geographic Society, both as a kind of vertical stabilizer and as the appropriate emblem of adventure. Yves Girault, general secretary of the French Office of Undersea Research, added artificial flowers, and writer James Dugan attached a sign reading RIP, for *Requiescat in Pace*.

Said Dumas, "This is the funeral monument for Edgerton's camera."

Camera Survives Undersea Journey

The sonic graphs assured us we were cruising over a fairly regular bottom, southeast of the Strait of Bonifacio in the Tyrrhenian Sea. Carefully we lifted the sled over the side and let it down into the dusky sea. Its automatic shutter began to click off the first of some 800 intermittent exposures. For an hour we dragged it gently across the floor. Then we hauled it up.

To our gleeful surprise the sled, its camera, flash, film, even its gay flowers, came up intact.

Our photographic haul on that pioneering attempt was nothing to write home about. But we didn't care. We knew that shooting pictures at random in the vast reaches of the sea is like photographing birds by blindly lowering a camera from a balloon, on a dark, fog-bound night, into an unknown forest.

Yet, in thousands of photographs taken during the ensuing months from our rugged little sled and with a sonic-controlled bottom camera, we have been able to bring scientists a startling glimpse of this lonely, pock-marked lunar landscape, with its countless burrows, its waving thickets of echinoderms, its shadowy elusive sharks, its embedded starlike creatures whose emplacements in the sand resemble rocket-launching platforms.

It is, of course, one thing to see these bottom dwellers in photographs, and another to see them with one's own eyes. In midsummer I received my long-awaited chance to visit the underwater realms in person.

On August 12 I boarded a Navy power cruiser in Toulon with Commander Taillez and several other French officers and bounced off to join the bathyscaphe and her accompanying destroyer and tug. We caught up to them after lunch at the diving site, and

A Blaze of Light from the Sea Sled Reveals an Asteroid Bed

Five-armed depressions left by burrowing echinoderms studded the path of *Calypso*'s photographic sled (opposite) as it cruised across the sea bottom steadily clicking pictures. Suddenly exposed to light, the tiny soft coral at top right throws a shadow for the first time in its life.

Jacques-Yves Cousteau

I was rowed in a dinghy to the deep-boat's wave-washed decks.

Houot was already inside, checking his instruments. Feet first and scrunching my shoulders together, I eased my body into the cramped chamber and knelt by the porthole.

Houot nodded a greeting and spoke a few words into the telephone. Presently one of our divers shimmered down through the water to polish the Plexiglas. Finished, he gave me the thumbs-up sign and struck out for the surface.

Now we were ready. Bringing out the soda-lime trays that would absorb the carbon dioxide we exhaled, Houot turned on the pressure regulator; with a soft hiss the precious oxygen seeped into our chamber. Then he clanged shut the heavy door and bolted it fast. The lid at the top of the air lock closed; the valves at the bottom opened; sea water, gurgling, rose swiftly in the shaft. As our buoyancy decreased, the bathyscaphe began to sink.

To slow the descent, Houot pushed a button releasing a compartment of iron pellets. I turned my attention to the porthole. Daylight was fading fast; soon I had to snap on the searchlight. Immediately the dark water sprang to life with pinpoints of particles, some of them darting in jerky trajectories. Here were the "blurs" I had seen on my negatives, the blurs that may yet prove to be part of the deep scattering layer!

I had a notebook on my knee, but I was reluctant to take my gaze from the window. At 1,150 feet I saw an old friend, a twin star-shaped object I had photographed many times with our dangle camera. At 1,380 feet I encountered my first fish, motionless, tiny. Sixty feet farther down I glimpsed a small medusa; I could detect its pulsation clearly, something I had never, of course, been able to capture on my still pictures.

In the next 200 feet the marine life thickened until I could no longer keep pace with it in my notes. I had not even noticed that we had stopped until Houot, puzzled and muttering to himself, told me we were rising.

"Well, why worry about our going up?" I said. "Going down and staying down are the only things we need to worry about."

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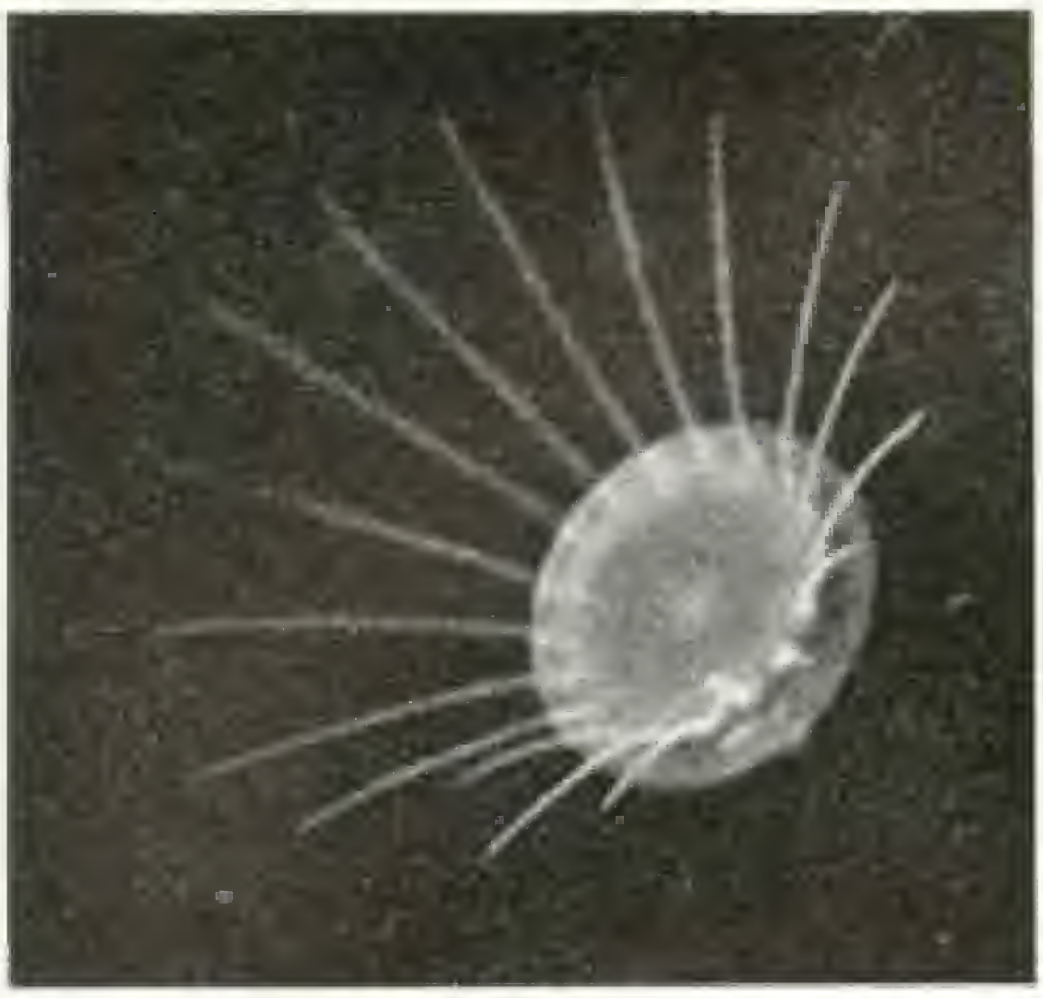
Sea Sled Gets a Checkup Before Its First Descent

A ladder once used by Aqualungers diving from *Calypso*'s launch forms the skeleton for the underwater craft, its bent rails serving as runners. This pioneer model has a flash lamp focused down upon the camera's field of vision; later versions reversed their positions. Here executive officer Saoût tightens the rigging while Madame Simone Cousteau supervises attachment of The Society's flag. She suggested the device as an appropriate emblem of adventure to accompany a unique exploration of the depths.



534 Jacques-Yves Cousteau

Fragile Medusa Sits for Its Portrait

Calypso's biologists were amazed at the number of these jellyfish that showed up in undersea photographs. The author was able to provide negatives showing hundreds of specimens of *Solmaris leucostyla* for identification and study by Dr. Jacques Picard (page 536). This specimen, about 3 inches in diameter, was photographed in the Mediterranean as it swam past the cable-suspended camera.

All the same, it was disconcerting to see the water around us become distinctly lighter in tone. Houot reached over and turned a valve; at once, buoyant gasoline from the hull above us burbled into the sea. For a moment or two we hung in equilibrium. Then the bathyscaphe began once again to drop slowly through the silent depths.

Past an area thick with discarded shrimp shells we went until the chain on the end of our 500-foot guide rope sank into the mud and we hovered at rest.

We could not make out the actual sea floor. Nevertheless, the water around us was far from lifeless. Into the scope of our overhead illumination swam an *Argyropelecus*, a hatchetfish, the first I had ever seen—a twinkling pattern of tiny, reflected lights.* It was wiggling fast, and, as it moved past the porthole, its mirrorlike reflections of the spotlight's beams appeared as a marvelous little spectrum.

Next came a fast-moving arrowworm, about four inches long; then a jellyfish rather like the sea walnuts one finds near the surface; in the distance, a cantaloupe-shaped object glowed orange and green. As Nature's parade went on before me, I wished that my opportunity could be shared by a marine biologist, who could competently observe the scene.

Our time was growing short. Presently Houot pressed a button controlling an external magnet, and our guide rope fell clear. Freed of its weight, the bathyscaphe floated upward. Eddies raised by our progress stirred the "soup" of particles surrounding us and made observation difficult. I noticed, however, that many of these minute organisms seemed to be platelike in form, reflecting light from our beam as they spun through the water.

Minutes passed. Then we became aware of a slight rocking motion in the sphere. The stability of the depths was behind us: we must now be at the surface, with the waves breaking over our decks. Houot reached up and turned the compressed air valve; within about 10 minutes the sea water would be driven from the air lock.

"Sure we have enough air to do the job?" I asked.

"About three times as much as we need."

"And if the lock is broken?"

"We wouldn't get out till they'd towed us into harbor, drained the gasoline above us, and dumped the ballast. We'd go on breathing—there's plenty of oxygen—but we might die of something else."

"What?"

"Boredom."

Fortunately, we were spared such a fate. Under the remorseless push of the compressed air the water in the lock went down steadily; soon it reached the window in the conical hatch. Impatient, Houot picked up his ratchet wrench and began loosening the bolts on the door; not long after, we were scrambling up the ladder, to feel the fresh wind on our faces and to blink at rays from the setting sun.

Undersea Camera Versus Dredge

Thus ended, for the summer, my camera work with the bathyscaphe. Our special camera was left with Houot so that he could record with flash photographs of good definition everything that he saw on his dives. Plans were made for new, improved cameras which are now being designed.

My respect for the deep-boat as a laboratory for underwater research remains undiminished. Only such a craft can allow the observer to direct, control, and select his pictures of the great depths; only such a craft can permit him to cruise along the bottom in search of his subjects. Yet the bathyscaphe's disadvantages had been made apparent, too: a French Navy vessel, it is in effect tethered to its base at Toulon; its operations are subject to the

* See "Fishing in the Whirlpool of Charybdis," by Paul A. Zahl, NATIONAL GEOGRAPHIC MAGAZINE, November, 1953.

caprice of the weather; and its launchings are both time-consuming and costly.

I turned, then, with renewed interest to the possibilities latent in the unmanned bottom camera. On August 17, aboard the *Calypso*, I set out from Marseille with Cousteau and a party of marine scientists for a 3-week cruise between Sicily and Tunisia. Our objective was to drag the sea floor for specimens. My private goal was a little different: to see if the underwater camera couldn't prove, as a research tool, a useful companion to the dredge.

I knew it wouldn't be easy. To a biologist, somehow, a squid or a medusa or an *Argyropelecus* isn't quite real until he has dredged it up, hauled it out on deck, fingered it, popped it into a bottle, and labeled it. To me, on the contrary, these creatures truly exist only in their own environment; once yanked out of it, they suffer a kind of land change. It is not merely that their colors quickly fade; more important, their limp, exhausted forms give no hint of the living, pulsating grace they exhibit undersea.

One instrument on which I counted heavily was the sonar "bottom detector" I had devised at the Massachusetts Institute of Technology. A problem anyone faces in deep photography is to know just when his camera has touched bottom. After a winch has unreeled cable to a length of a mile or so, it just isn't possible to be sure when it has made contact with the ocean floor. All that one can feel is the dead weight of the cable itself.

To meet this problem, I concocted an underwater sound transmitter attachable to one end of the cable. It gives forth sonic pulses at one-second intervals until a mercury switch hits bottom and tips over.

535 Harold E. Edgerton

Scientists Eagerly Inspect Films of Deep-sea Creatures

Biologists accustomed to assessing only such tangible objects as they could take up from the ocean floor were reluctant at first to halt *Calypso* long enough to send the author's cable-hung cameras over the side. But skepticism melted into enthusiasm when negatives showed sea fans, echinoderms, and even sharks in presumably barren areas (page 537).

These researchers studied stretches of the Mediterranean bottom between Sicily and Tunisia on a 3-week cruise aboard *Calypso* last summer. Cousteau stands behind Yves Gantier, Jean-Marie Pérès, Jacques Picard, all marine biologists, and Jean-Joseph Blanc, a marine geologist.

We tried it first off the coast of Tunisia, at 1,640 feet; the casing leaked and the mercury switch went out of order. We tried it again off Bizerte in 720 feet: it worked fine for a moment, then began to tick madly for no discernible reason. We hauled it up: the casing was dry this time, but the mercury switch was completely gone.

"A shark bit it off," declared Cousteau.

The next day Bill and I built a new bottom switch which was supported by double-strand steel wires.

"You can't produce a shark big enough to eat this one," I told Cousteau.

And he couldn't. The next time we lowered the transmitter it behaved admirably. Seamen

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Cousteau © Rapho

***Benthosaurus*, the Tripod Fish, Hops Across the Sea Floor on Built-in Stilts**

First attempts to photograph the grotesque fish in its sunless home failed (page 329), but on a later dive bathyscaphe brought up this remarkable study. Marine biologists who had examined dead specimens thought that *Benthosaurus* trailed its two long pelvic fins and caudal appendage as feelers. But the bathyscaphe's viewing port revealed that the fish uses its extremities as a kind of landing gear, springing across the bottom like a cricket. *Halosaurus* (right) casts a shadow of its characteristic "double tail" (opposite). Lieutenant Commander Hesnot snapped this extraordinary picture at 7,000 feet.

and scientists alike gathered around the Edo graph in the navigation room and followed the progress of the "tick-tick" into the depths. They were especially delighted when we proved that we could regulate the position of the camera on its long cable within a few feet of the bottom.

Our executive officer, Saoût, was a particular fan. He would come up to me eagerly at breakfast time and sing out, "Allo, Papa Flash! Tick-tick today?"

Perhaps he liked my camera technique because it didn't dirty up his decks. He would gaze at the marine biologists pawing eagerly through a pile of mud and remark in sorrow, "Once I had a clean ship."

Such considerations never bothered two of the most ardent researchers we had on board: Scaphe and Philippe, Cousteau's dachshund and 14-year-old son, respectively. The moment Scaphe heard the winch creaking upward with its load he would rush over, barking, to greet the dripping bucket, snarl at the starfish, snap at the sea cucumbers, and smell everything thoroughly. His interest was intense but short-lived. Philippe, however, would still be elbow-deep in the intriguing muck long after Scaphe had puttered off.

But if Scaphe and Philippe and the biologists looked slightly mad to me as they delved in their mud heaps, I must have seemed just as insane to them in my tiny darkroom. This Black Hole of Calcutta was located down near the engine room—airless, windowless, and hotter than a Nebraska cornfield in July.

At Bizerte we installed an air-conditioning unit, but it was effective only up to about shoulder height. I would stand with my feet in the Arctic and my head in a Turkish bath, developing yard after yard of film, searching for the rare sea creatures that would make the hours of tedium and torment suddenly worth while.

Pulsating Medusa Caught on Film

Nevertheless, we had our good moments. One of them was our success in photographing the medusa, *Solmaris leucostyla*. Examining our developed negatives, Dr. Jacques Picard, a marine biologist, expressed amazement at the large population revealed by our cameras.

The doctor checked literally hundreds of medusae for analysis of their number, location, depth, and time of day when seen (page 534).

Another success was our portrait of the echinoderm *Ophiothrix quinquemaculata*, a slender-armed brittle star. Many biologists had thought it lay flat on the sea floor, as they had seen it on deck. But our photos taken in quick sequence portrayed it thrashing its arms about like a demented octopus, seemingly bent on snatching food from the currents flowing above it. When I first produced pictures demonstrating this action, Picard, to my vast surprise, grabbed them and ran all over the ship to show them to his equally excited colleagues, in a cloudburst of French expletives.

We derived, too, a good deal of amusement and pleasure from Prof. Jean-Marie Pérès's first head-on collision with the camera. The *Calypso* was cruising along one afternoon south of Pantelleria with the dredge being lowered at frequent intervals to check the status of the sea floor. As one load of mud after another came dripping up from below, the professor and his three keen assistants poked into it, smelled it, tasted it, and made their solemn pronouncements: "Yellow mud. Heavily oxidized. Azoic bottom—no life whatsoever."

We were not so sure. The professor was far from eager to stop dredging long enough to let Cousteau get our camera over the side; but Cousteau finally persuaded him. Later, I was able to bring Pérès photographs of this "barren" zone—big coral fans (page 527), a shark, echinoderms, and a great many burrows that indicated an active underground life. The professor's doubts dwindled, and he changed overnight into one of the camera's stoutest champions.

Our cruise ended back in Marseille. But our adventure continues: the adventure of exploring by camera the still virtually unknown world beneath the waves.

Next Goal: the Abyssal Depths?

Before long we shall be ready for new forays below the surface, perhaps in a 15,900-foot spot near Greece, deepest known in the Mediterranean; perhaps in the Indian Ocean; perhaps in the 26,000-foot trough off Puerto Rico; perhaps eventually in the 35,640-foot Challenger Depth southwest of Guam, deepest known spot in the oceans. It's only a matter of time (and an immense amount of undramatic but exhaustive experimentation) before we focus our lenses on the ocean's most jealously guarded recesses.

What will we find there? As I said before, I haven't the least idea. That's why I'm anxious to have a look.

See the Cumulative Index to the National Geographic Magazine for other articles on undersea research, including: "New Discoveries on the Mid-Atlantic Ridge," November, 1949, and "Exploring the Mid-Atlantic Ridge," September, 1948, both by Maurice Ewing; and "A Half Mile Down," by William Beebe, December, 1934.

High Antenna Gives *Haloporphyrus* a Fish-from-Mars Look

Hakelike *Haloporphyrus*, photographed for the first time in its true habitat, languidly floats past the bathyscaphe's camera more than a mile beneath the surface. Its tapered dorsal ray may help to guide the fish on its way through the depths' eternal night. Large anal and dorsal fins give the creature a twin-tailed look.

George S. Bond

Diving Through an Undersea Avalanche

Nearly a Mile Beneath the Mediterranean, the Bathyscaphe Touches Off a Slide Dislodging Tons of Mud

By Capt. Jacques-Yves Cousteau

Leader, National Geographic Society–*Calypso* Oceanographic Expeditions

EVERY dive is a good dive if you return to the surface. By this definition, the plunge I took last summer in the French Navy's bathyscaphe, *F. N. R. S. 3*, was a good dive. But it proved also to be one of the strangest and most exciting the little underwater craft has ever made.

Unwittingly, we started an avalanche of mud from the cliffsides of an oceanic canyon, an experience unique in our work with this deep-diving sea dirigible.*

I had taken a month off from my oceanographic duties aboard the research vessel *Calypso* to concentrate on deep photography with Lt. Comdr. Georges S. Houot, master of the bathyscaphe. For days and weeks we waited, while rough weather and mechanical difficulties canceled dive after dive in the open Mediterranean.

Goal: an Undersea Grand Canyon

At last, overcome with impatience, we decided upon a coastal descent of about 5,300 feet into a canyon off Cap Cépet. This huge submarine trough near Toulon, in southern France, had been carefully charted by Prof. Jacques Bourcart through echo soundings. It would offer few surprises and no dangers—we thought.

On the morning of July 24, clutching two movie cameras and two still cameras, I hobbled aboard the bathyscaphe. I was not the picture of an able seaman; my right foot was encased in plaster, a reward for playing tennis with my son after a 20-year layoff.

At any rate, I managed to squeeze through the hatch of the bathyscaphe's sphere and join Houot, noting that his brief case with the sandwiches and the bottles of vintage wine was safely on board. Houot locked the door and phoned up to the "topman" on the deck above.

"Is the tow rope free?"

"Oui, commandant."

"Have the divers let down the guide chain?"

"Oui, commandant."

"Have they removed all seven clamps from the electromagnets?"

"Have the gasoline valves been opened?"

Houot ritually ticked off 20 more safety precautions on his check list. I crouched in the rocking ball, wondering if there wasn't a simpler way of visiting the ocean floor.

Through the porthole I saw two pale Aqua-lung divers in the bright-green water—Dr. Harold Edgerton of the Massachusetts Institute of Technology, and his son Bill, cleaning the lenses of the electronic flash camera provided by the National Geographic Society.

Harold held up his finger at a point 80 inches from the window, so I might judge where to snap fish in focus. I tested the camera by pressing a button: it photographed the Edgertons as sea monsters (page 525).

Houot flooded the air lock to sink the bathyscaphe. On the radiotelephone we heard Lt. Comdr. Georges Ortolan from the tender: "Allo, bathyscaphe. The topmen are off in the rubber boat. They are recovering *les Edgerton*. . . ."

At last the bathyscaphe sank into green silence.

Descent into the Abyss

A little deeper, the water shaded into blue. At 1,000 feet it was practically dark. In the light of the exterior droplights I saw crazy "snow" falling upward. The flakes were tiny suspended organisms passing as we fell; otherwise, there was no sensation of motion in the bathyscaphe. We were in a calm room in the country at night.

This was my second dive. Comparing the snow and the swimming organisms with those I had observed the first time, I noted they were again thickest in the 2,000- to 3,300-foot stratum, below the point where the "deep scattering layer" is first met (page 528). As before, squids stopped for an instant in the lights and flashed away, leaving a spurt of phosphorescent ink. I clicked the Edgerton flash repeatedly, hoping to catch a squid in

* For graphic accounts of previous descents, see, in the July, 1954, National Geographic Magazine: "Two and a Half Miles Down," by Lt. Comdr. Georges S. Houot, and "To the Depths of the Sea by Bathyscaphe," by Capt. Jacques-Yves Cousteau.

color at the point of focus. There was small chance, however, the real photos would come on the sea floor.

At 4,600 feet I asked Houot to slow the descent. He discharged iron pellets and reduced our falling speed to 10 inches a second. A few moments later he looked at the echo-sound graph.

"According to this," he said, "the bottom's about 200 feet below us."

As he spoke, I saw beyond the droplights, perhaps as far away as the bow of our hull, a vague, cloudy shape.

"Listen, that's the bottom over there. We're down already."

"Absurd," said Houot. "The sonic detector couldn't be wrong."

"If that isn't the bottom, what is it? A shot of ink from an enormous squid?" I looked harder. "I don't think it's a squid. The cloud is yellow."

"What's going on, anyway?" said Houot. "The depth gauge, the sonic detector, and the vertical-speed indicator all say we're still going down."

He was right, and so were our instruments. But what was the strange cloud? Was it the side of the canyon?

Peering down, I saw our slender shafts of light thrust through the blackness and lose themselves in it. Soon, however, we could make out a soft reflected glow. The effulgence brightened as we sank and resolved into two overlapping circles, the impact of the lights. Eighty feet away I saw what I thought was the bottom.

Far below, five long fish with solid pectorals —sharks of the abyss—were on hand to greet us. A triangular ray, disturbed by our arrival, shook its "wings" and flew off.

539 George F. Houot

Shrimp Drift Past the Bathyscaphe Like Autumn Leaves

Diving beyond even the faintest penetration of the sun's rays, men in the *F. N. R. S. 3* have passed through zones of dense marine life—squids firing jets of white "ink," arrowworms, hatchetfish, medusae, tiny darting particles, and columns of shrimp like these (drawing, page 5401). Bigger game—sharks, rays, hake, and groupers—can be better stalked along the bottom.

The dangling guide chain touched gently on the mud, and the sharks vanished. The depth gauge read 4,920 feet.

I was astonished to see that our craft was standing on an undulating shelf of mud right at the edge of a vertical cliff.

When I told Houot, he laughed skeptically. "No," he said. "We are just in equilibrium, hanging off the canyon wall."

"Look for yourself," I said, and yielded the window to him.

He gazed a long time and then got up with a puzzled expression.

"It's a shelf all right—and that cloud we saw is a cliff rising sheer above us."

We remembered Professor Bourcart's chart of the canyon, compiled from echo soundings by surface vessels. It had shown the canyon walls with a regular slope of 20 to 30 degrees. Yet the actual crevasse, as we could now see, was carved into large steps. Only later were we able to decide what had happened: the echo sounder's impulses leave the surface in a narrow beam, but at such depths the beam fans out into a cone, unable to register even large irregularities in a slope. For bathyscaphe work we must obtain a more discriminating instrument.

While we were mulling over this question, *F. N. R. S. 3* settled down upon her guide chain until the sphere rested on the ledge.

"Shall we start the motors and drive off the cliff?" I asked.

Houot pressed the shot-release button for 20 seconds. Slowly the bathyscaphe rose about five feet: some of the guide chain remained coiled in the mud. Houot put the starboard motor ahead and the port astern

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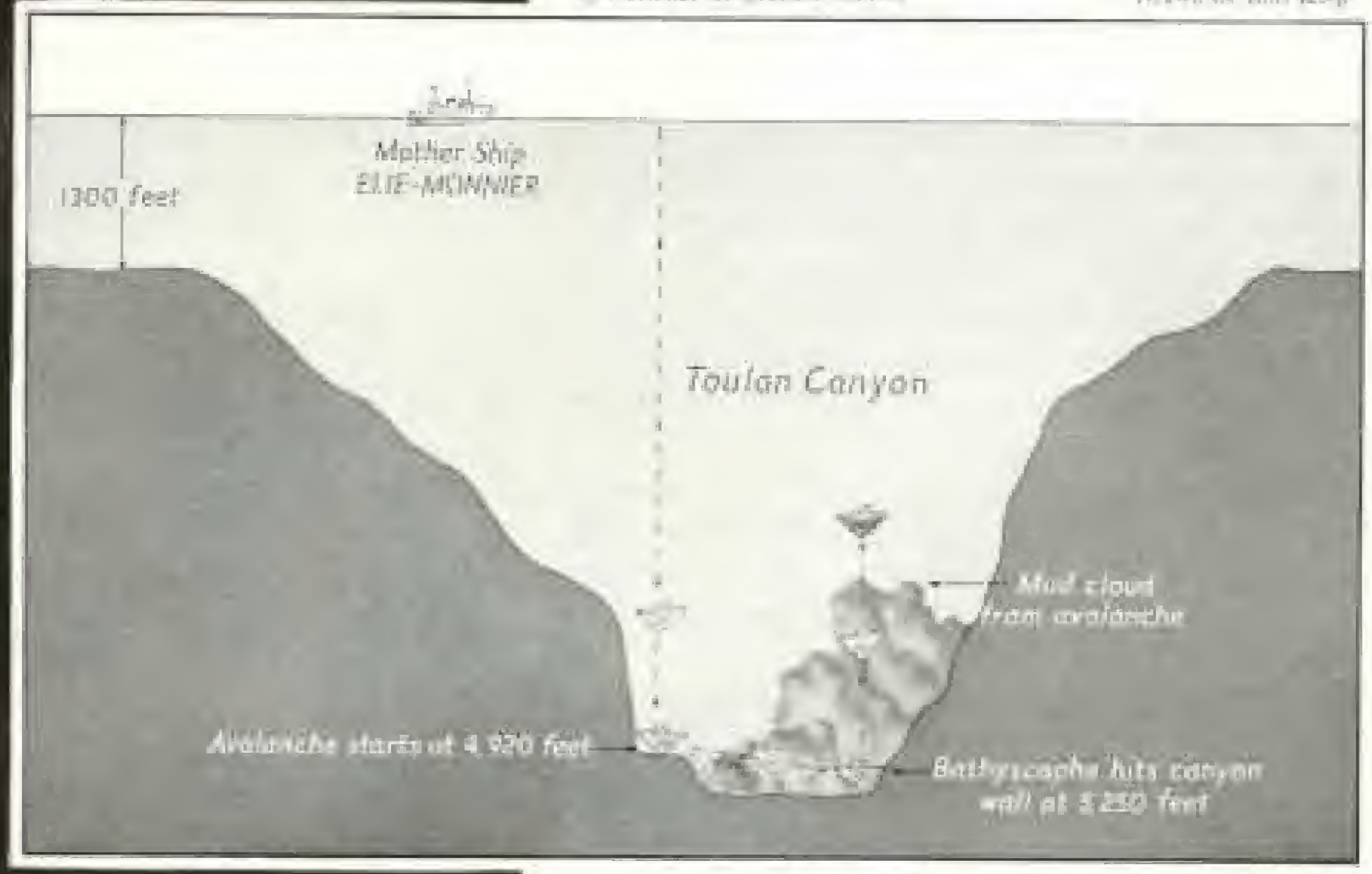
A Subsea Avalanche Engulfs Bathyscaphe; Schools of Shrimp Dance Above Her Deck

Bathyscaphe's 2,000-watt searchlights vainly attempt to pierce the murk. For clarity, dimensions are exaggerated on the diagram. Actual scale would show the craft a mere dot in roiling thunderheads of mud churning up from the canyon bottom below.

Drawn by Rolf Klep



to pivot into take-off position, then ran both motors ahead. *F. N. R. S. 3* started sluggishly, apparently held back by the chain. Then she pulled free—and things began to happen.

I saw a great block of hard mud tumble off the ledge, dislodging more big lumps. Clouds bloomed below, boiled up, and spread.

"Houot, we've started an avalanche!"

Like skiers stirring up snow on a mountainside and causing a great avalanche, our guide chain had dislodged silt that had collected through the ages and started it sliding down the canyon wall into the abyss.

We laughed nervously and decided to rest on the ledge until the sediment settled. I could hardly take pictures on a floor turbulent with mud.

For 20 minutes we waited, looking down into thick clouds that would not subside. Since there was still fair visibility around the ship herself, we thought we might find clear bottom by steering across the canyon on a compass bearing, even though it would mean sailing directly through the disturbance.

Soaring Through Yellow Fog

It was a mad crossing. We had the impression of flying over a sea of cumulus clouds, like those one soars above on a transatlantic flight. Several times our craft entered towering cumulo-nimbus heads, immersing us in yellow fog. The porthole would look as if it had been blanked out with cardboard. Emerging from such a cloud, we would see others rolling endlessly below, beyond sight, a vast structure of dun cotton balls reflecting and counterreflecting our lights.

"How could one hunk of mud stir up a whole canyon?" we asked ourselves, laughing incredulously. Then a new cloud tower would swallow us.

It seemed never to end. The width of the canyon is about 1,300 feet, and we had been under way for 20 minutes, ample time at our one-knot speed to reach the other wall. Our motors were still running with a steady whir, but suddenly we became aware of a chilling fact: particles no longer rushed at our window. We were not moving.

Had we struck the other side, or the bottom? Houot cut the motors, and we waited for something to suggest itself. Silence, within and without the sphere. At the portholes, only the opaque yellow "cardboard."

Perhaps a slight current would dispel the fog. But in the privacy of our own minds Houot and I harbored less cheerful thoughts: we might well have loosened the opposite canyon wall and now be buried deep in soft mud!

We entered upon a discussion of the unexpected features of the Toulon canyon. It is strange to sit in a blind steel ball 5,250 feet down and talk geology, especially when it begins to occur to you that canyons which suddenly acquire huge shelves may also have large overhangs capable of trapping a little submarine that always wants to go up. It could even be, we thought, that the mysterious yellow cloud we had mistaken for a squid's ink jet when we were about to land was actually a cloud of mud stirred up by our bow pounding down on such an overhang. No way of telling now.

An hour passed, and the water still had not cleared. An iron bracket holding a baited fishhook only a foot beyond our window remained invisible. Clearly, this dive was lost to photography. We decided to surface.

Houot jettisoned a lot of shot. The depth gauge and vertical-speed indicator did not move. An inch outside the port, mud particles remained suspended in the murky water, motionless. Our theory of an overhang gained considerable substance.

Trying to keep cool, we talked no more than necessary. Only a little movement of the needle on the vertical-speed indicator—that was all we wanted, from the bottom of our hearts.

Things cannot be this bad, I thought. Had we forgotten something?

Muddy Clouds Tower 800 Feet

We reviewed the behavior of bathyscaphes at such depths and over such periods of immersion. And then it came to us: in the hour we had waited here in the cold, the gasoline must have cooled even further. Unquestionably, we had grown really heavy.

Houot squirted more shot from the silos. We heard it hailing down upon our sphere. A moment passed, and suddenly the speed indicator stirred. I saw specks sliding down the window. We were climbing!

The windows remained yellow as we soared. We rose, in fact, 800 feet before the muddy "thunderheads" began thinning into black water, and, leaving the clouds below us, we flew upward into night. Daylight came faintly at last and swelled into a green haze. The bathyscaphe began to rock in the swell.

Afterwards I went to see Professor Bourcart.

"Listen," I said. "You know that canyon you charted so carefully? You'll have to do it again. We just wrecked it."

Weather from the White North

In Lonely Year-round Vigil, Canadian and American Meteorologists Transmit Vital Data from the Top of the World

By Andrew H. Brown

National Geographic Magazine Staff

With Illustrations by National Geographic Photographer John E. Fletcher

YESTERDAY, at Winnipeg, the warm prairie wind carried the earthy redolence of spring, for April had come.

Today, 1,700 miles farther north in Canada's arctic islands, we tumbled out of our Royal Canadian Air Force plane into 12-below-zero blasts.

"Welcome," greeted a black-lettered sign proclaiming that this was "Resolute, pronounced R-e-s-o-l-u-t-e," located "in the heart of Canada's Northland, surrounded by miles and miles of nothing but miles and miles."

Shaking the snow from our parkas, we plunged gratefully into the shelter of Resolute's combined mess hall and barracks building. Inside, hot food and hearty hospitality caught us up.

"Here," a friendly stranger volunteered, "let me help you with that stuff. George over there is frying steaks for you."

On the Threshold of the North Pole

It was difficult to realize, as we relaxed and went to work on loaded plates, that outside lay the frozen doorsill of northernmost North America.

Photographer Jack Fletcher and I had come to this Air Age polar steppingstone, 2,100 miles northwest of Montreal, to get a word-and-picture account of the annual supply by air of five remote weather stations jointly operated by Canada and the United States. They are spotted across the jumble of icy islands where North America fronts the Arctic Ocean (map, page 547). From these lonely outposts, local weather reports are sent every three hours, via Resolute, to Edmonton, Alberta. From there the information is distributed to forecasters around the world.

For us the journey to the Arctic had turned back a whole season. In southern Canada buds were swelling. In the lifeless desolation of the Queen Elizabeth Islands, frost flowers' brittle blooms were our only floral greeting. Daylight in April was continuous around the clock, but unrelenting winds, defying the sun, filled the cold air with rime and blowing snow.

Resolute's buildings, agleam in orange paint, lay half-hidden behind wind-piled drifts (page 548). Gusts drove whirling snow devils down the bulldozed canyon of the main street.

Restless activity gripped Resolute. Day and "night" (the period of daylight between 6 p.m. and 6 a.m.), Canadian-U. S. crews loaded Fairchild C-119 "Flying Boxcars" that were constantly taking off on shuttle runs to outposts at Mould Bay and Isachsen.

Coming in from the acid cold, men ate with appetites worthy of Henry VIII. Coffee consumption was prodigal. For the daytime crew it averaged 80 gallons; another 45 gallons was gulped every night.

Living at Resolute presents problems unknown in temperate regions. Power plants and boilers burn diesel oil called "minus sixty pour-point"; it will flow in temperatures at which ordinary fuel oil becomes syrup-thick. Water comes from a small lake through a heated boxed-in pipe that tunnels under the runway.

"The high north is a frozen desert," said J. Glenn Dyer, head of the U. S. Weather Bureau's Arctic Operations Project. "Canada's northern islands get little more precipitation than the Sahara. Most of it comes down as snow that blows back and forth for months before it melts. In winter and spring, skies stay clear and sunny for weeks on end."

Where Compasses Point South

We took temporary leave of Resolute and flew 500 miles northwest to Mould Bay. As the supply plane droned along, I went forward and looked over the navigator's shoulder while he worked out our course. Converging lines on the flight chart verified what I already knew: here the magnetic compass is useless. Its needle points south to the North Magnetic Pole or wobbles erratically.

"How do you find your way?" I asked.

The navigator touched a dial-faced instrument. "Especially in high latitudes," he re-

plied, "a directional gyro supplements the magnetic compass.

"Of course each airstrip has a radio beacon," he added. "We're homing on the Mould Bay beacon right now."

The plane let down over Melville Island. I stared out over a landscape as untouched by humanity as the mountains of the moon.

Crossing Fitzwilliam Strait, we reached Prince Patrick Island and dropped to the Mould Bay airstrip, which lies as far west as Santa Barbara, California. Toylike weather station buildings, lonely in an immensity of snow and ice, came into view.

On the ground men started loading cargo sleds; I joined the pilot as he gave his aircraft the customary post-flight check.

"The Boxcar's a good kite," he said. "She hauls a big load and takes a lot of punishment. Made to order for this job."

Our flight into Mould Bay was one of more than two dozen that delivered to the isolated station everything necessary for a year's operation. In 53 flights last April, RCAF pilots, crews, and planes carried 655,000 pounds of supplies and equipment, as well as replacement personnel, to the Canadian-U. S. weather outposts at Mould Bay and Isachsen.

Crewmen and station hands joined in manhandling building panels, drums of paint, helium cylinders, and boxed food disgorged from the cavernous belly of the Flying Boxcar. Tractors pulled the loaded sleds up the grade to Mould Bay's drifted buildings.

Jack and I rode atop a loaded sled. The

Snow Sparkles Under the Midnight Sun

Round-the-clock daylight or darkness is a general rule at Alert weather station on north Ellesmere Island. The sun never sets for 147 days a year, never rises for 145. This panorama, taken in April, shows barracks, operations building, warehouses, and the domed structure housing instruments for upper air observation (pages 549 and 550).

545 Gilbert Grosvenor

† Alert Station Is Last in Icy Wastes

Almost invisible in the trackless landscape, Alert is one of five far-northern stations from which Canadian and U. S. civilians transmit vital weather observations (map, page 547). Mould Bay and Isachsen can be supplied only by air. Alert is comparatively accessible, icebreakers have reached it on three attempts, only the 1954 expedition failing.

Dr. Gilbert Grosvenor, Chairman of the Board of the National Geographic Society, made this photograph from the U. S. Air Force plane that took him to the North Pole in May, 1953 (page 557).

Upended slabs of ice, some of them 20 feet high, form a pebbled pattern where the Arctic Ocean's pack ice grinds against the shore. The dark gash in the center is the land world's northernmost airstrip. Buildings (arrow) appear as mere dots.

camp's pet dogs, nuzzling the frozen carcass of a wolf, growled a welcome as we passed.

Mould Bay's main building combines mess hall, radio station, and weather office. In the central room, men greeted us across heaped lunch plates.

Amiably but with resignation, the cook served us bean soup, baked ham, fried potatoes, peas, cake, fruit, and coffee. To him, plane crews and "tourists" are just extra mouths to feed at airlift time.

As we warmed our hands on hot coffee mugs, station activity hummed around us. One stalwart carried chunks of ice into the kitchen and dumped them into a tub next to the stove. This was the water supply.

Red-cheeked, a weather observer came in from the instrument shelter with temperature and relative humidity readings (page 564). Frost whitened the fur fringing his parka.

In the radio room a loudspeaker spluttered: "This is aircraft one three two. We're estimating Mould at 1800. How do you read me?"

"I read you five square; I read you five by five," the operator answered. Both expressions are radio jargon for perfect reception.

With a bounce in his step, Bob Wilson, the Canadian officer in charge, showed us around. In a few days he would be leaving "Mouldy Bay," southbound for matrimony and a new assignment. Bob's northern tour had substantially boosted his bank account.

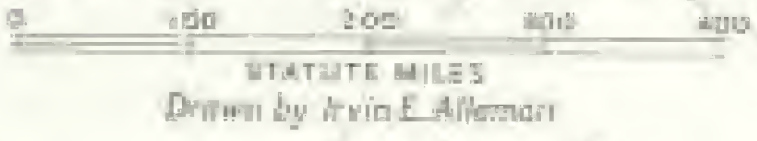
The "frozen chosen" of these remote weather stations make no bones about the higher pay for arctic duty being the prime attraction. The goal of such saving, of course, is to spend it on something you want very much—a wife, a boat, school, or travel.

Half of the men at these jointly operated outposts are Canadians and half are United States citizens. All are civilians, and, with few exceptions, single. The officer in charge

Frozen Isachsen Lacks Water. Men Drag Snow to the Cook Shack to Be Melted

Andrew H. Brown, National Geographic Staff

WEATHER MEN of the ARCTIC WASTES



Drawn by Irvin E. Alleman

Ice-packed Polar Seas Separate North America and Russia

The United States garrisons Thule Air Base. Denmark operates a weather station at Nord. Canada and the United States jointly man observatories at Resolute, Mould Bay, Isachsen, Eureka, and Alert. The Canadian icebreaker *Labrador* in 1954 became the first large vessel ever to traverse the Northwest Passage. Ice Island T-3, lately manned by the U. S. Air Force, is now abandoned.

* North Pole

is a Canadian, for these installations are on Canadian soil. The senior U. S. member carries the title of executive officer.

These weather lookouts in North America's attic are the dream-come-true of an ex-Harvard football captain and all-American, Charles J. Hubbard. Pilot, explorer, and veteran of World War II service in both the Army Air Forces and U. S. Navy, Hubbard planned a daring program. The upshot was a bill, Public Law 296, by which the 79th Congress authorized the U. S. Weather Bureau to "take such action as may be necessary in the development of an international basic meteorological reporting network in the Arctic region of the Western Hemisphere . . ."

Canada and Denmark gave full cooperation. A weather station at Thule, northwest Green-

← 12 Below and Blinding White: Resolute Air Station in April

This northernmost post of the Royal Canadian Air Force lies on Cornwallis Island, 560 miles north of the Arctic Circle. Each spring its airstrip hums with activity. Outgoing planes make about 50 flights, carrying men and a year's supplies to Mould Bay and Isachsen, Resolute's dependent weather stations (pages 564–5).

Last spring the base presented this wintry scene. Temperatures climbed to zero only now and then. Daylight around the clock blanked out the stars; the National Geographic staff men could make pictures at any time. Permanent frost extended at least 675 feet into the ground, as deep as bits have drilled here.

Three track-laying snowmobiles stand abreast on Resolute's snow-paved main street. Drivers leave engines running in fear of freeze-ups. Mess hall and barracks stand on the left, radio and operations building on the right.

Reconstructed by Andrew H. Brown (top) and John E. Fletcher, National Geographic Staff

Drifting Snow Engulfs an Imported Christmas Tree →

Far beyond timber line, Resolute depends on airplanes to bring its holiday evergreens. This lonely tree, planted close to the Royal Canadian Air Force flag, bears witness to violent winds that stripped its needles.

The dome near the whirling cups of the wind indicator houses the rawin (from radio-wind) receiver. Electronic equipment within this plastic, translucent shell tracks a balloon-borne transmitter that relays weather information from the upper air (page 551).

← Messages from the Skies Pour into This Room

Page 548: Information from Resolute's ionosphere station, correlated with that from four other stations in Canada, three in Alaska, two in Greenland, and one in Iceland, allows forecasts of Arctic-wide radio reception 3 to 4 months in advance.

Here Edward Leaver, officer in charge, types his daily report. Recorder at right catches radio signals bounced back from the ionosphere, an ionized layer of atmosphere 60 to several hundred miles above the earth's surface.

land, went in during the summer of 1946, those at Resolute and Eureka in 1947. The spring of 1948 saw Mould Bay and Isachsen installed by air, and in 1950 Alert was built.

A Danish-manned station, erected in 1952, made Nord, on Danmarks Fjord in northeast Greenland, the eastern anchor of this chain of outposts. The U. S. Air Force and Weather Bureau shared in Nord's installation.

Charles Hubbard, unfortunately, died in the act of giving aerial support to one of the stations his vision had brought into being. He was aboard an RCAF Lancaster bomber making a parachute mail drop at Alert on July 31, 1950. Shrouds of a chute fouled the tail of the aircraft, and it plunged to earth, killing the nine men aboard (pages 566 and 567).

Hunger Drives Animals to Camp

After our tour of the half-dozen station buildings at Mould Bay, we went back to the mess hall for the inevitable one more cup of coffee. Here is the focus of station life, where off-duty reading, letter writing, and "chewing the fat" goes on. And here, particularly during the long dark, is where the men get to know what makes one another tick.

The Arctic at times plays the jealous mistress, waiting to trap a man. Nerves frayed by monotony and minor irritations can cause hand or mind to lose its sureness. The prescription then may be a hike over the bare hills, a tussle with a playful dog, a swift ski run, an engrossing novel, or just a noisy argument.

Animosities build up—and melt away. At Mould Bay we saw boxing gloves furnished as a safety valve for anger. They looked new.

After months of drabness and gloom, "south" becomes a magic word. "Who wants to be a sub-zero hero?" someone asks. "Give me the hot sand on the beach back home."

Yet the station work, demanding and monotonous as it is, gets done.

"There's not much sign of life around here now," said black-bearded Max Silver, Mould Bay's executive officer. "Sometimes in winter, though, it looks as if someone left the zoo gate open.

"Last January one of our crew dropped a polar bear right there beside the generator shed. And Les Snyder spotted a wolf on the garbage dump. He crawled close with his rifle: the beast dropped at the first shot."

Max explained that Canadian game laws protect all wildlife on the arctic islands. Of course, in self-defense or to protect property these restraints are waived.

Floodlights mounted on buildings give outdoor illumination in winter and discourage animal prowlers. But in December and January hunger often drives wild creatures to abandon caution and trot right up to the station door.

"Last fall two musk oxen hung around camp, as if craving company," said Silver. "One of them stayed for three days. We threw him a cabbage; he sniffed it, but wouldn't eat."

Flying back to Resolute, we welcomed a chance to learn about activities there.

Resolute supports a handful of Eskimos, for whom Constable F. Ross Gibson of the Royal Canadian Mounted Police has special responsibility. He also functions as game warden, customs officer, and immigration registrar, as well as being guardian of the law.

"I can't imagine who might immigrate here," Ross said, "though as a matter of fact our Eskimos are immigrants. At least, they are not native here. We brought in three families from Quebec and one from Baffin Island, hoping they'd kill enough polar bear and seal to keep going. That way, men would be available to load aircraft and do other chores."

Driving us to the shore of Barrow Strait, Constable Gibson stopped his snowmobile beside a group of white mounds.

"This is our Eskimo town," he told us as we spilled out into the snow glare. "The mounds are igloos." Beside them Eskimo children romped, playing with toy sleds and miniature dog whips (pages 558 and 560-1).

"Let's get out of the wind," said Ross.

We plunged down snow steps, crawled through a tiny vestibule, then along a dim tunnel and through a plywood door hinged with straps.

A world of warmth, comfort, and life opened

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American and Canadian Flags Fly over Eureka, Ellesmere Island →

Eureka, a satellite weather station 600 miles from the North Pole, now uses its wind charger only for a flagstaff; diesel equipment generates all electricity.

Here an observer prepares to release a rawinsonde (radio-wind-sounding) balloon to carry aloft a compact transmitter. The instrument will send back news of temperature, relative humidity, and barometric pressure at successive levels. Ground observers track the balloon to compute wind speed and direction.

Photograph by National Geographic Photographer John E. Fletcher

to us. The domed snowhouse was about 12 feet in diameter. Light flooded through a slanted pane of smoothed ice set into the roof. On an upended crate burned an open stone lamp, its wick drawing polar bear oil from the bowl. In one corner lay a red haunch of bear meat. A blue fox skin hung from the wall.

Fondling an infant, an Eskimo mother squatted on a snow platform warmly spread with skins and blankets; it served as handicraft shop, living room, and bedroom. Two other children smiled a shy welcome.

Pages torn from magazines papered the whole dome of the snowhouse. Prominent was a magazine article, "Report from Russia." Color photographs of the British Queen and Consort held a place of honor.

"Paper freezes to the snow blocks," Ross explained. "It prevents dripping."

Paste Coats Sledge Runners

When we emerged, an Eskimo fan-hitched a dog team and took us for a ride on his 22-foot *komatik*, or sledge. Sealskin thongs creaked as we scraped over the sea ice.

I knew it was a custom, farther south, to coat steel runners with mud and then to rub or plane them smooth. Komatik runners here were plastered with a whitish material.

"It's flour paste, frozen on and smoothed," explained Gibson. "There's no mud available. One application lasts a long time."

On the snowmobile ride back to the RCAF station we passed piles of gravel lying unused not far from the runway.

"These pyramids—likely they'll be there as long as Egypt's—recall a lesson the airstrip builders learned," Gibson told us. "During the first summer's work on the strip they bull-

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Glaciers Chiseled the Stern Features of Greely Fiord, Ellesmere Island

The frozen sea arm takes its name from Gen. A. W. Greely, who made pioneer discoveries on Ellesmere. The explorer for 47 years was a member of the National Geographic Society's Board of Trustees. Lt. J. B. Lockwood of the Greely party discovered the fiord in 1883.

← Musk oxen gallop away at the sound of the photographer's helicopter near Eureka Sound, between Ellesmere and Axel Heiberg Islands. While flying over interior Ellesmere, the author saw herds totaling more than a hundred animals.

The mammals' rumps-together defensive circles repel wolves and bears, but not hunters, who almost wiped them out. Canada now protects the animals.

During the Ice Age, ancestors of the musk ox ranged as far south as Kansas. They retreated northward with the receding ice.

U. S. Navy, official

Ships and Aircraft Serve Arctic Islands Ice-locked 10 Months a Year

Cargo ships and tankers, convoyed by icebreakers, push through to Resolute Bay late each summer and deliver a year's supplies for the base and its two substations. A landing craft stands by in the foreground.

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Kodachrome by Robert F. Asen

A Canadian 4-engine North Star Takes Off with Cargo for a Satellite Outpost

U.S.S. *Neapeka* pumps oil and gasoline through a floating hose (right) to tanks ashore. Small landing craft prevent ice floes from fouling the fuel line. A cargo ship lies at anchor beyond the tanker.

dozed together a lot of thawed-out surface gravel for stock piles. When the drivers went back a few days later with power shovels and trucks to haul the gravel away, they found it frozen as solid as concrete.

"Old King Permafrost had crept out of the ground and stiffened the piles, reclaiming what was his," said Ross. "No use trying to blast that stuff. They found a new supply."

Drilling at Resolute has measured permafrost downward through the earth's crust to a depth of 675 feet.

Frost in the Far North has a way of preserving the marks of man. Near Bridport Inlet on Melville Island, Glenn Dyer, coming ashore from the U. S. icebreaker *Atka* in August, 1951, to reconnoiter a new station site, found wheel tracks in the tundra. A check through exploration history revealed that at least a century had passed since an expedition portaging cart left the marks.

Radio Ham Links Arctic with Home

Another morning found us en route to Isachsen, 325 miles north northwest of Resolute, in latitude 78°47′. Across Cornwallis Island we flew, then over Queens Channel and Penny Strait, to Ellef Ringnes Island and Isachsen's ice strip, scraped out on the ice of Hole-in-Fog Bay (pages 546, 565).

From Isachsen that morning, our friend Glenn Dyer put through a call to his home in Washington, D. C.

Isachsen radio raised J. Stan Surber, the ham operator of Peru, Indiana, who received the Edison Radio Amateur Award from the General Electric Company for his services to remote northern stations during 1953. Surber, a railroad dispatcher, devotes off-duty hours to relaying personal messages from men isolated at these arctic outposts.

When Isachsen reached Surber by radio, the "Santa Claus of the air waves" put in a collect long-distance call to Mr. Dyer's Washington home. Surber linked radio and telephone by flipping a switch.

"It's hot here today, Daddy. Eighty degrees," said Dyer's daughter, Nancy. "What's the weather where you are?"

"Sort of chilly; it's fourteen below zero."

"Br-rr-r-rr!" said Nancy across 2,800 miles.

A shortwave receiver in the Isachsen mess hall pulls in programs from all over the world. Radio Moscow came in loud and clear; while we listened, the announcer introduced "A Cock-eyed Optimist" and "Red River Valley" in Yankee accents to which he surely must have been born. Moscow Molly, the platter spinner, is clearly heard, but her propaganda gets a cool reception.

Isachsen keeps its ice runway 'dozed out only during the spring airlift. Occasional fall landings are made on frozen silt of a delta across the bay. During the rest of the year the station loses contact with the outer world, except by radio and airdrop.

Bill Nemeth, departing officer in charge, pointed out to us that Isachsen gets more snow in summer than in winter.

"Cold air can't hold much moisture—and it's cold here," he said. "Even in March our average temperature was 35.6 degrees."

"Below?" I asked.

"Naturally," said Bill. "When it's above zero, we add 'plus.'"

Late one night, from the crest of a jagged 1,000-foot peak south of camp, we watched the low sun light up glowing "sun dogs" in the rime-filled air. Blowing snow almost blotted out the distant outpost buildings.

Far below us as we stumbled down the hill, another C-119 hummed in through the numbing cold and rolled to a stop on the ice of Hole-in-Fog Bay. Back and forth the planes went, just as they do in the real world.

Flight to an Operating Room

Back again at Resolute, we waited for a plane to the U. S. Air Base at Thule (pronounced *too'-lee*), Greenland, a way stop for us en route to Alert and Eureka.

A mercy flight finally routed us out of bed at 2 a.m. One of Resolute's powerhouse operators showed symptoms of appendicitis: the post had a medical aide, but no surgeon. Thule's was the nearest operating room.

Less than three hours after leaving Resolute, Bob Gillan was in the Thule hospital. His appendix had burst, but an operation and expert care quickly restored him to health.

After easing our patient into an ambulance and breakfasting, Jack and I were off again, north to Alert.

Beyond Kennedy Channel the gashed and truncated coastal mountains of Ellesmere Island lifted into view. Once across Hall Basin, we spiraled above bleak hills, then touched tires to Alert's shale runway, dry land's northernmost airfield (page 545).

Fuel barrels stood ranked beside the runway. A snow road climbed a long slope. The polar pack ice crunched against the coast; its

snaps and groans were the only sounds other than our own voices. Not a building showed above the snowy desert.

Then a weasel snow vehicle waddled over the hill and hauled us to the station, a mile and a half away and invisible from the landing strip.

Among Canadian-U. S. weather stations Alert is closest to the North Pole, a mere 518 miles. It houses the most northerly post office on earth and the northernmost land-based radio and weather station (pages 544-5, 566-7).

Far north as it is, Alert received a message in December, 1953: "Christmas Greetings to our southern friends." It was a salutation from T-3, an ice island drifting slowly with the Arctic Ocean pack; it was then 225 miles to the northwest.*

John Brisbois, Canadian radio operator at Alert, had talked over the air waves with Dr. Gilbert Grosvenor, recently retired as President of The National Geographic Society and Editor of its Magazine, and with Dr. Thomas W. McKnew, The Society's Vice-President and Secretary, when they circled Alert on a flight to the North Pole in the spring of 1953.†

"We had more snow in '53 than this year," John told us. "Huge drifts half-buried the camp. Dr. Grosvenor, I remember, thought we were snowbound; I reassured him that we weren't, but that we still didn't have any place to go."

Alert's buildings overlook Dumb Bell Bay. In three annual tries in late summer, a U. S. icebreaker from Thule poked far enough into the Arctic Ocean to reach Alert. But last year the ice refused to yield, stopping the hippo-beamed craft short of its goal. In a normal season, fuel, building materials, vehicles, and other heavy equipment are barged to shore.

For 147 days each year the sun never sets at Alert; during 145 winter days it is lost below the horizon. Now, at the end of April, the sun rode ceaselessly around the sky. We ate meals at odd hours. Photographs Jack Fletcher took at midnight differed little from those made in the blaze of noon.

At the edge of the polar sea we walked among upended slabs and pinnacles of the pack ice. Jumping fissures, we paused in the

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Marilyn Monroe Makes Typing Dull at Mould Bay

Lack of feminine companionship imposes a hardship during year-long duty hours at northern outposts. Darts, reading, chess, skiing, record-playing, table tennis, and other diversions cannot compensate. Personal appearance becomes a problem. For many an isolated man, the choice is amateur barbering or a mop of uncut hair.

* See "Three Months on an Arctic Ice Island," by Joseph O. Fletcher, National Geographic Magazine, April, 1954.

† See "We Followed Peary to the Pole," by Gilbert Grosvenor and Thomas W. McKnew, National Geographic Magazine, October, 1955.

← An Eskimo Packs Baby in Her Caribou-skin Parka

Carefree Jeannie is a member of one of Resolute's four Eskimo families. Here on a sunny day, with the temperature only a few degrees below zero, she exposes her head; the boy on her back shows his machine-knit wool cap. Jeannie's wool mittens and calico dress came from a tiny Government trading post. An ivory pin in her hair resembles the whistling swan of arctic skies.

↓ Guests in a Snowhouse Enjoy Music with Their Tea

Resolute's igloos, their domed ceilings lined with magazine pages to prevent dripping, offer many conveniences. This jovial gathering squats on a blanketed snow shelf where the family sleeps and entertains.

Sarah, wife of Sudlavenik, leader of the Resolute Eskimos, plays a fiddle made from orange crates with a bowstring fashioned from seal sinew. Sarah, Jeannie, and Lizzie all carry infants in parka hoods. Shelves and rods behind them hold crockery cups, metal saucepans, clothes hangers, clocks, and storage tins (page 561). Allie, the boy, faces the camera with misgivings.

Wall pictures include one of the British royal couple.

Kodachromes by Andrew H. Brown
and (below) John E. Fletcher, National Geographic Staff

shadow of ice cliffs and frosty caverns. Memorable were the ice's translucent hues of blue, ocean-green, and emerald, and unforgettable the utter silence of this waiting, waiting world.

At Alert we heard a true tale of wishful thinking in a region where wondrous installations at a few spots deceive the unwary about facilities in general.

An Air Force C-47, bound by night from the Ice Island T-3 to Thule's 2-mile runway and 1,000 lighted windows, developed engine trouble approaching Ellesmere Island. The pilot knew that Alert had an airstrip—but apparently that was the limit of his knowledge.

"I'm flying on one fan and running low on fuel," the pilot radioed Alert. "Give me your runway lights, please."

Alert's gravel strip has no hangars, no control tower, no cab service—and no runway lights. Patiently the radio operator told the pilot to hang on. Two of Alert's meager complement gathered up empty coffee cans, a carton of toilet paper, and some diesel oil.

The men improvised flares by putting three fingers of oil and a roll of toilet tissue in each coffee can and placed them, widely spaced, along both sides of the runway. Overhead, the single functioning engine of the C-47 growled in great circles above the lamplighters.

An hour after the optimistic pilot had requested "Runway lights, please" he eased his crippled C-47 onto the ground. Only then could the weathermen allow themselves the luxury of breaking out in a cold sweat.

Musk Oxen and Mountain Majesty

Early on the morning of April 24 we left Alert for Eureka (page 551).

As we flew to the southwest, the glittering mountains of Ellesmere Island drew us to the cabin portholes. The United States Range pushed white teeth through a far-spreading ice field. One of these alabaster peaks, according to our map, probes more than 8,000 feet into the blue.

Someone spotted a few black specks moving over the ground. Musk oxen! Then groups of 10 and 20! Where the little bands had pawed through the snow, foraging for dried grass and arctic willow, their tracks made patterns like fine lace (page 553).

Beyond mountain passes, our flight path led to Tanquary and Greely Fiords. Crossing Fosheim Peninsula, we dropped to Eureka's landing strip.

Officer in charge Tom Kilpatrick of Sudbury, Ontario, proudly showed us the station's new heated 15,000-gallon water tank. Water, he told us, used to be so hard to get that a Navy icebreaker twice tried to nudge an iceberg close to shore to provide a frozen reservoir from which the men could hack a supply.

Arctic veteran Chuck Havens had arrived at Eureka with us to round out his latest northern tour. Chuck recalled the spring of 1950 at Eureka, when howls and yelps brought the men tumbling outdoors to find 17 wolves tangling with the station's dogs.

A bullet wounded one wolf. He fled to the sea ice. The rest of the hungry horde melted away; with grim singleness of purpose, the 16 able-bodied creatures converged on the maimed member of the pack.

"Out where the wolves moved in on their injured pal," Chuck told me, "we found only a backbone and a chewed-up head."

Quipped the Weather Bureau's E. A. Wood: "The wolves here will eat right out of your hand—or your leg or your back!"

Gravity Varies with Latitude

Eureka's men eyed quizzically one of our transient company: a stocky figure who peered into a mysterious instrument consisting of two metal cylinders linked with wire and straps.

This was John Rose, a geophysicist who was measuring differences in the intensity of the earth's gravitational field among these northern stations. Gravity varies with latitude, Rose pointed out. A man who weighs 200 pounds at the Equator weighs 201 at Eureka.

A University of Wisconsin graduate student, Rose was the butt of good-natured raillery for the loving care he lavished on his gravimeter. When prop-wash from one of the 3,250-horsepower engines of a C-119 upended Rose and his "milk cans," everyone managed to button up the banter until "Doc" was sure that his pampered instrument had suffered no hurt.

Rose's work is but one instance of the research for which these weather stations have provided Far North footholds. On flights to the outposts our companions included, at one time or another, an entomologist, a naturalist, and an expert in the structure of ice and snow.

The naturalist, Stewart MacDonald, showed us a tubular gadget he uses to collect wolf specimens for the National Museum of Canada.

"See, it's a booby trap," he explained. "When a wolf nips at the bait, a cartridge fires a puff of potassium cyanide dust into his

Eskimo Ices Sled Runners for Speed in the Snow

Aircraft, snowmobiles, and tractors are slowly pushing the old-time sourdough's dog sled into limbo. This Eskimo sled gave the author and the photographer a jouncing run over ridged sea ice at Resolute (page 563). Overturned, the sled reveals its running surfaces.

Canadian Eskimos normally use mud to coat runners, but none is available at Resolute. Amagoalik has mixed flour and water, spread the paste, and planed the surface smooth. Here he applies a coating of warm water, which instantly freezes to a hard, glassy surface. If stones damage one of these ice "tires," he can quickly apply a friction-free patch.

Amagoalik heads one of the Eskimo families taken to Resolute from Canadian regions suffering from a dearth of game animals. His igloo, built three miles from the Resolute air station, faces Barrow Strait. Melting in summer, it will give way to a skin or canvas tent.

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Metal Pans Modernize → a Snowhouse Kitchen

Arctic experts of all northern nations learn to build snowhouses—streamlined, snug, and strong. This Resolute igloo (above) has one window, a thin pane of clear ice above the door.

Sarah here stirs batter. The bright-eyed child burdening her back seldom distracts her. Flame (left) marks a stone lamp that cooks meals and heats the igloo with bear or seal oil.

← Mountie and Eskimo Share a Cold World

If hunting and handicrafts fail to support Canada's Eskimos, the Government helps them to find work. Local control of the Eskimos lies in the hands of the Royal Canadian Mounted Police.

Here Constable F. Ross Gibson takes down a report given by Amagoalik.

mouth. The animal dashes off but drops dead in his tracks within seconds."

The larger arctic bases offer sites for some of modern science's most intricate electronic tools. Resolute houses an ionosphere station whose readings make possible forecasts of radio reception conditions (page 548), a cosmic ray and terrestrial magnetism observatory, and a seismic station.

At Resolute, too, Dr. Henry B. Collins, Jr., of the Bureau of American Ethnology, Smithsonian Institution, has excavated four Eskimo dwelling sites of the ancient Thule culture. Two were built over remains of still older homes of the Dorset culture, which he has been investigating elsewhere with National Geographic Society support. Dr. Collins unearthed a rich array of implements and weapons—harpoon heads, soapstone and limestone pots, knives, arrows, and many others.

Thule, Man's Boldest Arctic Imprint

From Eureka our big-bellied bird bore us over more sugar-loaf mountains, more musk ox herds, more "miles and miles of nothing but miles and miles."

In eastern Ellesmere Island we circled the lonely Canadian "Mountie" station at Alexandra Fiord. "Two constables," said Ross Gibson, "one Eskimo family, one dog team—and one whale of a big district to patrol."

Soon Thule slid into the scene again, its site flagged by the upside-down dishpan of Mount Dundas. In the background the Greenland icecap bunched implacably, curling its lip above the fringe of land.*

Multimillion-dollar Thule Air Base, almost magically conjured up during 1951-53, stands as the major military fact of life in the North American Arctic. Today, from a spot the Eskimos used to call *Pituglik*, "the place where you tie up your dogs," jet planes scream from a 2-mile runway, ready to fight off house-breakers from the top story of our continent (pages 568-9).

Built on Danish soil by agreement with Denmark, this northernmost of the Free World's airbases lies almost equidistant from Washington, D. C., and Moscow. It sprawls over a gravelly valley between ridges of rock 941 miles from the North Pole.

Actually, an airstrip that proved invaluable during the base construction had existed at Thule since 1946, when Edward E. Goodale of the Weather Bureau took charge of the newly installed Danish-U. S. weather station.

A mile away, under Mount Dundas, we could see the homes, hospital, and little church of the old village of Thule. Knud Rasmussen, the Danish explorer, founded it in 1910; now it is being abandoned.

Rasmussen chose the name Thule advisedly: It is the ancients' word for the most northerly region of the habitable world. Relocated because of too-close proximity to the base, Thule's Eskimos have carried away with them the name of their former home; Thule, the town, has moved 64 miles farther north.

"What is Thule for?" The question is inevitable.

Thule's commanding officer, Col. William L. Kimball, explained to us the major purpose of this costly installation: to give the Air Force a top-of-the-world perch for its long-range bombers, and, in the event of military emergency, a base for attack missions.

Operated by the U. S. Northeast Command, Thule also provides a key early-warning listening post, tuned to detect enemy air attack across a broad sector of the polar regions.

Within a radius from Thule that may not be revealed, radar picks up all aircraft in flight. If an inbound plane deviates from its estimated time of arrival or wanders off course, Thule's radar post zips a "hot line" message to the jet squadron ready room: "Scramble!"

Within two minutes, the first F-89 all-weather jet is in the air, guns ready. Swiftly it seeks out the "intruder." "Judy!" the pilot reports, when his radar set has "locked on" the off-limits aircraft.

Even in the thickest "soup" of the winter night, the radar-equipped jets probe the black-wool murk until the "bogy" has been found. For practice, Thule's fighter pilots often draw

(Continued on page 571)

* See "Greenland from 1598 to Now," by Robert A. Bartlett, National Geographic Magazine, July, 1940.

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Tide-heaved Ice Thrusts Up a Blunt and Frozen Face

Pressure ridges assume weird shapes in Barrow Strait. Sledging parties from Resolute's Eskimo colony normally avoid such treacherous footing. This group skirted a pinnacle to oblige the photographer. Mountie Gibson (foreground) dresses like the Eskimos. The author stands atop the peak.

Inset: Radio operator William Fedorak feeds CQ, a pet husky at Resolute. The dog takes his name from a letter call, meaning "open for business," often used by amateur radio operators.

Photographs by National Geographic Photographer John E. Fletcher


R FORCE

← Eskimo Mother and Child Huddle Beside a Flying Boxcar at Mould Bay

Operating from short, rough airstrips in temperatures down to 50° below zero, airplanes nourish islands of civilization in regions shunned even by Eskimos. Without aircraft, human activity in the high Arctic would be limited by the range of icebreakers and sled-and-tractor convoys.

No ship has ever reached the Mould Bay weather outpost on Prince Patrick Island. This station and its twin at Isachsen (below) have been installed, supplied, and manned entirely by air. Rugged Fairchild C-119's (shown here) and North Stars unlock these important but inaccessible spots.

This C-119's boxlike fuselage hauls six tons on runs to the outposts. Sturdy aluminum loading ramps are carried aboard. Clamshell doors disgorge a canoe. The boat, an apparent anomaly in Mould Bay's frozen desolation, came along with a geologist to cross open water leads in the sea ice during July and August.

When Eskimo Amagoalik (page 560) agreed to fly to Mould Bay to help the geologist, he insisted on taking his wife and two children. For them, as for their 14 sled dogs, the 500-mile trip from Resolute was flight number one.

Tractors Distribute → Aerial Cargo

These boxes have just been unloaded at Isachsen airstrip, an installation scraped out of sea ice on Hole-in-Fog Bay, Ellef Ringnes Island. Another tractor-drawn sled delivers lumber.

Since the temperature may fall to 25° below zero even in April, perishables must be hustled into heated buildings.

Isachsen's meager 5.10 inches of precipitation a year is typical of the Far North's white desert; it compares with the Sahara's. More snow falls here in summer than in winter. Bare earth appears briefly in July and August.

← An Observer Reads His Instruments

Page 564: Standing before Resolute's instrument shelter, Wellington P. Gavin jots down the hourly weather readings.

Miniature Alps of Ice Rim the Arctic Ocean at Alert

Scanning the giant ice cubes tossed against the north coast of Ellesmere Island, the author gained new respect for the courage of Robert E. Peary. In 1909 Admiral Peary and his men set out from Cape Columbia, 73 miles to the west, and sledged to the North Pole in 37 days. Here the National Geographic flag unfurls 518 miles south of the pole. Alert boasts the Western World's northernmost weather station and post office.

Crosses Mark the Graves of 9 Men Killed in an Air Crash at Alert

The fenced grave is that of Charles J. Hubbard, an American who perished just as he realized his dream: a chain of far-northern weather stations operated by Canada and the United States. As chief of the U. S. Weather Bureau's Arctic Operations Project, Mr. Hubbard died in 1950 with eight others when a parachuted mail drop fouled the tail of their plane.

→Page 567: Alert's pylon commemorates the dead.


ALERT

← Color-tipped Bullets Test the Aim of Thule Air Gunners

Practice is unremitting at the new United States airbase in northwest Greenland. To make scoring possible, crewmen dip bullets in paint, a different color for the guns of each fighter (opposite).

↓ "Scramble!" Jet Fighters Get into the Air in 120 Seconds

Radar tracks all air traffic near Thule Air Base. Even friendly aircraft deviating from course or schedule become the immediate object of a jet-fighter scramble. Thule's air defenders search out the "bogy" and identify him within minutes, even in "zero-zero" visibility.

The base keeps four of its jets always on the ready, each in a separate hangar with doors at either end. Crews stand on 24-hour alert. When the siren wails the scramble signal, they race to planes.

Here pilot and radar operator in white-felt "bunny" boots rush to board their F-94 fighter, recently replaced by the more powerful F-89. Radar man at lower left climbs into his seat; the pilot hooks up his parachute.

Flat-topped Mount Dundas (right) is Thule's familiar landmark.

Thule Fighter Pilots Count Paint-daubed Hits on a Tow Target

This plastic mesh has been dragged through the air and riddled with bullets (opposite). Each hit left a smear of paint identifying the gunner. Skilled pilots pierce the target with 35 to 40 percent of their shots. Back on the ground, the flyers impatiently wait for the scorekeeper to total their marks.

570

A Narrow Base Supports 1,212 Feet of Skyscraping Steel

Rising almost a quarter mile into the air above Thule Air Base, the Global Communications radio tower (opposite) looks out over Greenland's forbidding icecap.

Recently a crack appeared in one of the three insulators on which the structure here stands. Jacking up the tower, workmen replaced the tripod with a single support.

To guard against electrocution by static, the transmitter is turned off and the structure grounded before men ascend the tower.

Inset: Air Force Maj. L. E. Walls and the author sit beside the flashing red aircraft-warning beacon atop the tower. To get there, they climbed 60 feet on ladders, then rode one of the world's longest single-lift vertical elevators. After an 18-minute ride they scaled another ladder to the pinnacle.

"I was conscious of an irresistible urge to hold on," photographer Fletcher recalls. "I could feel the tower swaying and see the guy wires fluttering in the breeze."

Kodachromes by National Geographic Photographer John E. Fletcher

close enough in fog and dark to an inbound MATS transport to throw a flashlight's beam on the aircraft's identifying markings.

Thule provides the jump-off point for spectacular U. S. Navy and Army Transportation Corps researches on the icecap. Using burly snow tractors and trains of cargo sleds, the Transportation Corps is perfecting travel and living techniques on Greenland's inland ice.

A Navy Seabee detachment, meanwhile, has been building long airport runways, taxi strips, and parking aprons on its bare surface. Here advanced equipment and methods will allow them to roll and compact runways from which the heaviest aircraft can operate.

Ability to move men and supplies freely on the Greenland icecap and to operate airstrips at will up and down the vast ice plateau obviously has dramatic implications for possible future air defense in the Arctic.

Ground Troops Protect Airbase

Thule depends, too, on ground troops. U. S. Army antiaircraft units have their own barracks, day rooms, mess halls, and movie shows.

Practice firing of Thule's high-reaching batteries is demanding duty. Smartly drilled antiaircraft troops, like all of Thule's personnel, are posted there for just a year. After 9 or 10 months every man starts counting the days until he'll be called to the air terminal for "rotation" to the States.

The base allows morale leaves of 30 days midway through the duty tour. Those who take it must add the length of their leave plus travel time to their Thule stay.

Among the most effective of Thule's morale-building activities are two local Armed Forces radio stations. Disc jockeys warm the local air waves with news, transcribed network shows, and popular music over station KOLD. Its theme song is appropriate: *"I'm Sitting on Top of the World."*

One factor above all others holds down the lid on airmen's and soldiers' spirits: the gnawing absence of the opposite sex. Five nurses are Thule's only women.

From a helicopter of the 55th Air Rescue Squadron, Jack and I got a snow bunting's view of the Thule base. Jeeps, trucks, and

---

Thule's Steel Exclamation Point →

The world's highest structure, a mast serving television station KWTV in Oklahoma City, reaches only 960 feet higher than Thule's radio tower; the Empire State Building in New York City tops it by 260 feet. Guy wires support the Thule mast; grounding cables form the raylike pattern around its base.

buses scurried between orderly rows of buildings. Jets taking off on gunnery practice flicked past us as if we were going backward. Radio antennas spread their tangle of wires over the desolate hills as thickly as laundry lines on a tenement roof.

Back in the "whirlybird's" hangar we talked with the men who direct Thule's rescue squadron. "We can get a mission off in 15 minutes," Maj. Michael V. Pedulla told us. "And Thule, luckily, has the best emergency landing ground you could ask for: 720,000 square miles of icecap.

Parachutists to the Rescue

"Our efficiency is on trial right now," the major went on. "A Navy Privateer crashed into a cliff on Ellesmere Island a few days ago. Two of our men parachuted to the wreckage yesterday—probably the northernmost intentional jump in Air Force history. Our next problem is to get them out.

"Unfortunately, the men found no one alive. But survivors or no, we have to make a report."

One of the men who jumped on the Ellesmere Island rescue mission, Major Pedulla told me, was veteran para-rescue man T Sgt. Elliott Holder; it was his 169th jump. In addition to parachuting skills, Sergeant Holder and his squadron buddies are trained in survival techniques, first aid, skiing, and mountain climbing.

But Thule has preoccupations other than defense, calendar watching, and rescue.

We stopped a crisply uniformed youth walking a Thule street with an armful of books.

"Going to school?" I asked.

"To the University of Maryland," the airman told me.

"Kind of a long walk, isn't it?"

"Nope." The airman nodded in the direction of a near-by building. "The professor holds classes right over there."

More than 100 at Thule attend Maryland by "remote control." The university has sent instructors to several Northeast Air Command bases: Thule's teacher at the time of our visit (they're switched every 8 or 10 weeks) was Dr. Anthony Campanella.

Organized as a part of "Operation Bootstrap," the educational program at Thule offers off-duty students a wide range of subjects, from history and geography to economics and government. The officer or airman pays a quarter of the tuition, the Air Force the balance. The courses are a part of the Education Services Program of the Air Force.

Back to Thule last spring for further duty as a civilian engineer went the son of the discoverer of the North Pole. Imagine the Admiral's delight had he known that Robert E. Peary, Jr., would one day choose service in his beloved Arctic!

On an earlier tour, the explorer's son made a difficult journey north of Thule to visit lame old Ootah, only surviving Eskimo member of the little group that Peary, Senior, headed when they fought through to the Pole on April 6, 1909.*

Everyone in Thule grows used to wind alerts, expressed in phases. During a phase-one wind (15-30 knots) normal activities continue with caution. In a phase-two wind (30-50 knots) all but essential traffic stops.

When a phase-three wind (above 50 knots) booms in, everyone is restricted to buildings. Mess halls cease serving. Emergency rations are broken out. Storm-flung stones often shatter windows, and fuel drums may rumble like juggernauts along the streets.

Thule's veterans tell their friends about the rugged weather they've endured. And rough it is, with winter temperatures that hit 40 below zero and winds that exceed 100 knots. Yet, thanks to a combination of topography and prevailing southeasterly winds, Thule is favored with far more genial conditions than the Canadian Arctic to the west or the icecap to the east.

When we flew from Resolute to Thule in late April, Resolute was shivering at 11 below; at Thule, 117 miles farther north, the thermometer recorded a balmy 20° above zero.

Arctic Desert Still Unconquered

The day came when Jack and I packed our gear and boarded a southbound C-54. We lifted from the asphalt runway: Thule's city-in-the-snow, its hundreds of buildings and almost unbelievable facilities, vanished beneath us as the plane swept out over the sea ice.

We had witnessed miracles of human achievement. Yet, as Jack summed it up: "Against all that men have done up here, look at the real estate that's still vacant!"

The weather stations we had seen, even the great base at Thule, are but lonely specks in a vast, ice-bound wilderness still barely touched by man.

* See "The Peary Flag Comes to Rest," by Marie Peary Stafford, National Geographic Magazine, October, 1954.

Patrolling Troubled Formosa Strait

573 National Geographic Photographer J. Baylor Roberts

Navy Neptunes from Okinawa Guard Formosa 24 Hours a Day

CHRISTIAN missionaries on Formosa tell of an old superstition among the island's tattooed aborigines. On the trail, these tribesmen watched the birds. If the birds flew ahead, it was safe to proceed; if to the rear, it was best to turn back; and if they flew across the trail, the only thing to do was sit and wait.

For nearly five years mechanical birds like this United States Navy P2V—together with ships of the Seventh Fleet—have exercised a deterrent effect upon the Chinese Communists, who covet Formosa and the near-by Pescadores (map, page 573). Gunners sit alert against attack. A powerful searchlight on the right wing tip identifies vessels in the dark.

Shaped like a tobacco leaf, Formosa is a land of cloud-topped mountains, plains, and valleys. Mountains thrust 12,000-foot peaks into the sky and descend to the sea on the east coast in tremendous cliffs (page 588).

To pilots cruising over Formosa, the island seems a green paradise. Both of its names reflect impressions of the beholder. Taiwan, its Chinese name, means "Bay of Terraces." Formosa, as Portuguese explorers christened it, means "Beautiful."

But this is an uneasy Eden. The islands teem with Formosan Chinese, Nationalist troops and civilians from the mainland, and some 170,000 aborigines.

Formosa's population of 8,500,000 almost matches that of Australia, a continent more than 200 times as large. Two hundred forty miles long and 85 miles wide, the island has about the same area as The Netherlands.

Crowded Formosa suggests a heavily loaded lifeboat. Or it may be likened to a beautiful woman beset by determined suitors. Long a part of China, it was Japan's from 1895 until the close of World War II. In 1949, Formosa, the Pescadores, and several small coastal islands became the last toeholds of Nationalist forces driven from the mainland.

In Communist hands, Formosa would threaten United States bases in Okinawa, 365 miles to the northeast, and the Philippines, a scant 225 miles to the south. Formosa was the springboard that launched the Japanese invasion of Luzon in 1941. Red China lies less than 100 miles away.

For other background articles on Formosa, see in the NATIONAL GEOGRAPHIC MAGAZINE: "Our Navy in the Far East," by Adm. Arthur W. Radford, October, 1955; "Formosa—Hot Spot of the East," by Frederick G. Vosburgh, February, 1950; and "I Lived on Formosa," by Joseph W. Ballentine, January, 1943.

Lusty Wails Herald a Formosan Crisis

Formosa swarms with children. Youngsters hardly past the toddling stage watch over little brothers and sisters with loving care, holding them on hips or wheeling them in little bamboo buggies.

The photographer's gift of chocolate precipitated this crisis in Taichung.

Missionaries have long been active on Formosa, and some children have such names as Everlasting Life and Poplar Tree Religion Mercy.

National Geographic
Photographer J. Baylor Roberts

Soldiers Shop in Quemoy Town

Quemoy Island commands the major Communist port of Amoy (map, opposite). Coastal batteries have repeatedly pounded the island with its Nationalist garrison and 40,000 civilians.

Alfred Eisenstaedt, Black Star

575

Glynn, from Three Lions

↑ Nationalist on Quemoy Looks Wistfully at His Mainland Home 5 Miles Away

Defenders of the island routed a 20,000-man invasion force in October, 1949, inflicting heavy casualties and capturing 4,000 Communists. An elaborate tunnel system shelters troops. Century plants from the New World help camouflage this beachside trench.

↓ Formosa and Its Outposts Bulwark U. S. Defense in the Far East

Activity in the Chinese coastal war early this year centered in the Tachen and Quemoy islands (insets). For a more comprehensive view, see the National Geographic Society's 10-color China Coast and Korea map, a supplement to the October, 1951, MAGAZINE.

♦ USS *Salisbury Sound*, Berthed in Chilung (Keelung) Harbor, Breaks Out Holiday Dress

← **Ships Cram Chilung, North Formosa Port**

This busy harbor, recently improved, serves near-by Taipei, the island's capital. Nationalist warships berth here, as well as at Kaohsiung on the southwest coast and Makung in the Pescadores (page 592).

National Geographic
Photographer J. Baylor Roberts

Page 576, lower: Fluttering pennants on *Salisbury Sound*, a seaplane tender, honor "Double 10 Day," October 10 anniversary of the Republic of China. Trading ships in the harbor also run up flags.

The tender is part of the U. S. Seventh Fleet, which recently included six aircraft carriers, three cruisers, and 36 destroyers, as well as submarines, minelayers, and minesweepers.

↓ **Martin Mariner Roars Off on Patrol**

Jet-assisted take-off lifts the heavy PBM from the water near the *Salisbury Sound*. The biz planes land at Okinawa or the Philippines after completing their night patrol missions.

U. S. I. A.

Policeman in His Crow's-nest Directs Traffic in Taipei, Formosa's Bustling Capital

Cars and bicycles move to the right, a postwar change-over from the Japanese left-hand rule. Most traffic is two- or three-wheeled, with foot-powered pedicabs vying for fares.

Nationalist Pilots, Flying American Jets, Defend Formosa Skies

The United States transfers planes and ships to Nationalist China under the Mutual Security Act of 1954. Faster, more maneuverable F-86 Sabrejets arrival in Formosa this year to supplement these F-84 Thunderjets.

Schoolboys Hoist a New "Mayor"

Excitement ran high when pupils in a Taipei school recently held an American-style election. Intensive campaigning preceded secret balloting; the vote was tallied on a classroom blackboard.

Eight-year-old Liu Da-chung won the office of school mayor. Here joyful supporters parade him triumphantly about the halls. In an acceptance speech the youth thanked his backers and promised to fulfill campaign promises. "I might even study a bit harder," he said.

← Bamboo Peaks Shade Young Islanders

Migrant Chinese from the crowded coastal Provinces of Fukien and Kwangtung settled Formosa three centuries ago. Today's islanders resemble their mainland cousins—short, strong-muscled, with broad faces and flat noses. Most speak a Fukinese dialect. Mandarin has replaced Japanese in the schools.

Formosa takes pride in its 65-percent literacy rate, high by average Asian standards. Total enrollment in the island's 1,500-odd schools, including one university and eight colleges, is estimated at more than 1,250,000. Military training is compulsory for all young men after graduation from high school or college; girls learn nursing.

Young and old alike wear these volcano-shaped hats. Youth at left, anticipating summer's frequent showers, wears a palm-fiber raincoat.

Alfred Eisenstaedt, Black Star

← Rice Fields Climb Like Stairsteps

Farmers make up half of Formosa's population. Many hold title to their lands. An installment system permits them to pay as they till. Three acres is the average holding. Favorable climate, irrigation, and use of fertilizers allow two or three crops yearly.

Watered fields of rice, the island's major crop, terrace Formosa's fertile lowlands. Bumper crops in 1954 produced a record 1,873,010 tons.

This farmer and his water buffalo plow a paddy near Tanshui on the northwest coast. Son wields a hoe. Young green sprouts will replace the clipped stalks of an earlier rice crop. To avoid the torrid sun, the family works in the late afternoon.

Neighbors often help one another, a dozen or more combining their efforts in a single small field. To weed rice, Formosans crawl through muck and water on hands and knees, like charwomen scrubbing floors, instead of stooping as Japanese weeders do.

National Geographic Photographer J. Baylor Roberts

↓ Tea Pickers Harvest a Crop for Export

Formosa oolong is popular in the United States. North Africa prefers the island's green tea.

Balancing baskets of leaves, this worker heads toward a weighing station in the hills near Taipei.

↑ Patrol Planes Afloat Off the Pescadores Line Up for Service by Tenders

The Pescadores, 64 tiny islands totaling only 50 square miles, command Formosa Strait. No past invader of Formosa has ever achieved success without first occupying the bleak island cluster.

Relentless northeast winds buffet the islands in winter. Fishing and farming supply a scant livelihood for the 80,000 inhabitants of the Pescadores, whose Portuguese name means "Fishermen."

Here the seaplane tender *Corson* drops anchor to service and refuel Martin Mariners of the Seventh Fleet patrol squadron. Twin 40-mm antiaircraft guns belong to the tender *Pine Island*.

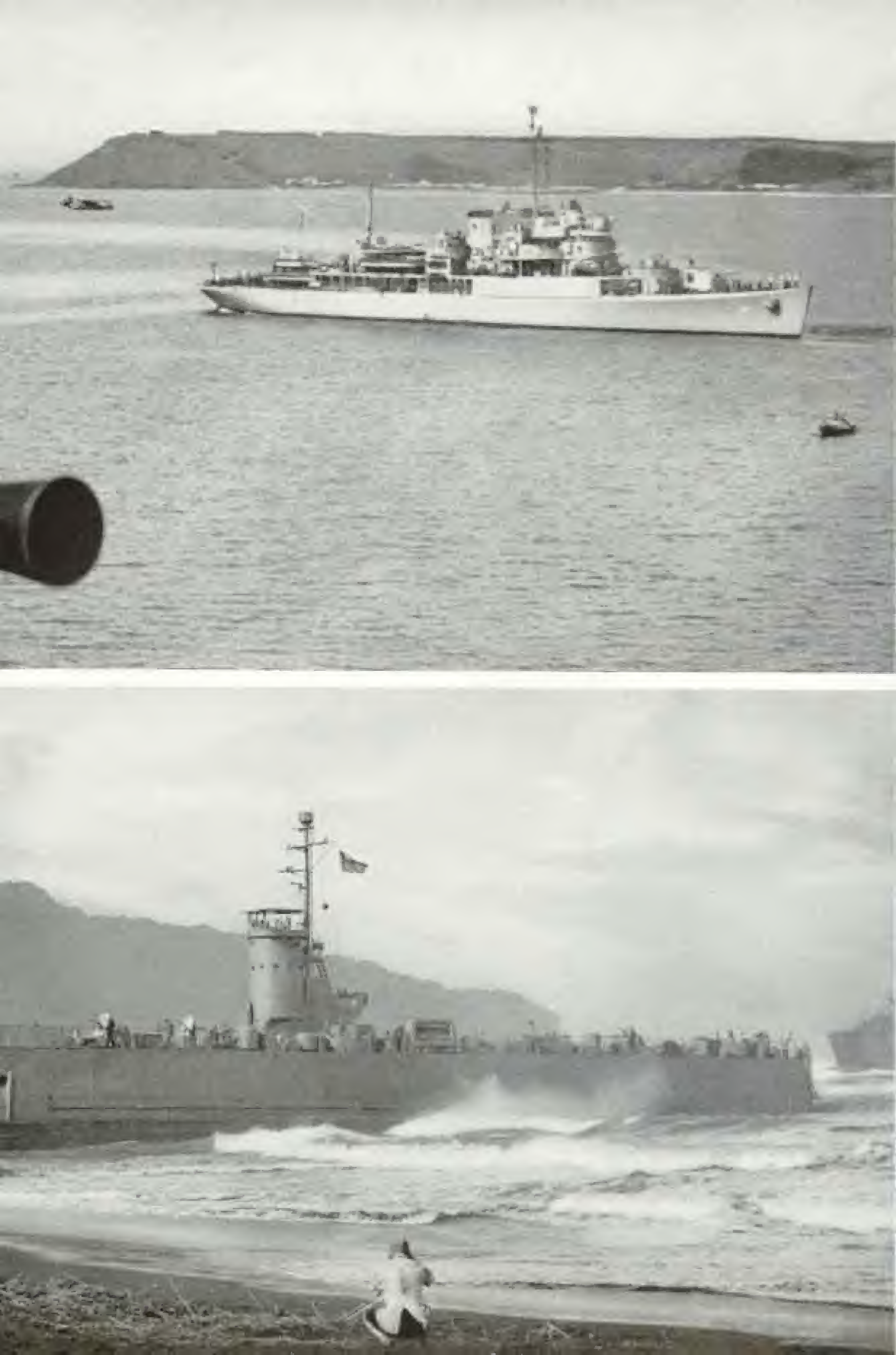
Penghu, largest of the Pescadores, lies in the background.

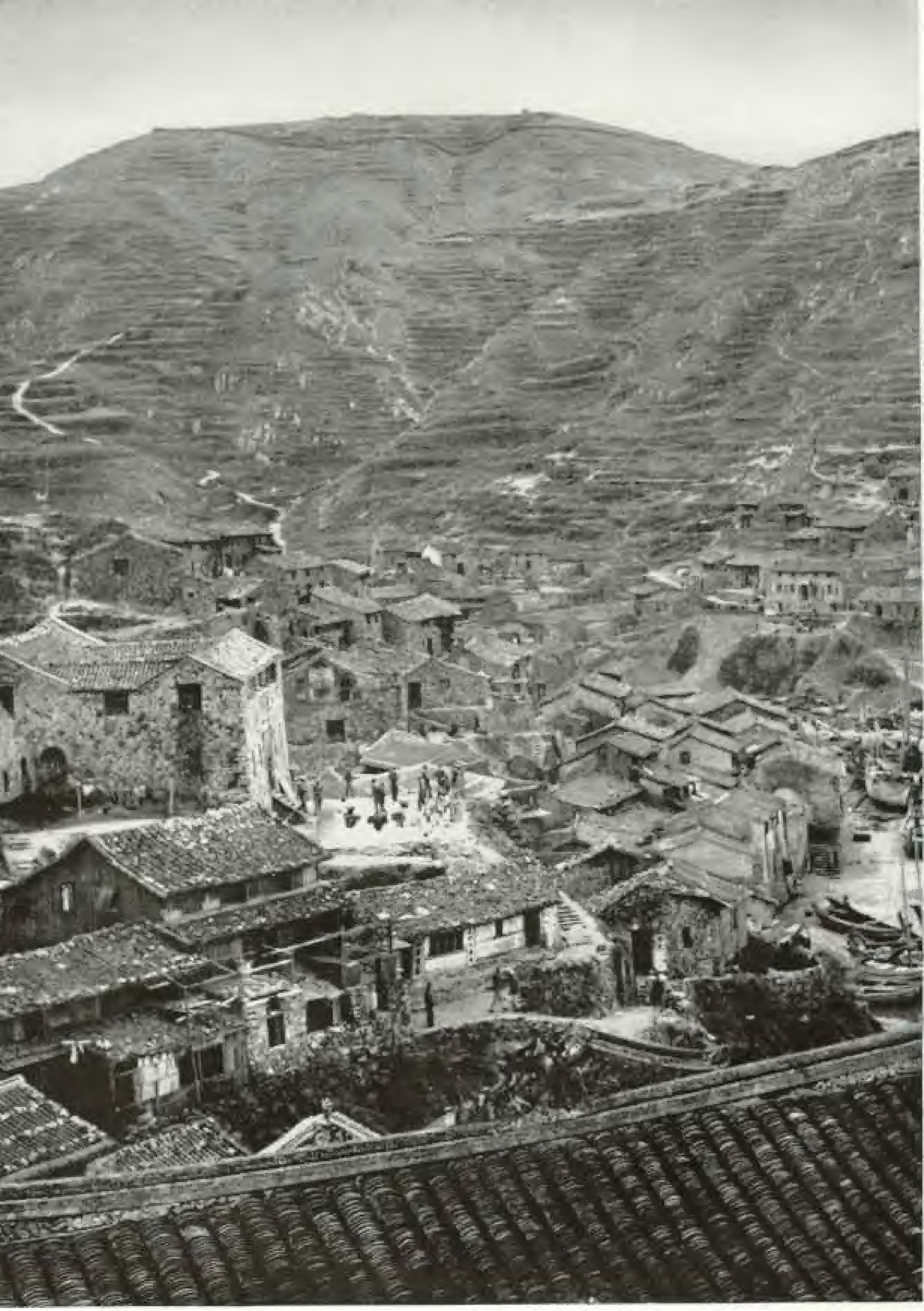
Working together in defense of Formosa and the Pescadores are U. S. Air Force planes, sea and air units of the Seventh Fleet, and Nationalist air, naval, and land fighters.

A Chinese Navy LSM Hits the Formosa Beach →

Landing craft crash the surf during an invasion practice near Tsoying in southern Formosa. United States Marines helped supervise the operation.

Brooks Thornton





584 **Sia (Lower) Tachen, Treeless as a Slag Heap, Built Its Houses of Stone**

Gray chimps of dwellings squeeze against desolate hills. Laboriously chiseled terraces produce a few cabbages and sweet potatoes. These pictures were made before the Nationalists evacuated the Tachens last February.

Beached Fishing Junks, Waiting for Tide, Jam the Inner Harbor 585

Tachen islanders lived off the sea, trading fish for most of their other foodstuffs. Here at the village of Tutiang the East China Sea rises an average 12 feet at high tide. Photograph by Charles H. Barber.

586

Charles E. Barton

Tachen Women Grind the Day's Meal on a Streetside Block of Stone

Tutiaun villagers built terraces even for their homes. Denuded hills cannot hold the torrential rains that batter the island; inhabitants suffered a constant water shortage.

Wide from Three Lions

↑ **Chiang Kai-shek Inspects Troops Before the Tachens Evacuation**

Departing Nationalists destroyed installations. The U. S. Seventh Fleet removed soldiers and civilians.

↓ **Bleak Hills Yielded Little Food for Goats or Youngsters**

Tachen civilians cheerfully boarded American evacuation craft. Communist bombings had killed scores.

From Wayers World Wide

588

National Geographic Photographer J. Baylor Roberts

Japanese Carved a Highway in 1,000-foot Cliffs Walling Much of Formosa's East Coast

Two-way traffic on a road only wide enough for one car made this one of the most dangerous drives in the world. Sharp turns posed a constant threat of head-on collision. Cars meeting had to back up to turnout points like the one at left, precariously close to a drop of 300 feet to the sea. Now traffic moves in one-way convoys on a fixed schedule. Beneath the overhanging rocks of Tachinghui (Great Clear Water) Cliff, an American geologist and his Formosan Chinese interpreter halt their jeep to look down at the Pacific.

In contrast to these east-coast cliffs, Formosa's west coast, facing China, is one long potential beachhead, with fertile lowlands sweeping down to Formosa Strait. Rice, tea, sugar cane, and fruit, notably sweet, delicious pineapple, thrive in the moist climate. Earthquakes and typhoons are frequent.

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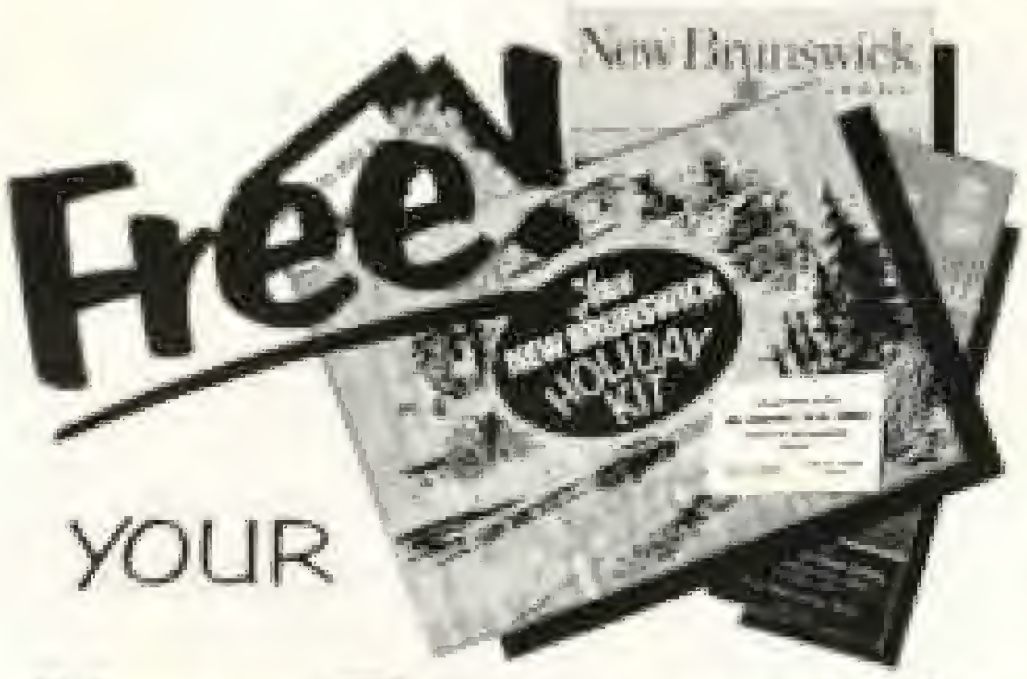

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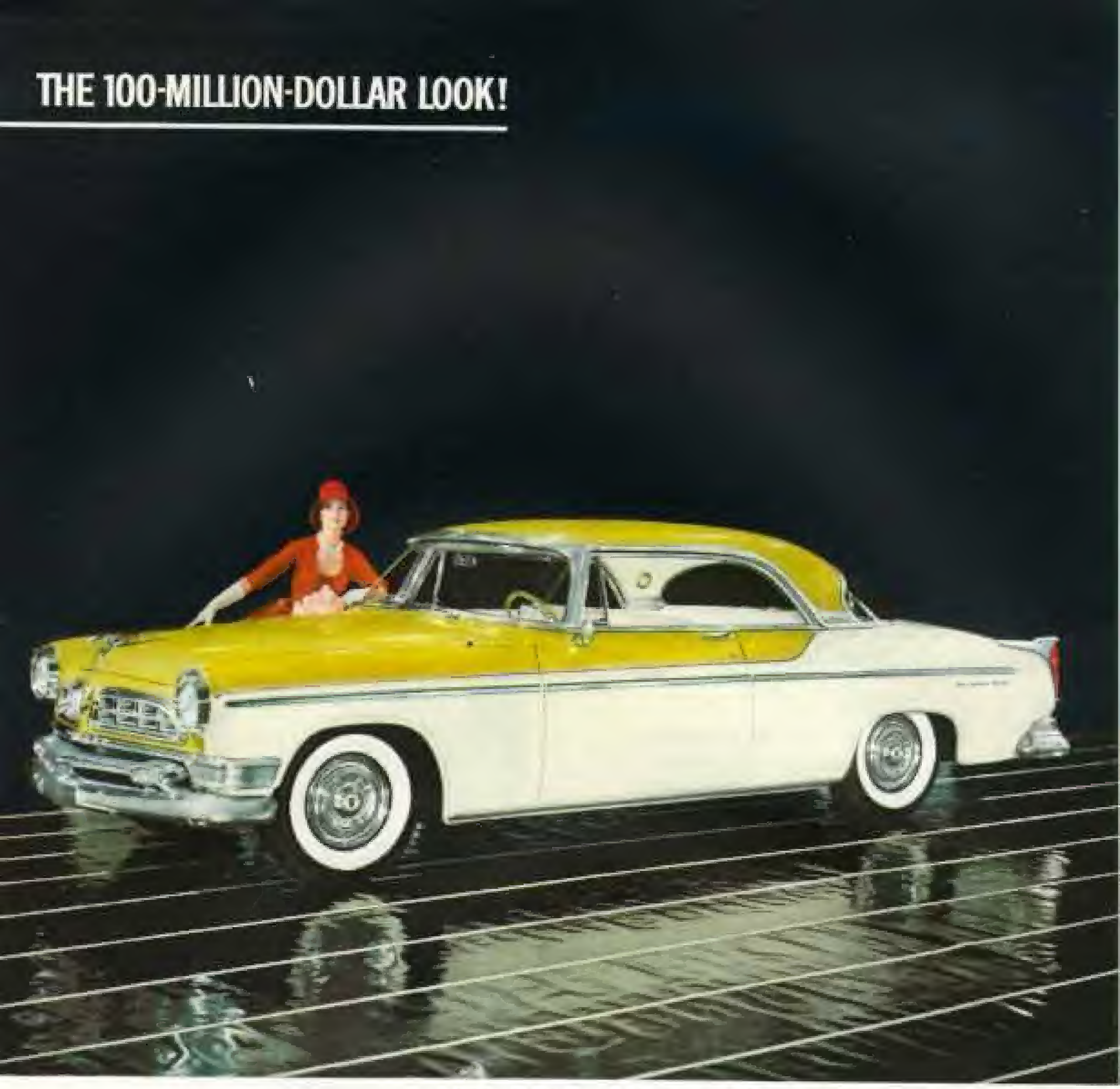

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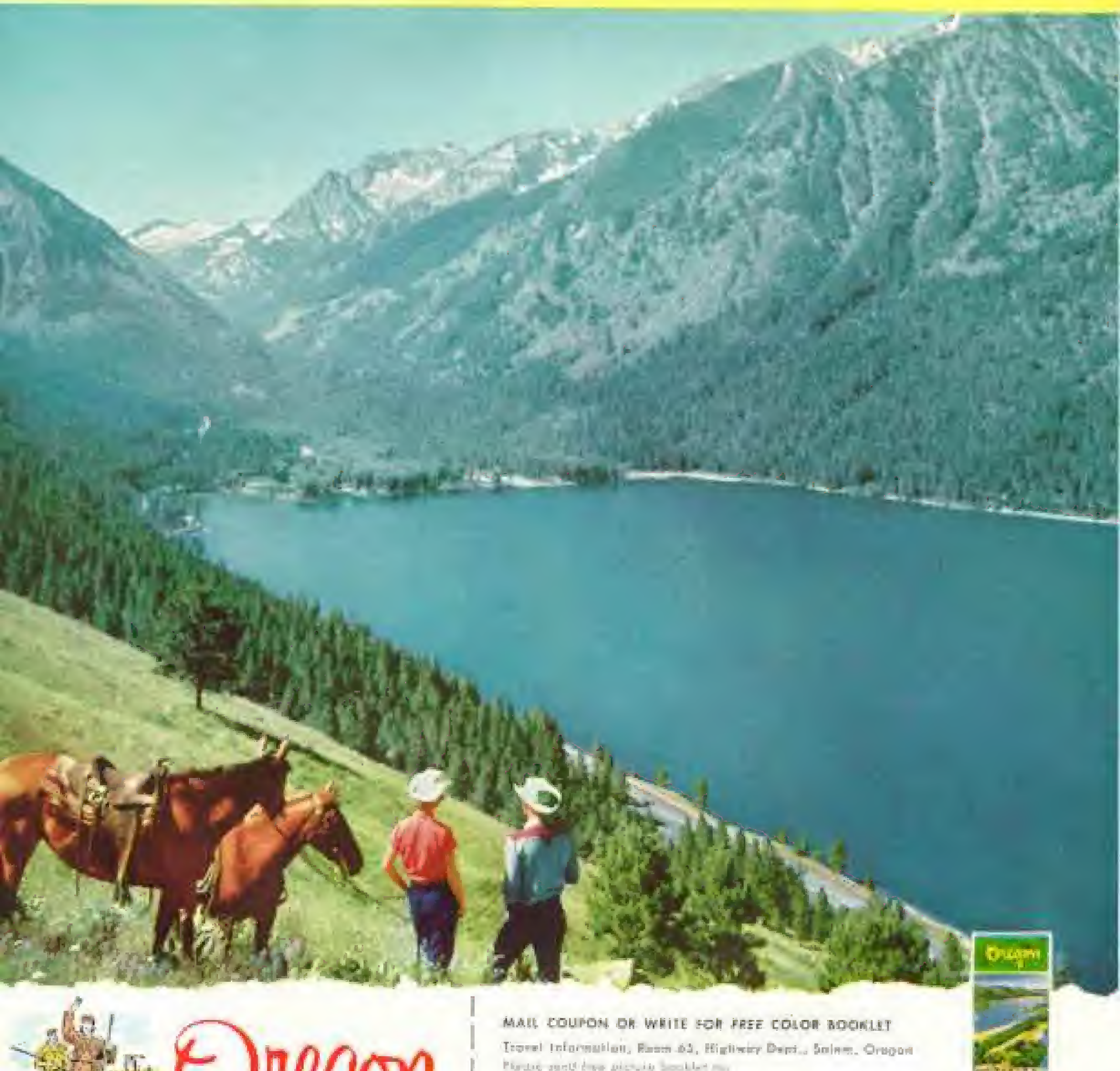

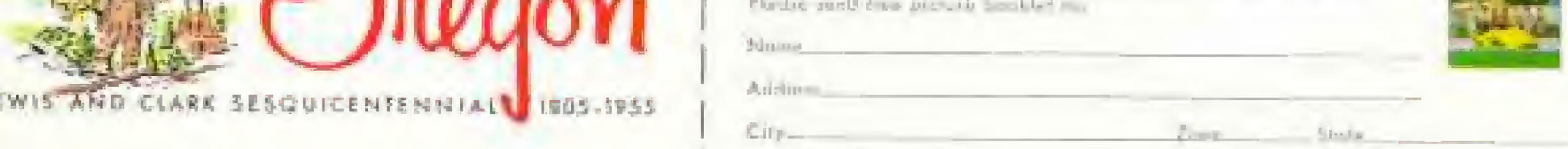

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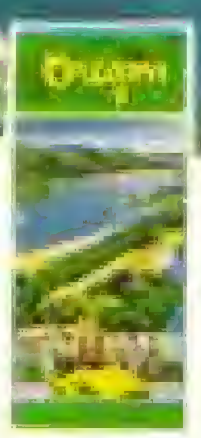

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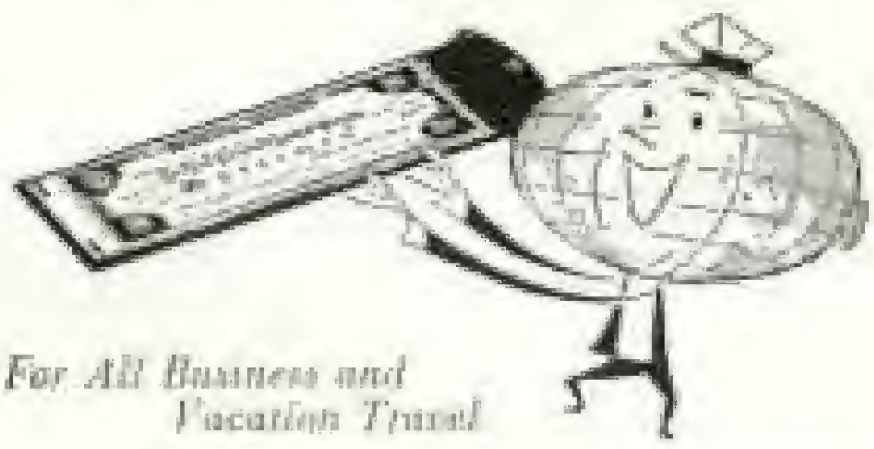

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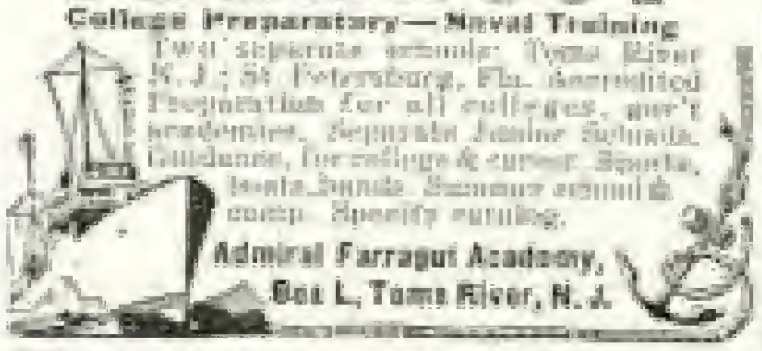

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This is Yannoula, aged 3½. Her home is a hut. Her bed, wooden planks with gunny sacks for covers, is shared with three others. The bed is outdoors all summer lest the roof cave in. Only trust in God permits sleep indoors in winter. Dinner is a scrap of bread. There is no family laughter, no father to take care of them . . . to dry a tear, to pat them gently, to scold and kiss. Yannoula's father was killed three years ago when he stepped on a mine. Her mother, 26, already old and ill, forages in the hills of her native Greece to feed her children. It is hard to believe that in 1955, the age of enlightenment, children like Yannoula have never known the joy of home. For her, each hour becomes just another day of want and misery in the wreckage of a war that still goes on for daily survival.

You alone, or as a member of a group, can help these children by becoming a Foster Parent. You will be sent the case history and photograph of "your" child upon receipt of application with initial payment. "Your" child is told that you are his or her Foster Parent. All correspondence is through our office, and is translated and encouraged. We do no mass relief. Each child, treated as an individual, receives food, clothing, shelter, education and medical care according to his or her needs.

The Plan is a non-political, non-profit, non-sectarian, independent relief organization, helping children in Greece, France, Belgium, Italy, Holland, England, Western Germany and Korea and is registered under No. VFA019 with the Advisory Committee on Voluntary Foreign Aid of the United States Government and is filed with the National Information Bureau. Your help is vital to a child struggling for life. Won't you let some child love you?

Foster Parents' Plan

For War Children, Inc.

43 W. 61st STREET, NEW YORK 23, N. Y.

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43 W. 61st St., New York 23, N. Y. In Canada: P. O. Box 65, Sta. L, Montreal, Que.

A. I wish to become a Foster Parent of a needy child for one year. If possible, one ....., I will pay $15 a month for one year ($180). Payments will be made monthly ( ); quarterly ( ); semi-annually ( ); yearly ( ). I enclose herewith my first payment of $ .....

B. I cannot "adopt" a child, but I would like to help a child by contributing $ .....

Name .....

Address .....

City ..... Zone ..... State .....

Date ..... Contributions are deductible from Income Tax

The Telephone Pole That Became a Memorial

The cottage on Lincoln Street in Portland, Oregon, is shaded by graceful trees and covered with ivy.

Many years ago A. H. Feldman and his wife remodeled the house to fit their dreams . . . and set out slips of ivy around it. And when their son, Danny, came along, he, too, liked to watch things grow. One day, when he was only nine, he took a handful of ivy slips and planted them at the base of the telephone pole in front of the house.

Time passed . . . and the ivy grew, climbing to the top of the pole. Like the ivy, Danny grew too. He finished high school, went to college. The war came along before he finished—and Danny joined the Army and went overseas. There he gave his life for his country.

Not very long ago the overhead telephone lines were being removed from the poles on Lincoln Street. The ivy-covered telephone pole in front of the Feldman home was about to be taken down.

But, when the telephone crew arrived, Mrs. Feldman came out to meet them. "Couldn't it be left standing?" she asked. And then she told them about her son.

So the pole wasn't touched at all. And there it is today, mantled in ivy, a living memorial to Sergeant Danny Feldman.

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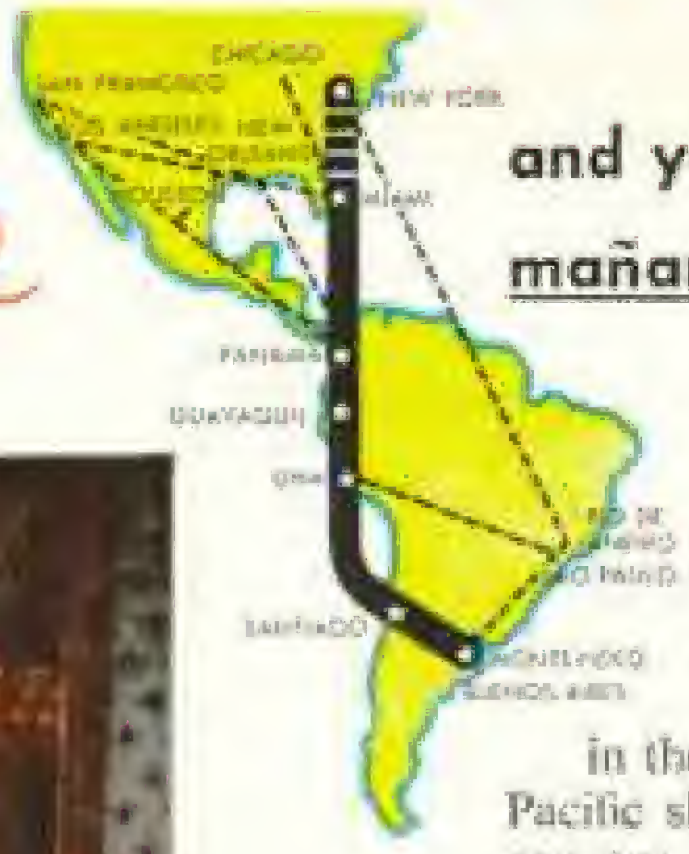

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