

VOL. 117, NO. 6

JUNE, 1960

NATIONAL GEOGRAPHIC



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National Geographic Magazine

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◀ COVER: Young lovers pause before the Arc de Triomphe, floodlit symbol of Eternal France (page 77).



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WHEREVER HE GOES, MR. TRUSLOW GETS HIS BIRD

To outwit the rare and wary trumpeter swans (above) and bring back a remarkable series of color photographs for the July *GEOGRAPHIC*, Frederick Kent Truslow, who always works like a beaver, emulated another aquatic mammal and hid himself, waist-deep in water, in a man-made muskrat house in Montana. From the perch at left, in the Everglades, he made an equally brilliant camera record of the country's only stork, the wood ibis, for another future issue.

Fred Truslow exchanged an office chair for a soggy seat in a nature photographer's blind when he retired in middle life as an executive of a large cable manufacturing company. His doctor had insisted that he take it easy. Since then he has duly relaxed by climbing innumerable trees and other perches, wading hip-deep in icy lakes, and spending 14 successive hours in a blind to make such memorable *GEOGRAPHIC* pictures as those of limpkins, birds of paradise, and whooping cranes.

That Fred Truslow should be devoting his talents to the *NATIONAL GEOGRAPHIC* is hardly surprising. His grandfather joined The Society in its 19th-century infancy, and his grandchildren today are fifth-generation members.

RECOMMENDATION FOR ...AND INQUIRY ABOUT

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Members of The Society roam the world through the pages of their official journal, the *NATIONAL GEOGRAPHIC*. Annual dues of **\$6.50** include subscription to the magazine, and bring frequent map supplements. Members' enthusiastic nomination of friends for membership explains the National Geographic Society's phenomenal growth.

Nonmembers who are interested in joining The Society—but who do not know a member—should inquire (right).

Members and others may make gifts or bequests of money, securities, or other property to The Society for "the increase and diffusion of geographic knowledge." Such gifts are deductible for tax purposes.

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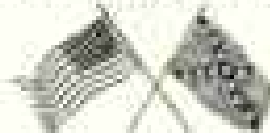
More importantly, you will stand at Gettysburg with your eyes closed, and your mind will be touched by the hand of history, and your spirit will feel the inspiration that gave Lincoln his finest speech.

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MEDIEVAL HOSPITALS—reproduced here in one of a series of original oil paintings commissioned by Parke-Davis.

Great Moments in Medicine

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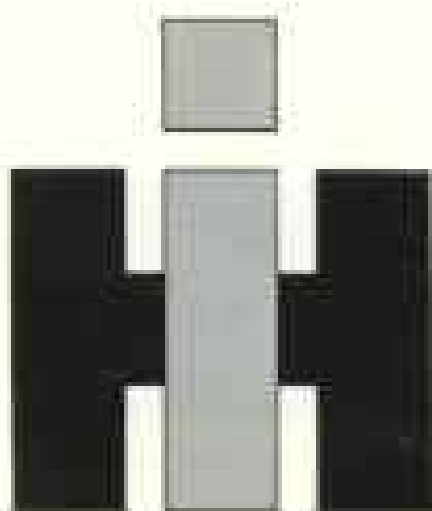
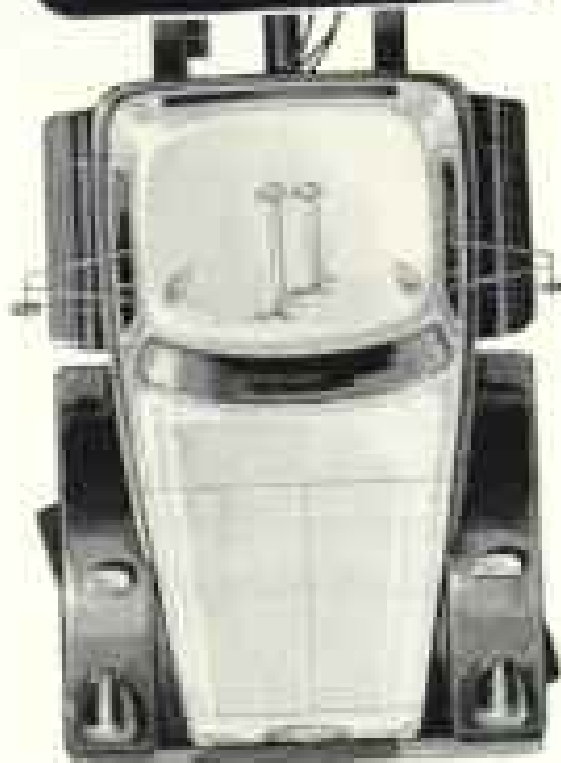
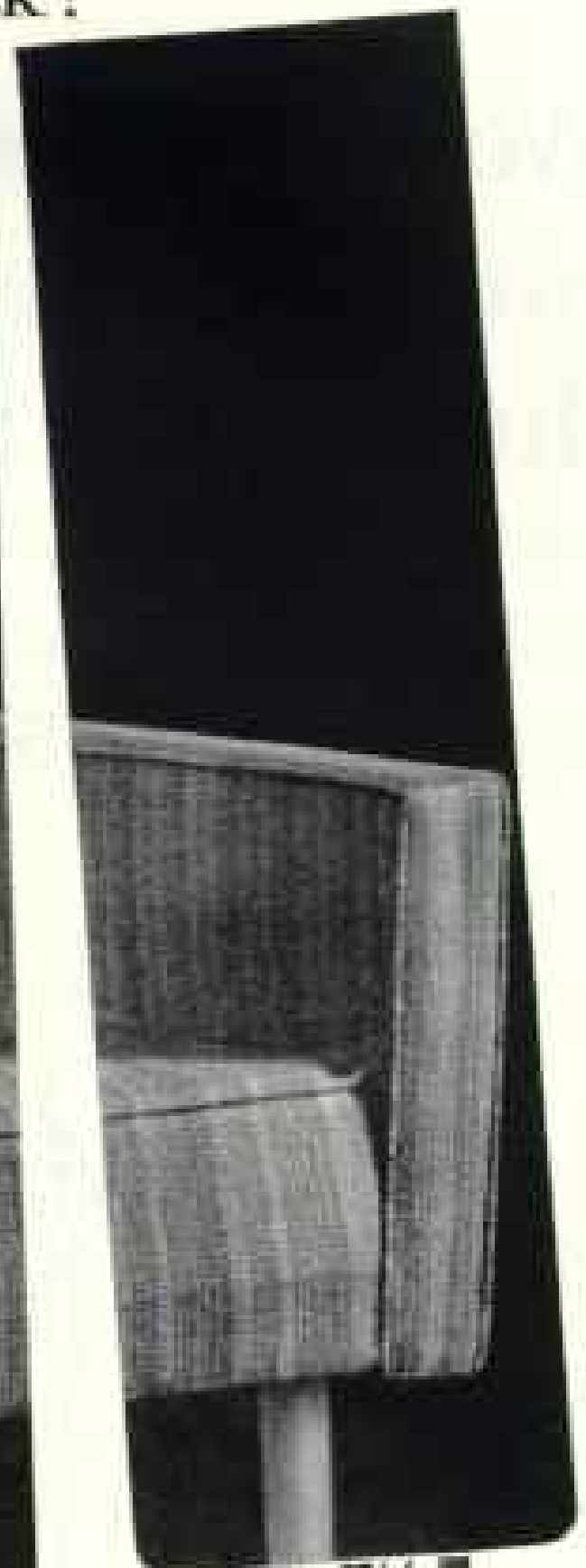
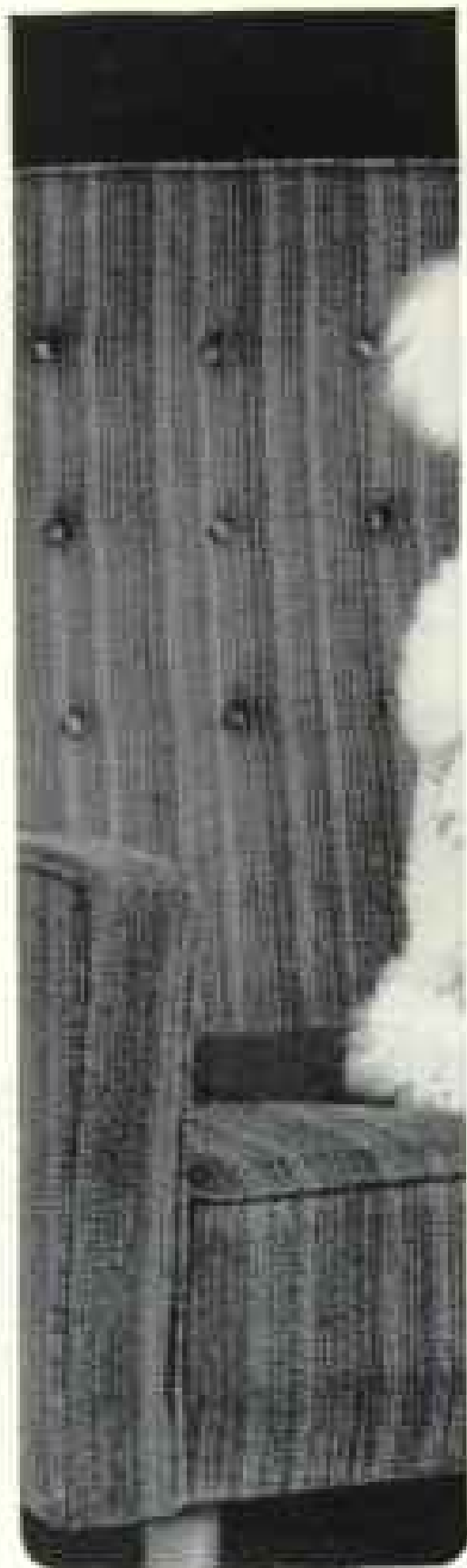
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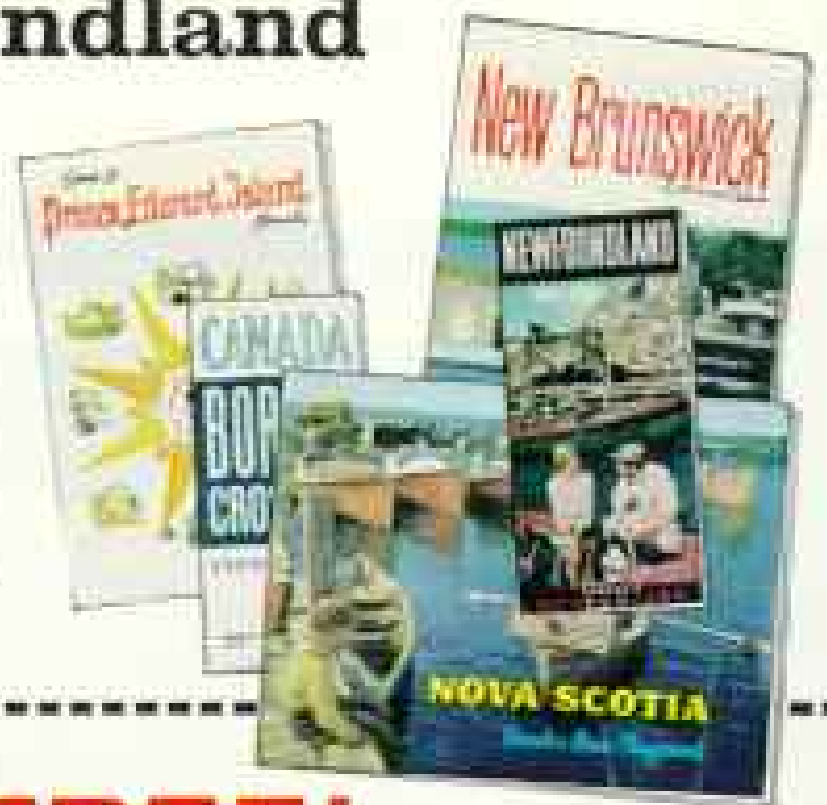
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Watch the sun set on the squid-jiggin' ground in colourful Newfoundland

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No. 6 (continued from NGM April issue)

by Georges Carpari



ALPA Reflex 35 mm

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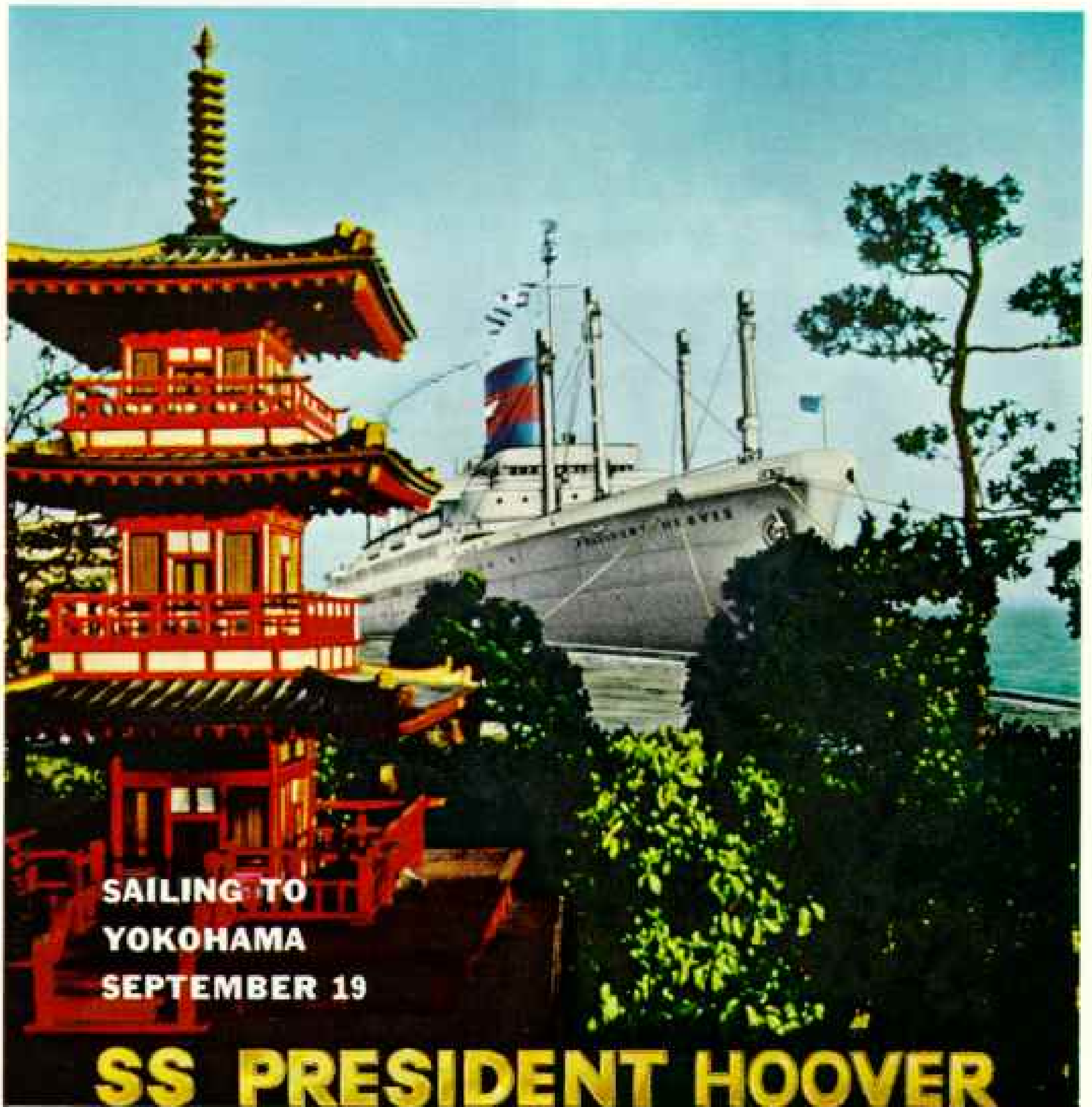
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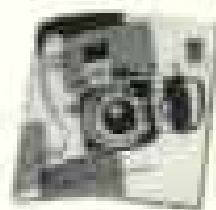
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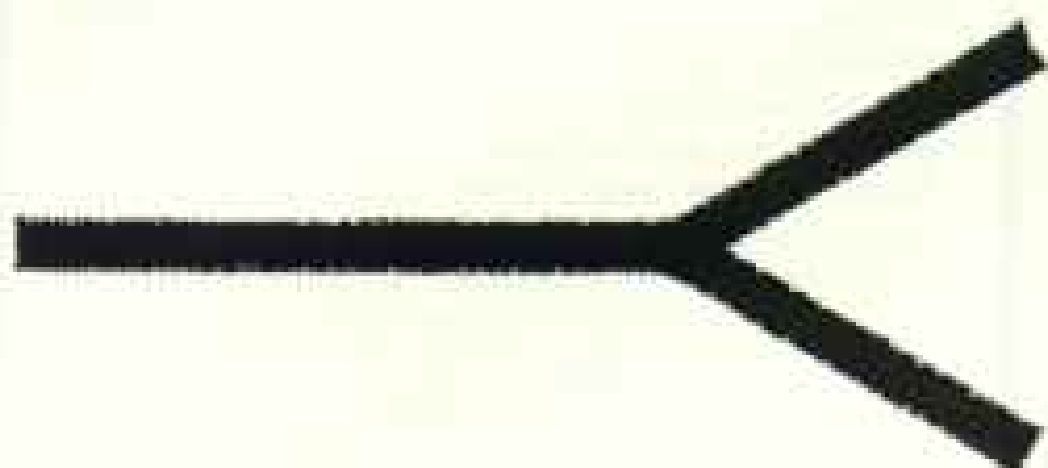
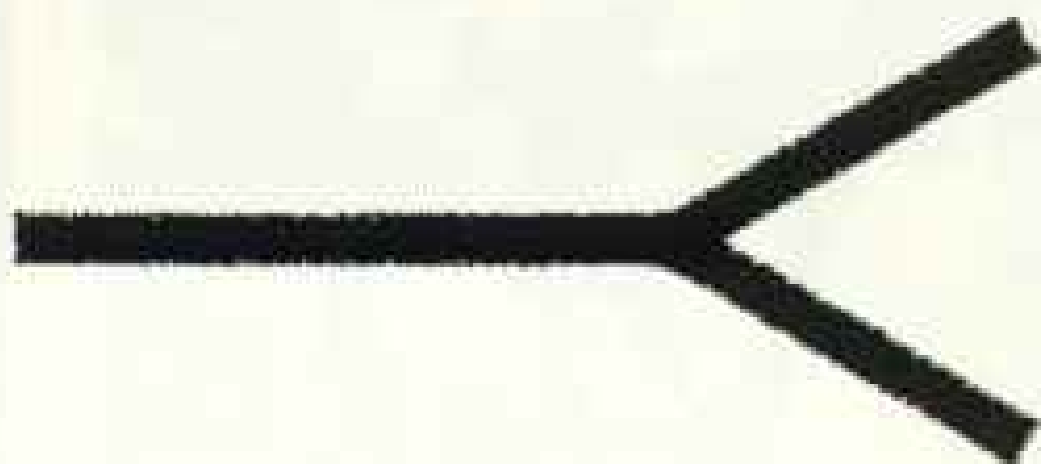
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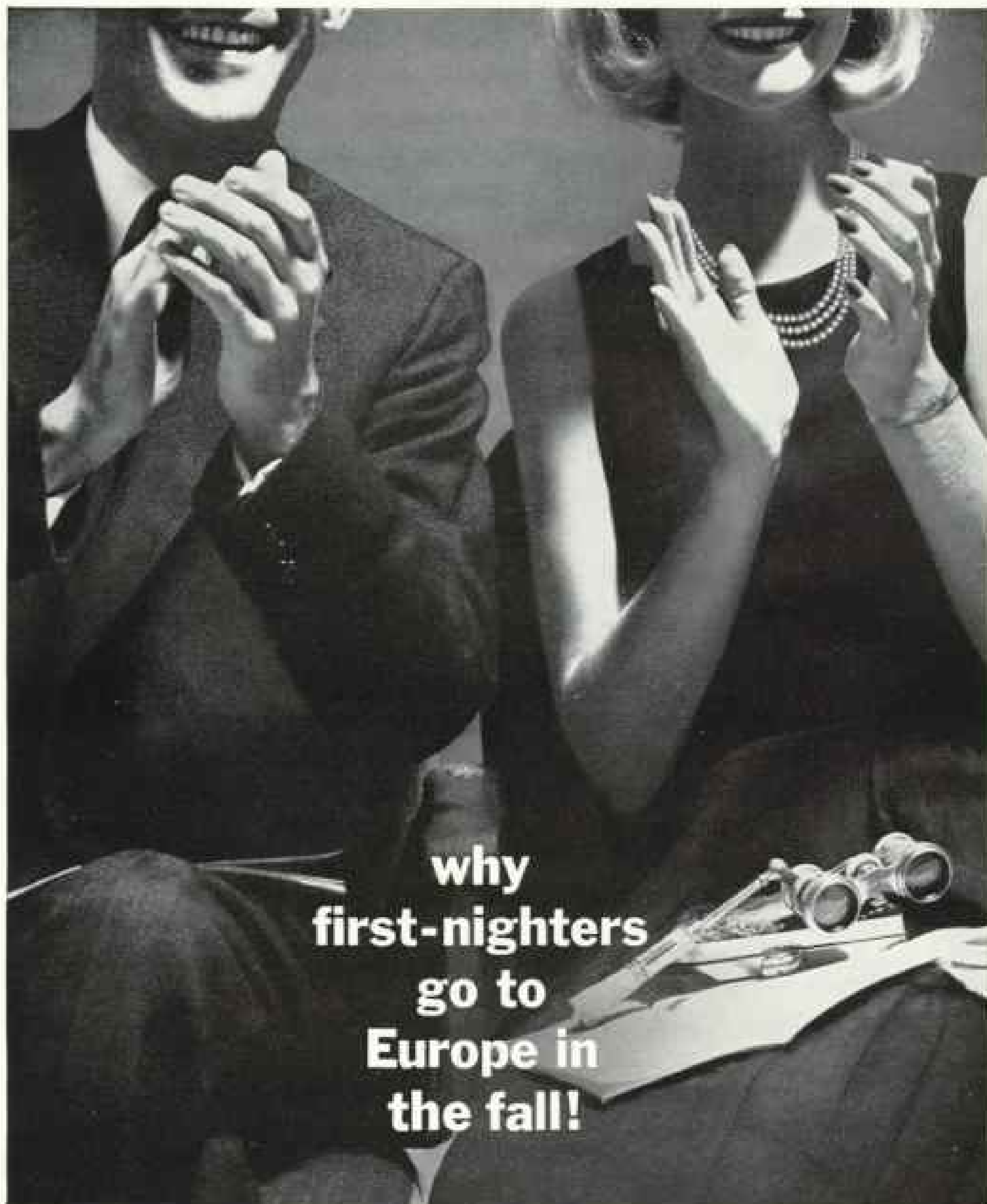
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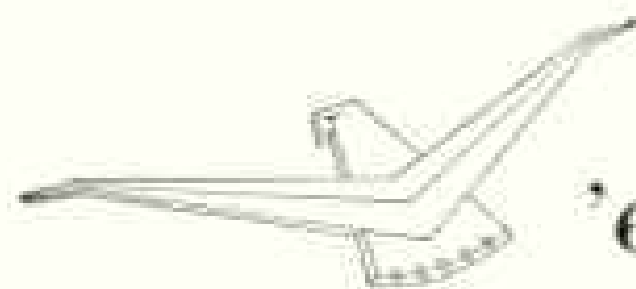
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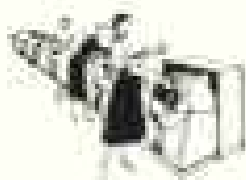


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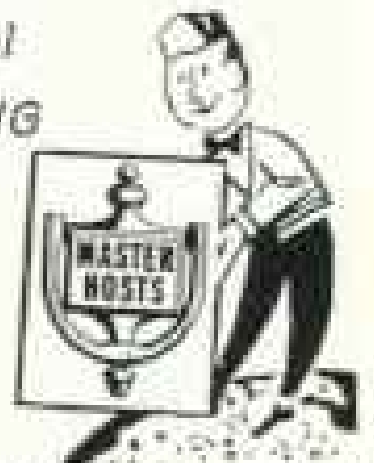
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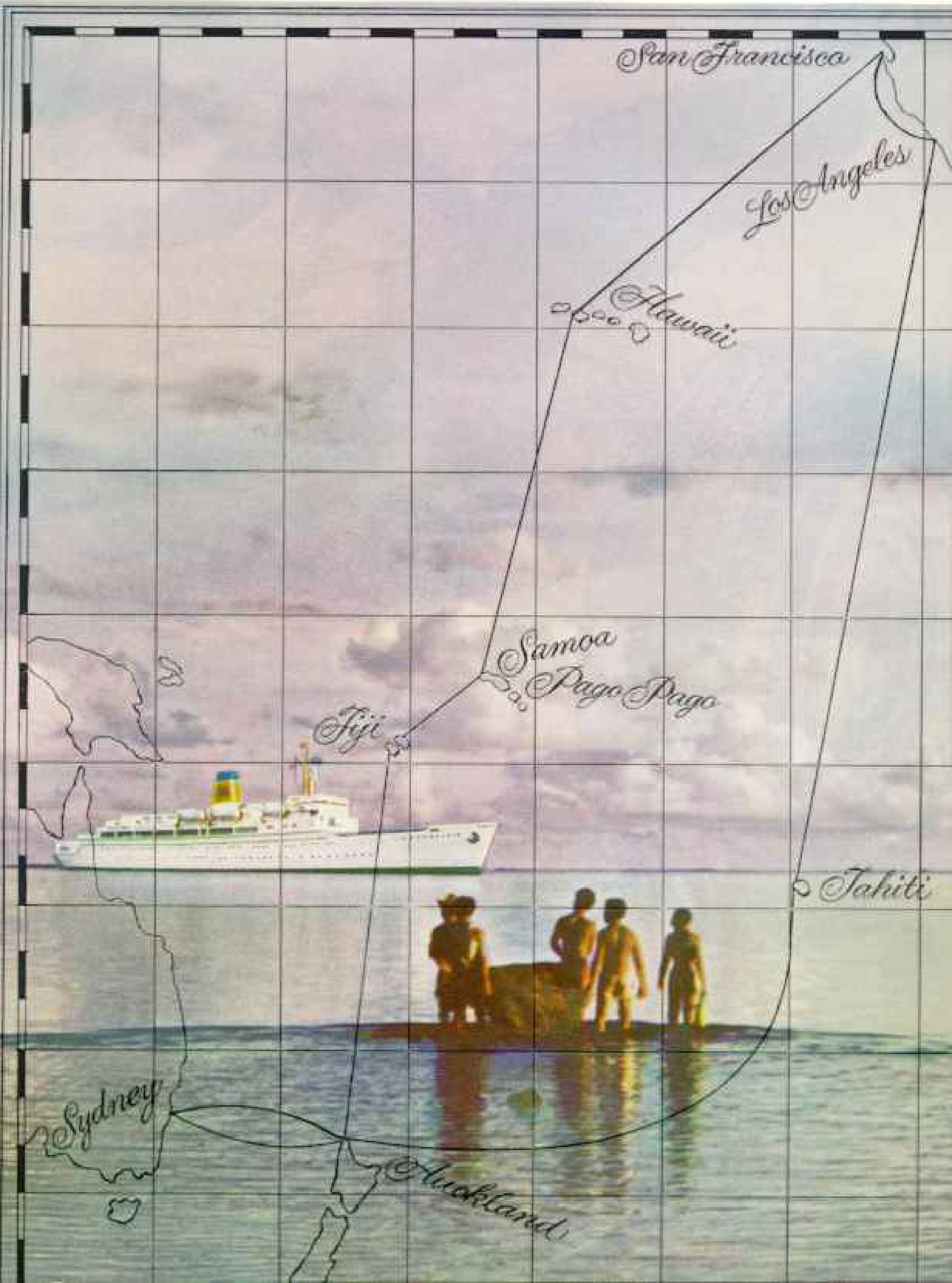
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Be sure your eyes are all right. Have your eyes examined regularly. If you notice changes in vision between examinations, see your doctor for another eye test. To reduce eye strain, wear properly fitted sunglasses, but take them off after dark.

Never drive after drinking. No driver can take much alcohol without becoming a potential menace to himself and to others. Always remember that alcohol and gasoline are a dangerous combination!

Stop when you feel tired. Driver fatigue plays a part in many accidents, especially those that occur at night. With increasing fatigue, driver efficiency falls, until finally, nodding at the wheel results. Accidents that occur when the driver is dozing are generally very serious ones.

Don't drive after taking certain medicines. Sedatives may dull your reflexes; tranquilizers can cloud your judgment. Ask your doctor about the

side effects of drugs, including antihistamines and cold tablets.

On long drives, take turns at the wheel. Share the driving with others—or stop now and then for a rest or refreshment. Prolonged driving—and its attendant eye, muscular and nervous strain—can impair your efficiency without your being aware of it. It's wise for drivers to rest every two hours on long trips.

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VOL. 117, No. 6 JUNE, 1960

*New energies—including atomic—galvanize the Gallic land of
Jeanne d'Arc and Lafayette, of Carcassonne and soaring Chartres*

Eternal France

By WALTER MEYERS EDWARDS

National Geographic Foreign Editorial Staff

Photographs by the author

AN ARTICLE ON ALL OF FRANCE? But it is impossible! We have more than 300 different kinds of cheese alone!" Jean Lurçat, famous painter and tapestry designer, gave a Gallic shrug and arched his eyebrows in mock dismay.

In a way he was right. Julius Caesar divided Gaul into three parts. Today, after 2,000 years of turbulent history, one would need to divide it into many more—into its 35 ancient provinces, for instance—and dwell on each to tell the story of so varied a land. (See 10-color Atlas Map France, Belgium, and the Netherlands, a supplement to this issue.)

Fifth Republic Marches On

In the last decade France has lost a war and a colony in Indochina, struggled through the Suez Canal crisis, and now endures a rebellion in Algeria (page 768). The creaky Fourth Republic, with 24 premiers in 14 years, finally foundered; the Fifth, under President Charles de Gaulle, goes forward under a drastically revised constitution.

The country of the Curies entered the Atomic Age with a bang when her scien-

tists set off a nuclear test explosion in the Sahara last February. At Marcoule, on the Rhône River, France's first atomic energy plant turns out power and plutonium (page 765); in ten years one-fourth of all her electricity may come from fission.

New sources of oil, gas, and hydroelectric power have been tapped to turn the wheels of a lusty, reborn French industry. Factories and mills today pour out twice as much as in prewar years, and at their present rate will nearly double production every decade.

Traditional Franco-German enmity has faded. The two countries are tied together as never before in all-embracing trade treaties.

Minor aspects of French life, too, wear a different look. One development may have set Brillat-Savarin, Escoffier, and other gastronomic immortals to whirling in their graves: housewives buying pastry mixes, cellophane-wrapped bread, and frozen vegetables in supermarkets. Drive-in restaurants sell cheeseburgers—although one may still wash them down with champagne. From the Eiffel Tower sprout television antennas.

How much had all this changed the France

that had so captivated us on previous visits? In a sleek new Citroën sedan and armed with Michelin maps and guidebooks, my wife, Mary, and I set out from Paris in search of the answer. In four months we drove 11,000 miles.

What better place to begin than Chartres? The city of the magnificent cathedral is only a two-hour drive from Paris. From the rich wheat plain of the Beauce we could see the two spires miles away piercing the sky. Then, as we threaded narrow streets, they vanished until we emerged on the tiny shrubbery-lined square in front of the main façade.

Entering by the sculptured royal portal, we joined a throng marveling at the incomparable 12th- and 13th-century stained-glass windows.

"The cathedral suffered very minor damage during World War II," said our guide, Jean Villette, a local artist. "The glass was removed at the start of both world wars. Last time, it took forty men about ten days."

We followed him up the spiral stairway in the "new" tower—actually the older of the two.

"The first Christian church here was built in the 4th century, probably on the site of a Roman temple," Monsieur Villette told us. "Four centuries later, fire destroyed it. A new structure was built, and again it burned down. Several times this happened."

Nobles and Peasants Helped Build Chartres

After the last disastrous fire, in 1194, rulers all over Christendom sent generous gifts to rebuild the cathedral. Those who could not contribute money gave their labor; many gave both. For 25 years rich merchants and nobles, gentlewomen and monks worked side by side with laborers and peasants until the main structure was completed.

"Certainly there is something of the beauty of music in the sublime proportions of the façade of Chartres," wrote Henry James. But because of the narrow square, he experienced the same difficulty as I in trying to back away and view the towers. "The proper way to look at the towers would be to go up in a balloon and hang poised, face to face with them, in the blue air," he said. I achieved the same result later in a helicopter (page 736).

From the 377-foot spire we looked down on the great flying buttresses and out over brown gabled roofs to the fields beyond.

"No French cathedral is ever really completed," remarked Villette, pointing out several massive square towers below us, obviously designed to support additional spires.

A day's drive westward, we found ourselves in a remote enclave with a heritage not Gallic but Celtic. Brittany still retains much of the culture of Celts who were driven from the British Isles 1,500 years ago.

More than a million people speak Breton, a language akin

Symbol of France, the Arc de Triomphe soars 160 feet above the rain-glistening streets of Paris. Begun by Napoleon in 1806, the memorial stands in the Place de l'Étoile, hub of 12 converging avenues. Silhouetted against the floodlighted arch, young lovers embrace beside an advertising kiosk.





GEVEOR

GEVEOR

LA VIE
PARISIENNE

CHATEAUX

VERMOREL

LINE PENNIN

ATELAN

ROBIN

SIGNOR

MAD MARY

ATELAN

to Welsh and Cornish across the Channel. They share with the Cornish a common folklore and love the tales of King Arthur and the Round Table. Traditional dances, costumes, and music are kept alive by scores of Celtic clubs.

Through mist and drizzle we had passed gradually from a bountiful land of flourishing farms, over rolling, vine-clad hills, to poorer heathland where hedges and stone fences enclosed tiny fields. Here little thatched stone dwellings, like the crofters' cottages of Scotland, huddled snugly against gorse-covered hillocks for shelter from the Atlantic wind. Almost three-quarters of Brittany's people make their living on farms, growing a wide variety of produce or raising dairy cattle.

A few days in the picturesque fishing port of Concarneau and the surrounding Cornouaille (Cornwall) district gave us glimpses of the sturdy folk who provide a generous share of the sailors for the French Navy.

Late one sunny afternoon the inner port of Concarneau, protected from the sea by an old walled town on an islet, was alive with color and activity. Diesel trawlers came and went. Fishermen in bright-yellow oilskin aprons unloaded trays of small fish, bucket-brigade fashion, to be sold on the quay.



Sugar-loaf coif, of starched lace and muslin, caps a sun-tanned Breton woman. A plastic cover protects the towering headgear on rainy days. The woman spends



her summers in Chartres selling handmade lace doilies and tablecloths. Here she holds a mirror while the author's wife, Mary, tries on a velvet skullcap.

Fishermen wrestle bait aboard a sardine smack in the crowded port of Concarneau. Sardines, which shoal off Brittany from June to November, are lured to the surface with a blend of peanut meal and cod roe, then taken by net. Each August the town observes the *Fête des Filets Bleus*, a festival named for the blue nets traditionally used to make the catch.



Coifs bobbing on bowed heads, holy banners borne on high, pilgrims march in a

A knot of fishermen lowered a heavy barrel to the deck of an outbound craft. A weathered salt removed his pipe and explained: "Sardine bait—peanut meal and cod roe. We get it mostly from Norway."

The nets piled on the deck of the sardine boat were bright blue, a fact we recalled one evening when we learned that the name of the local Celtic club was *Ar Rouédou Glas*, Breton for "the blue nets" (page 732).

One evening we watched a dozen couples, boys in large black broad-brimmed hats and girls in stiffly starched white lace coifs, rehearsing lively dance steps to the skirl of bagpipes, reminiscent of their Celtic forebears.

"They are doing a gavotte, the mother of the Breton dance," said Yves Hervé, the club president. "When they advance and withdraw in line like that, with arms linked, it represents the waves on the beach."

"Those coifs do resemble plumes of white sea foam," said Mary. Only that afternoon we had sat watching the waves crash against the granite of the Pointe du Raz, the wild land's end of Brittany.

A few miles out lay the little Ile de Sein, whose dauntless fishermen a few short years before had escaped the Nazis by sailing to England. There they carried on the fight in the Free French forces of "Le Grand



SCULPTURE BY HELENE JEANBAHI, PUBLISHED IN LA BRETAGNE, ÉDITIONS SUD, PARIS

Breton *pardon*, or religious fete, in which the devout beg forgiveness for sins

Charlie," the tall general who would later become their President.

Dauntless, too, were the Bretons who remained behind to endure Allied bombardments and to rebuild their shattered towns when the ordeal was over. We marveled at what had been accomplished in Lorient, the bomb-flattened lair of a German submarine pack.

The elaborate commercial fishing installations have been repaired, new churches of modern design have risen, and large blocks of attractive flats have replaced all but a few of the temporary postwar shacks.

A few days later and 150 miles away we found ourselves transported four centuries

back in time. Roaming among the 30-odd chateaus of the Loire, we could not have escaped, if we had wanted to, grand visions of Renaissance court pageantry. Amboise, Blois, Chambord, Chenonceaux—these royal palaces conjured up the extravagant brocaded ghost of Francis I, the French monarch who epitomized the 16th-century love of the arts, gallantry, valor, sports, and luxury.

At the great Château d'Amboise, high above the Loire, Francis spent his boyhood. After his coronation at 20, Amboise became the scene of brilliant festivals, balls, and tournaments. Once, during a wild-animal fight on the terrace, a fierce boar dashed



Lace collar flares like an angel's wings from the shoulders of a Breton girl. Intricate collar and colf require a day's ironing. On her bodice is the sign of her Celtic club, "The Blue Nets" of Concarneau (page 730).

into the living quarters. The intrepid young king dispatched it singlehanded.

We saw in the castle grounds the charming little Gothic chapel of St. Hubert, which holds the remains of Leonardo da Vinci. Francis I brought the Italian genius to Amboise, where he passed the last years of his life, contributing ideas probably now enshrined in the stones of some of the Loire castles.

The king was not satisfied with rebuilding Blois to suit his taste. He wanted a house he could call his own, a little place in the country, a hunting lodge: Chambord.

We had heard it was big, but we weren't prepared for what we saw. This white stone pleasure palace holds 440 rooms; built on the plan of a feudal fortress, it sprawls 510 feet long by 384 feet. Leonardo perhaps had a finger in this, too, for it is richly decorated in Italian Renaissance style.

It was Chambord's conservator, Paul Robert-Houdin, who presented here in 1952 the first of the "Sound and Light" spectacles that have become such popular entertainment at historic sites throughout France, producing funds for their maintenance.

We saw our first such show from the fields of a hospitable farmer across the River Cher



Crash-helmeted Junior Joins Maman on a Scooter Vacation

During good weather, especially in the traditional travel month of August, Frenchmen take to the highways on millions of bicycles, motorcycles, and motor scooters. Close to Cahors, in the south of France, the author encountered this young woman and her son bound from Paris to Spain.

from Chenonceaux (page 735). Powerful floodlights waxed and waned, bathing the chateau in shifting light.

Over a stereophonic sound system, recorded voices with a musical accompaniment told how Chenonceaux was acquired by Francis I and how, years later, his son Henry II presented it to his mistress, Diane de Poitiers.

They told of sweet revenge, when, after Henry's death, his Florentine wife, the notorious Catherine de Médicis, forced her rival to yield her cherished castle. We heard the sounds of revelry at one of Catherine's festivals, the noise of carriage wheels and horses' hoofs as guests arrived, and the voices of the guests of honor, frail Francis II and his soon-to-be-widowed wife, Mary Queen of Scots.

On the way to the Massif

A King's Grand Staircase Spirals Three Stories up the Château de Blois

Once a grim feudal castle guarding a Loire crossing and now a *monument historique* open to the public, the chateau served as the residence of French monarchs in the 15th and 16th centuries.

Within its cold halls linger memories of intrigue and murder. Catherine de Médicis' room contains secret cupboards behind carved panels. On another floor, the ambitious Duc de Guise was slain by hirelings of Henry III.

Under Francis I, Blois became the Versailles of the Renaissance. The Cavalier King surrounded himself with scientists, poets, and artists. Francis' salamander insignia is repeated again and again in the intricate carving of the Grand Staircase, from which courtiers watched the arrival of important guests.





FENNO LACIDE, BLAIR STAR

Crusty loaves, at times as unwieldy as firewood, bang the knees of a proud errand-goer. French housewives buy this bread unwrapped. Only the durable crust protects it on the journey home.

Central, we paused for a day in the lush, green pasture country south of Nevers. M. Emile Maurice, mayor of the little commune of Lury-Levis, had promised to show us some of the remarkable Charollais cattle, whose name on a French menu means the best of beef.

With M. Maurice and a South African cattle buyer, we plodded through fields of rich grass to see a herd of handsome cows, sturdy calves, and a huge six-year-old bull named "Intrigue." In the barnyard, as he carefully examined a fine three-year-old bull that weighed more than 2,400 pounds, the South African kept muttering "Fantastic."

"In my opinion," he said later, "no other

cattle put on meat so rapidly. They have strong, wide mouths and eat large quantities of fodder. The carcass is well boned and gives a maximum of good, juicy meat. This is the finest breed of beef cattle I know of."

The mountainous south-central region of France, a volcanic land of scenic surprises, deserves to be better known by tourists who, after "doing" Paris, often rush straight to the Riviera, as if nothing worth noticing existed between them. To this end, as a sequel to the bicentennial of Lafayette in 1957,* much effort was being spent on improving hotels and restaurants, and "Route Lafayette" signs had been erected to attract motorists. Highland villages, like medieval Conques and cliff-hung Rocamadour, where our baggage was hoisted vertically to our hotel on a rope, are easy to reach.

Chateaus Guard Tranquillity and History

We enjoyed especially the lofty Château de Mercuès, near Cahors, one of several castles recently converted into hotels.

As we sat reading in the sunlit garden on a day of unforgettable tranquillity, a lizard scurried along the balustrade. Cicadas chirped. Cedars poked their pointed caps above the terrace wall to frame a patchwork of fields sloping gently toward wooded hills. Below, the River Lot cascaded soothingly over a low dam and curved away through an avenue of willows and poplars into a darker mass of trees. The scene was little changed from that enjoyed by the bishops of Cahors, who resided here for more than three centuries.

In a wilder region, near Le Puy, stands the Château de Lavoûte, summer residence of Prince Jean de Polignac. We stayed at a little inn with excellent cuisine that has been opened on the grounds.

In the grand salon of the castle one evening, with a gallery of ancestors' portraits eyeing our every move, Princess Madeleine de Polignac opened a glass case of prized family souvenirs. Among them were the map of the environs of Paris that Louis XVI always carried when hunting, and six letters from Queen Marie Antoinette, written just before her execution, to Duchess Yolande de Polignac, her intimate friend. The French Revolution had never seemed quite so real to me.

The next morning brought us back to 20th-century reality as we saw the Polignacs drive away for a picnic with their son and two

* Howell-Walker tells of the French soldier's background in "Lafayette's Homeland, Auvergne," *NATIONAL GEOGRAPHIC*, September, 1957.



EDUARDO DE LUIS/REAGLT © NATIONAL GEOGRAPHIC SOCIETY

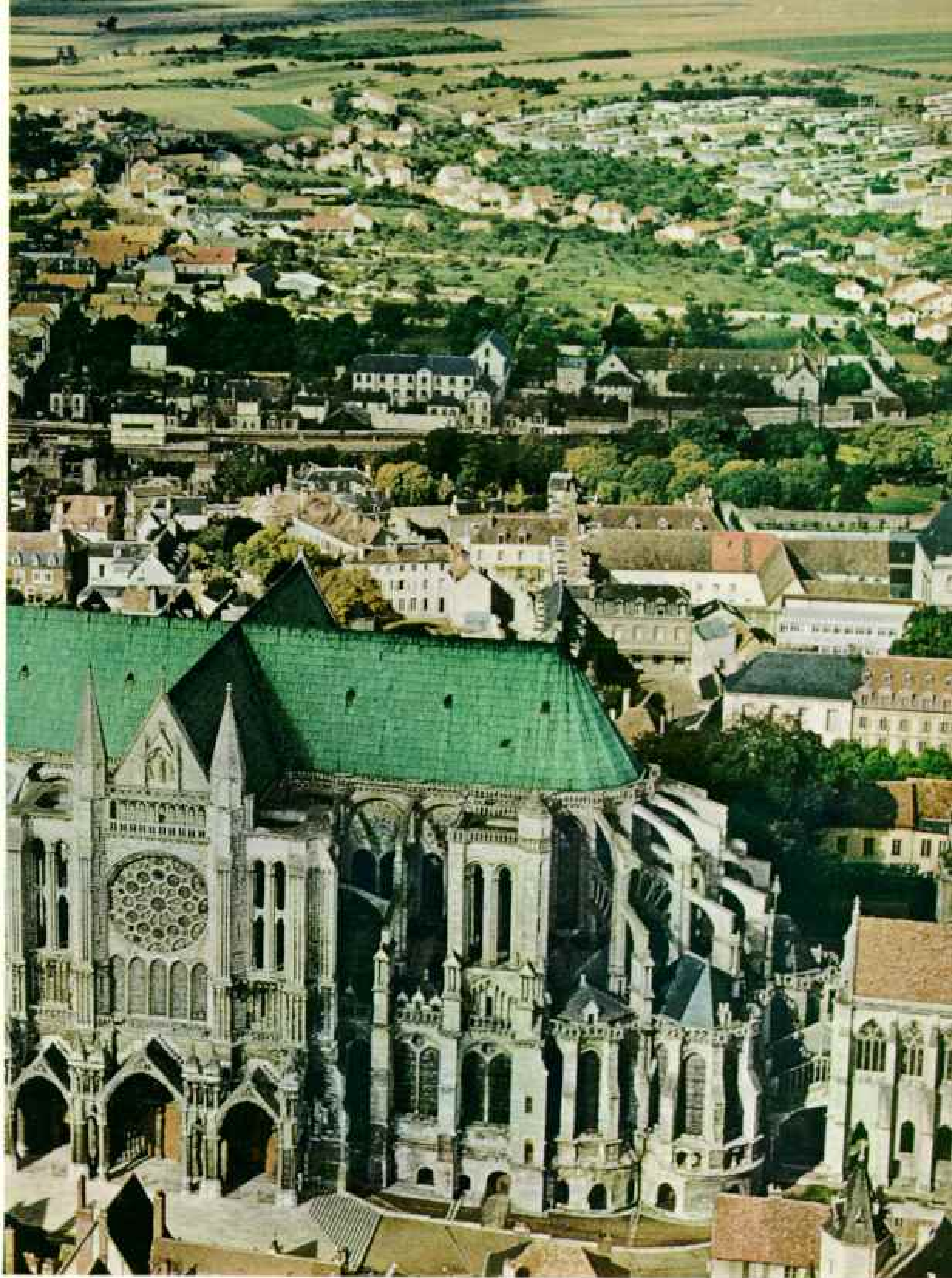
Chenonceaux Bridges the Cher; Royal Ladies Laid Out Its Flaglike Gardens

The four-century-old chateau flourished under two famous hostesses: Diane de Poitiers, mistress of Henry II, and Catherine de Médicis, Henry's widow, who evicted Diane Louise of Lorraine, the "White Queen," retired to mourn here when Henry III died.



Chartres Cathedral: Rodin Called This Gothic Masterpiece the Acropolis of France

Several earlier shrines stood here before a great surge of religious fervor raised this cathedral in the late 12th and early 13th centuries. The preceding church, ravaged by fire in 1194, con-



REIMS CATHEDRAL © NATIONAL GEOGRAPHIC SOCIETY

tributed the main façade and the two towers, now topped by totally dissimilar spires—Romanesque (left) and Gothic. Some 4,000 statues embellish the exterior. The 174 stained-glass windows in-

clude several roses; one shows here above the south transept's triple doors. Crowded houses block an over-all view from the ground; the author made this picture from a helicopter.

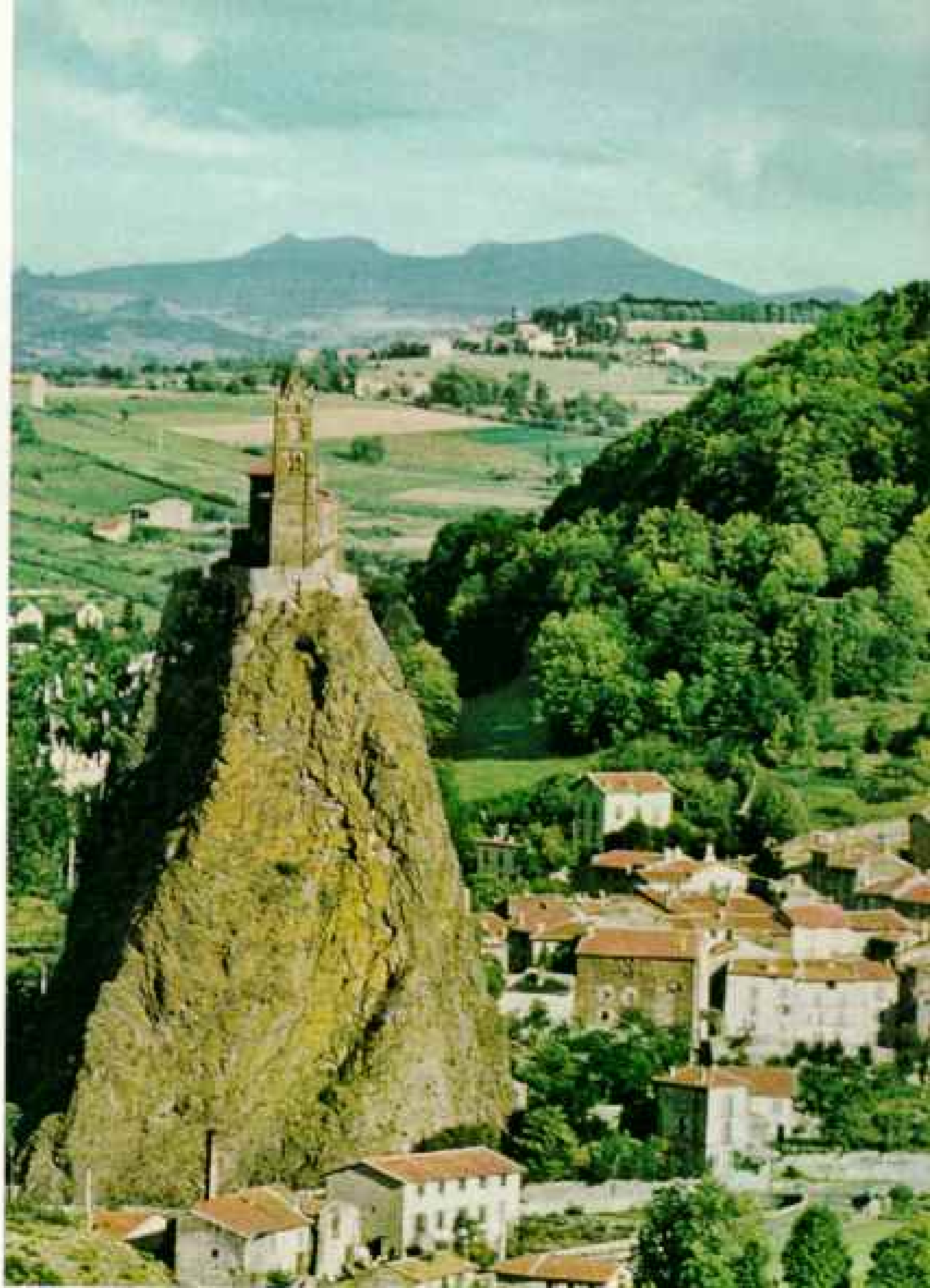
Church and Statue Cap Volcanic Plugs Overhanging Le Puy

An ancient center of the lacemaking industry, Le Puy means "the Peak" in the Auvergne dialect.

St. Michel's Chapel, ten centuries old, crowns the volcanic exclamation point at left. Visitors to the 280-foot summit climb 267 laborious steps. Residents call this spectacular outcropping *Aiguille* (the Needle) because of its prominence.

Corneille Rock (center) bears a lofty Madonna and Child cast from 213 Russian guns captured during the Crimean War.

During the Middle Ages, great pilgrimage crowds flocked to the Cathedral of Notre Dame du Puy (right) to venerate a Black Virgin reputedly taken from Egypt by Louis IX.



daughters in a two-horsepower Citroën—the humblest, homeliest, most popular car in France.

"A superb car!" a Paris taxi driver once described it to me. "It goes anywhere, costs almost nothing to run, and never gives any trouble. It's like a homely wife who's a good cook and very agreeable to live with."

Le Puy had changed little since our 1950 visit.* The strange old cathedral, with its multicolored Moorish masonry, the bronze Virgin on Corneille Rock, and the chapel of St. Michel standing atop a volcanic pinnacle still drew thousands of pilgrims.

The near-by feudal fortress of Polignac still guarded its brood of red-roofed houses. In the warmth of an idyllic afternoon, the tidy, open fields teemed with activity. Ox-carts creaked and rumbled. A sturdy woman

and a little boy sowed barley and plowed it under with two white cows. An old woman washed sheets in an outdoor laundry. An attractive miss sat watching her cows, crochet needles dancing in her busy fingers. Her shaggy shepherd dog trotted around importantly, and a pet goat tried to eat her skirt. No, things had not changed here since our last visit; perhaps not for centuries.

Fields That Feed Half of France

But French agriculture is not all primitive. It is actually more productive, acre for acre, than our own, although it takes five Frenchmen to feed ten, while one American farmer does the same job. The fertile plains between Flanders and the lower Loire, worked

* Charms of the Le Puy region are described in "France's Past Lives in Languedoc," July, 1951.



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with modern machinery, feed half of France.

One great problem is the divided ownership of the land. Fields are often too small to permit economical use of tractors.

France's more than two million farms average 36.3 acres in area, but fully two-thirds of them make up only 15 percent of the total farmland. Subdividing these small properties to produce a variety of crops creates a picturesque but inefficient patchwork of tiny fields.

Some owners are now merging their properties. Cooperative ownership of machinery helps others. France had only 30,000 farm tractors before the war; now it has more than 500,000.

We arrived in Carcassonne, as we had once before, in time for the Bastille Day celebration on July 14. Having written ahead, we had barely reached our room in the Hôtel

de la Cité before we were invited to see the mayor. Thanking the NATIONAL GEOGRAPHIC for its pictures of the Cité in July, 1951, he asked what he could do to help us this time. When I explained my wish to photograph the fireworks, he recommended the vantage point of a certain tower. I asked if it had a window facing the Cité. He thought it over.

"I'm not sure," he said. "Well, if not, we'll make one for you!"

Children Delight in Glorious 14th

Bastille Day is the French Fourth of July, and the children, of course, enjoy it most. Wide-eyed and delighted, they watched the military parade, unaware of the heartaches of some who had lost sons or husbands, perhaps in Algeria only a short time before.

In the afternoon in the park of the Lower

Town, the associate mayor displayed real talent as master of ceremonies for the children's games. He held the youngsters in rapt attention as he announced the rules of a treasure hunt, encouraged the timid in a singing competition, refereed an explosive balloon-inflating race, and urged the participants to a world record in an éclair-eating contest.

In one event little boys had to strip to their underwear, run around the park, and dress again. In their absence their clothes were scrambled. There must have been a practical joker in the crowd. After the race the largest boy went home minus trousers.

Larger Families Encouraged

Children number among the greatest assets of a nascent France, a fact appreciated by the government. In 1940, with the country engulfed by war, it followed a kind of premonition in creating a Ministry of the Family, which encouraged larger families by paying increasing subsidies for each child.

The resulting "new wave" of young people has created many problems of housing, employment, recreation, and, above all, education. To seek solutions, a High Commission for Youth and Sport has been established under Maurice Herzog, whose heroic exploits on Annapurna brought glory to French alpinism and guaranteed his prestige with the young.

With the mayor's permission we watched the fireworks not from the tower but from a point below the ramparts, almost on the firing line. For an exciting 20 minutes rockets flashed, bombs burst, and the towers overhead shone in the glow of green and red flares. A dog, inspired by an extra-loud salvo, fled past us into the night. A Niagara of white fire rained down from the wall behind us. Then 50 ear-splitting detonations in quick succession and a concentrated barrage of colored umbrella bursts, called a bouquet, signaled the end.

Silence fell. The massive old fortress receded into the gloom. Carcassonne's ghosts—victims of 13th-century religious struggles, of Franks and Visigoths, and even of Romans—could haunt it in peace for another year.

Roman remains abound in France, and the richest concentration lies in the area we now approached, in a triangle roughly comprising the Rhône Delta, made by drawing two lines to the sea from Orange, through Nîmes and Aix-en-Provence.

Here we saw once more the famous theaters

and well-preserved arenas of Orange, Nîmes, and Arles, and the Greek-style temple in Nîmes, known as the Maison Carrée. At St. Rémy a tall, graceful mausoleum believed to have been built by Caesar Augustus intrigued us. And at Vaison-la-Romaine we explored a recently uncovered French Pompeii. Two months later a disastrous storm washed out all bridges over the River Gard except the one that abuts the Pont du Gard, the time-defying Roman aqueduct that supplied water to Nîmes 20 centuries ago.

During the past 12 years, archeologists have made tantalizing discoveries of both Roman and pre-Roman culture in this area, but shortage of funds has retarded full excavation. We saw examples of the finds at the Archeological Museum of Marseille. Professor Fernand Benoit, Regional Director of Antiquities, pointed out two life-sized statues squatting like Buddha.

"The first pre-Roman figurative art found in France," he said. "We recently discovered several at Entremont, the capital of the Ligurian Celts in the 3d century B.C. We found two more at Roquepertuse. They are among our most important exhibits here."

Of special interest to us was a display of black Campanian dishes, cups, vases, and lamps from the Greek galley sunk off the Ile de Grand Congloué and excavated by our good friend Capt. Jacques-Yves Cousteau.*

The ship that carried this ancient wine cargo sank some 2,200 years ago, just 10 miles from port. Perhaps she foundered in a mistral—the formidable wind that roars down the Rhône Valley from the mountains.

Wind Gives Name to Fastest Train

This violent storm sometimes lasts for four days at a stretch and is the occasional exception to the idyllic weather that is the fortune of Provence. That France's fastest train bears the name "Mistral" testifies to the wind's velocity. In the papal palace garden at Avignon we saw great pines forever bent by the mistral. Farmers grow windbreaks of cypress trees or bamboo thickets to save their soil from blowing away, build houses with windowless north walls, and pile stones on their roofs to hold down the red tiles.

We crossed their fertile, irrigated land many times during the next few days. Trucks

* Captain Cousteau tells of these relics in "Fish Men Discover a 2,200-year-old Greek Ship," NATIONAL GEOGRAPHIC, JANUARY, 1954.



PHOTOGRAPHE BY BERT DUNN, FROM MARRIUS PHOTOS © NATIONAL GEOGRAPHIC SOCIETY

Artist's model strikes a pose in a Montmartre studio. Memories of Van Gogh, Renoir, Gauguin, and Toulouse-Lautrec haunt this ancient quarter, whose steep streets overlook the heart of Paris from a hill on the right bank of the Seine.



Harvesters attack a golden field of wheat near Carcassonne. Turrets

piled high with crates labeled "*primears*" (early vegetables) and "*melons*" passed us everywhere, especially in the vicinity of Cavaillon. During our stay in France, we each must have eaten our weight in delicious cantaloupes grown mainly in this area.

Vineyards cover many a slope in Provence, and fruit trees are abundant. The disastrous freeze of February, 1956, however, had killed more than half the olive trees. Some were centuries old. It saddened us to see row upon row of gnarled, twisted shapes, like a grotesque, motionless army.

Olive Growers Switch to Other Crops

Near the Fontaine de Vaucluse, on a small *domaine*, or country estate, we talked of this with M. Henry de Lucenay, who sells agricultural spraying and dusting equipment.

"It was a cruel blow to the olive oil business, which was very important around Salon and Aix-en-Provence. Provençal cooking, as you know, is based on olive oil. Now most of it comes from Tunisia," he said.

An olive tree must be at least seven years old before it can bear fruit. Few farmers can afford to wait that long. So they have been planting cherry, almond, apricot, and apple trees—about 40,000 a year in the department of Vaucluse alone. Ingeniously, they "dig"

the planting holes with explosive charges.

"A small cartridge not only makes a hole of about a cubic meter, but it loosens six times that much ground around it, so the roots can spread easily," de Lucenay said. "Results have been spectacular. They'll be marketing apples in three or four years."

The so-called Fountain of Vaucluse, really a huge spring at the base of a cliff, is the source of the River Sorgue. In an unsuccessful attempt to sound its depths, using Aqua-Lungs, Captain Cousteau and Frédéric Dumas almost lost their lives in 1946. In winter and spring the water gushes out in enormous volume, but when we saw it a mere trickle overflowed from the dark, mysterious throat. We learned its operation, however, from a working model in the little speleological museum of Norbert Casteret.*

We were thrilled by his exhibit of stalactites and fairylike crystal formations, the fruit of 30 years of prospecting in a thousand caverns. There are more than 300 formations, some jewel-like, some amusing, some extremely delicate, some fantastic—spirals, volutes, needles, flowers.

"Most of them appear to defy physical and

* Monsieur Casteret takes readers underground in "Probing Ice Caves of the Pyrenees," NATIONAL GEOGRAPHIC, March, 1953.



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and battlements of the medieval citadel were restored a century ago

chemical laws," M. Casteret told us. "They are mineralogical enigmas."

The calcareous mountains in southern France are honeycombed with caverns, and you might even say that the first modern "cave man" was a Frenchman. E. A. Martel pioneered in speleology, a fact commemorated by a bronze bust in the depths of the Gouffre de Padirac in the Dordogne region.

This huge chimney is 114 feet wide and 246 feet deep. After going down by three elevators, we joined an army of lively schoolboys and a flotilla of flat-bottomed boats for a short, wet river voyage. The cave is alive with water dripping freely everywhere; hence its formations still grow imperceptibly.

Baumanière Epitomizes Provençal Charm

From cave exploring we turned to Avignon and the pleasures of the palate. A dozen miles south of the city we found the Oustau de Baumanière, famed as one of the best restaurants in France.

Here proprietor Raymond Thuilier has created a shrine for gourmets. This appears to be his recipe: Take a group of low, red-tiled buildings, decorate them with vaulted ceilings, rich hangings, wrought iron, and shining copper; add plenty of flowers;

Add a swimming pool and flagstone walks;

sprinkle with petunias and oleanders. Add warm sunshine and balmy breezes; serve with the wine of enchantment. Like olive oil, garlic, and tomatoes in a Provençal dish, these ingredients are essential to the flavor of the Baumanière.

Above the restaurant towers a great finger-like rock capped by a ruined castle—Les Baux, once a stronghold of powerful feudal lords. But we found the place even more impressive as a bastion of *la grande cuisine*. Everything we ate—from lobster bisque through subtly seasoned lamb to delicate almond-flavored sweets—convinced us that the Baumanière richly deserved its three-star rating in the *Guide Michelin*.

M. Thuilier, a truly great restaurateur who gave up law at middle age to dedicate himself to the kitchen, imparted to us a few of his principles of good cookery.

"It must be done with the head," he said. "One uses, of course, only the very finest ingredients obtainable. And no matter how elaborately prepared, the main element must not lose its identity. Chicken must still taste like chicken."

The proprietor in countless French restaurants is also *chef de cuisine*. Seldom did we meet one who did not enjoy his work.

"The profession is the best in the world," 745

an innkeeper near Lyon told us, "when you are reconciled to being the slave of your clients. They come not like patients to a doctor, but to enjoy themselves. After eating well, they are in good humor and praise the *patron*. It is like receiving friends all day long."

In Grasse, the perfume capital of France, we encountered another profession peculiarly combining art and science. Molinard, one of the larger concerns, regaled us with delightful odors as we followed the processes for obtaining essential oils. The final step of one process—low-pressure, low-temperature distillation—produces three qualities. The finest they call the "heart." Then comes the "head," and, finally, the "tail," which is used in soap.

Perfume oils come from all kinds of aromatic substances: bark, roots, leaves, seeds, wood. Grasse specializes in essential oil of flowers—lavender, jasmine, rose, narcissus, jonquil, violet, tuberose, mimosa—which forms

Drainage Ditches Cut Pie Slices in the Dry Lake of Montady

Roman soldiers fished in the shallow water that covered this plain in Languedoc, near Béziers. Thirteenth-century landholders drained the swamp through an underground conduit. Seen from the old Roman settlement of Ensérune, the fields and vineyards converge toward the bowl's center, which serves as a drainage basin.

Loaves strapped to bicycles, two young shoppers ride home from market in Châteaurenard, near Avignon.





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the base of all fine perfumes. Jasmine, whose tiny blossoms whiten the Grasse region in late summer, is especially important, for no de luxe perfume is made without it.*

That rare individual indispensable to the industry, the creator of new perfumes, is known as "the nose." There are only a few noses in all of France. We asked Molinard's nose, M. Henri Liotard (page 750), who has been with the firm for more than 30 years, how he learned his profession.

"No school can teach it," he answered. "Through experience, I have had to develop an olfactory memory."

Waving his hand toward tiers of bottles ranged down the center of a bright, high-ceilinged room, he continued, "I can tell by smell

alone each substance contained in all these bottles. There are about 4,000, all different."

He showed us several dark, hairy pods—glands from Asiatic musk deer. "Tonquin musk is a valuable fixative in the costlier perfumes," he said. "It comes from China and is now very hard to get."

"Any advice for the ladies?" asked Mary.

"Buy perfume in small quantities," he replied. "Keep it in the box, so that it will be in the dark, and in a cool place. Once the bottle is opened, perfume will usually retain all its qualities only about six months."

From Grasse, it is only a few minutes' drive

* Lonelle Alkman reports on a fragrant industry in "Perfume, the Business of Illusion," NATIONAL GEOGRAPHIC, April, 1951.

to the heart of the French Riviera, which in the past half century has developed from the winter playground of the rich and the aristocracy to a summer resort for everyone.

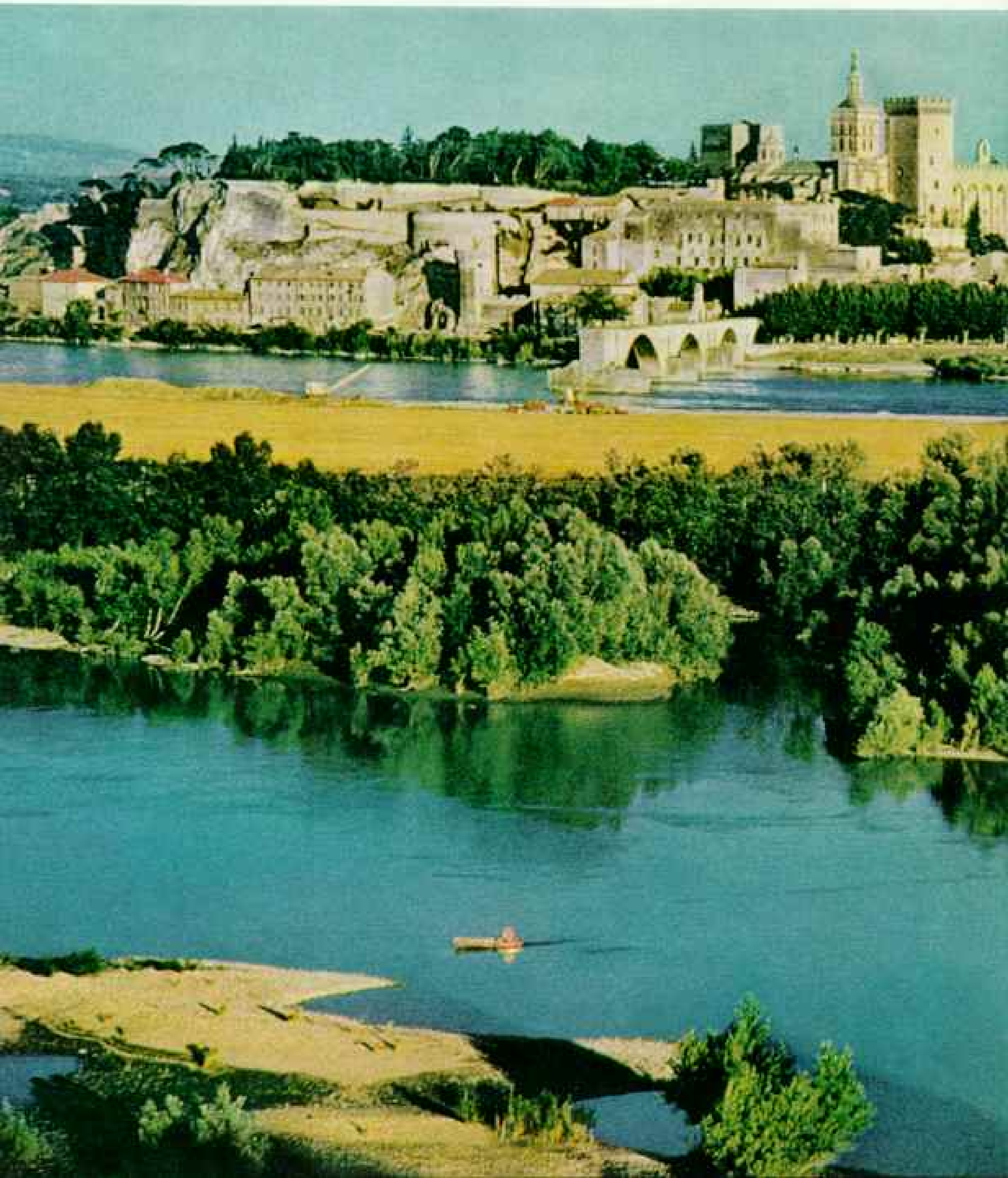
Massive mountains rising abruptly from an azure sea, palm-lined boulevards of gleaming shops and hotels, busy yacht harbors, crowded

camp grounds, gay and swarming beaches, bright bandannas and bikinis, artists, musicians, the humble and great, old and young—all these combine to make a Mediterranean Mecca, based on worship of sun and sea (page 752).

Not all is fun and frivolity. Toulon toils

746

Avignon dozes beside the Rhône and a bridge to nowhere that children immortalize



on the navy's ships. Cut flowers are produced by the thousands of tons, and small-scale fishing employs many a maritime family. Only Marseille's throbbing commerce outranks tourism on the Côte d'Azur. Vacationers come from every country in ever-growing numbers. Belgians, Swiss, Germans, Italians, English,

Swedes, Dutch, Finns, South Africans, Brazilians, and of course Americans—all these we identified from their license plates.

On a Sunday in August, France's favorite holiday month, roads were alive with every conceivable conveyance. Big cars, little cars, jalopies, and homemade trailers carried camp

747

in the song "Sur le pont d'Avignon." Seven popes lived here in the 1300's

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gear, baby carriages, boats, and skis. Countless motorcycles and scooters whizzed by with helmeted riders, packs on backs. Cyclists pedaled grimly up the steepest hills.

At noon, lunch was on everyone's mind. In half an hour every shady nook and almost every tree would shelter a picnic party, complete with table, cloth, and folding chairs. As we sat eating in the accepted style, three boys on bicycles waved and wished us a cheery "*bon appétit*."

"Two-horse" Citroën Tows a Curé

A little Deux-Chevaux Citroën, top down, chugged past, the front seat amply filled by a middle-aged couple in bright-blue shirts. Two shapely girls in tight shorts and gay pull-overs stood in the back, hair flying. And towed behind on a motorcycle rode a young curé, black robes flapping in sober contrast to the clothing of his benefactors.

Well fortified with a two-foot loaf of bread, Gruyère cheese, and muscat grapes, we resumed our journey from one vacationland to another, to the high Alps of the Haute-Savoie.

The French Alps, which form a natural boundary from the Mediterranean to the Lake of Geneva, provide peaks to test the mettle of the hardest climber, summer snow slopes for the keenest skier, and many a flower-decked upland meadow for the leisurely hiker.

For those who favor lacustrine pastimes, we could imagine no lovelier spot than the Lake of Annecy, bordered on three sides by high, wooded mountains (page 758). For several days we enjoyed its many attractions. An invigorating swim preceded a leisurely steamer tour or perhaps an exhilarating sail, or a stroll in the old town of Annecy with its Venetian vistas, or merely the pleasure of watching the holiday crowds and the rowboats slowly circling the Isle of Swans.

We climbed a winding trail through a cool forest of evergreens and ferns one day, and emerged on a broad expanse of steep meadowland where a hundred cows grazed. Clouds hovered over the ice-clad summits of the Mont Blanc Massif, clearly visible 40 miles due east.

On the evening of Annecy's Festival of the



Whipped Cream Tops a Slice of Galette, Specialty of Pérourges

Crumbling, vine-covered houses on a hill-top 20 miles northeast of Lyon mark the site of Pérourges, a textile center in the 16th century. When the industrial revolution made hand looms obsolete, the town withered. Now partly restored, it has a celebrated restaurant, the *Ostellerie du Vieux Pérourges*. Here Francisque Thibaut (right), the owner, treats a friend to one of his desserts, a galette. A pizza-shaped pastry with a delicate lemon flavor, the galette may be eaten plain or used as a base for berries and whipped cream. One advantage over ordinary pie: The crust never becomes soggy.

Gaillands. They moved easily up and down the perpendicular cliff, seeming to cling to nothing but slight discolorations in the rock.

Later we visited the chalet home of the most renowned of all the guides, Armand Charlet, who was recently made an Officer of the Legion of Honor. Inside the neat log building grouped with several others around a central yard, his wife stirred a steaming pot of fragrant wild-raspberry jelly. Their little son Jean-Claude played with a shuttlecock, while outside nine-year-old Catherine prepared for a climbing trip with *papa* by scaling a wall under his professional eye.

We talked of the government-run National Ski and Alpinism School, of which Charlet was the head teacher, and of mountaineering in general.

"It used to be exclusively a rich man's sport, but now," Charlet said a trifle sadly, "it has become democratized."

This was plain to see when we joined a crowd at six next morning to await our turn on Europe's highest cableway, which would whisk us to the summit of the Aiguille du Midi. Many were equipped for climbing; others carried skis. The second stage of the journey made our spines tingle—our car seemed to float motionless over the void, suspended from a skein of steel almost two miles long.

The panorama from the top, formerly known only to mountaineers, was breath-taking. In the crystal-clear air Mont Blanc, soaring only 3,000 feet above us, seemed close enough to touch. Groups of climbers, some roped together, set off across the Vallée Blanche, diminished to tiny specks, and then disappeared before they seemed halfway across the great snow field. Beyond, a sweeping arc

Lake, we sat at the end of a little jetty where millenniums ago Stone Age lake dwellers occupied houses on stilts. With 100,000 others, we watched a floating review of clever illuminated tableaux based on operettas.

When we arrived in Chamonix, capital of French Alpinism, banners and bunting proclaimed the annual "Guides Day." The purpose, we learned, was to raise money to help families of mountain guides lost in rescue work. In spite of the heroic efforts of skilled professional guides, an average of 60 climbers lose their lives each year in the French Alps.

Alpine Guides Decorated for Bravery

After placing a wreath on the monument to Jacques Balmat, first guide to climb Mont Blanc, the Company of Guides attended mass, while a crowd gathered in the flag-decked square before the little church. When the guides filed out, the prefect of Haute-Savoie, in a white uniform, presented medals for bravery and devotion to duty.

The day's climax for us was the guides' exhibition of rock climbing techniques at Les



Patchwork plots near Valensole produce aromatic oil of lavender for makers of soap and perfume. Fragrant blossoms carpeting the slopes await harvest. Patches of straw-colored

Maestro of perfume sniffs a scented strip of paper as he works on the formula for a new fragrance. He is Henri Liotard, known as a "nose" in Grasse, France's perfume capital. He can identify 4,000 substances just by smelling them.



FOTACHRONEE © NATIONAL GÉOGRAPHIC SOCIETY

clumps remain where the cutters have already passed. At right a slender chimney rises from the still which extracts the essence.

Blue haze shrouds the rugged Alps of Provence.

Sickle Swinger Harvests Lavender From a Field Near Puimoisson

Pickers collect the spikes in August. Taken directly to a still, the flowers give up their aromatic oil through steam distillation. An acre of lavender yields 10 to 30 pounds of oil, depending on the weather.

Southern France reigns as the floral-oil center of the world. Farmers patiently watch calendar and clock for the exact moment to pluck their ripened crops of jasmine, roses, orange blossoms, violets, and carnations.

of jagged granite peaks led away to infinity.

That afternoon we picnicked on the grassy slopes of La Flégère, on the other side of the valley, where hikers of all ages could enjoy Alpine exercise without needing the skill of a human fly.

On a Sunday morning in early September we stood on the high balcony of our hotel room overlooking Ribeauvillé, one of the necklace of picturesque old wine towns strung along the strip of vineyards that cloak the eastern foothills of the Vosges Mountains.

Before us stretched a fertile plain between the Vosges and the River Rhine, 14 miles distant. This land constitutes the greater part of rich Alsace, French once more after being under German occupation for 53 years out of the past 90. Above us and to our left rose the ruins of three of the many old castles that, centuries ago, dominated the valley from the wooded heights.

A knock on the door announced the chambermaid, carrying a large French flag.

"Today is the Festival of the Ménétriers—wandering minstrels," she said. "I have come to decorate your balcony."

She noted our nationality and disappeared for a short time. To our surprise, she re-





Mushrooming Parasols and Dazzling Hotels
Ring the Crescent Beach at Cannes

A favored Riviera resort, Cannes owes its fame to Lord Henry Brougham and a cholera epidemic. Journeying to Nice for the winter in 1834, the



PHOTOGRAPH BY VORRELL BELLEN, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Englishman found his way blocked by a quarantine. He stopped at Cannes, then a tiny fishing village, and enjoyed the stay so much that he

spread word of his discovery when he returned home. Today Cannes honors him with a statue. Twin black cupolas crown the Hotel Carlton.



Girl in a bikini beautifies the beach at Deauville, a summer playground for Parisians on the Normandy coast.

"Try some grapes," a picker invited the author. "They're very sweet."

Grapes grown on arid hillsides produce the finest wine. Vines need a moderately cold, slightly humid winter; a warm, dry spring; a hot summer with a spot of rain during August; and early-morning fog from mid-September to harvesttime.

Winetasters Sing the Praises of a Burgundy Vintage

Connoisseurs prize wine from the Côte d'Or, the Golden Slope, a 37,000-acre belt of vineyards south of Dijon, Burgundy.

One famous vintage comes from the vineyard of the Château du Clos de Vougeot. This onetime Cistercian monastery serves as the banquet hall for the *Confrérie des Chevaliers du Tastevin*—the Brotherhood of the Knights of the Wine Cup. Members wear silver *tastevins*, or winetasting cups, suspended from the neck.

These black-capped Cadets de Bourgogne, the society's ballad singers, serenade the gathering.

FOODSTYLING BY WALTER BEATERS EDWARDS AND EXTRACHROME (RIGHT) BY WARRIOR





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turned with a battered and faded version of Old Glory and unfurled it beside the French tricolor. It was not until later that we realized it had only 11 stripes and 39 stars, and learned its history from Henri Adam, the hotel owner.

"My mother made it secretly during the occupation, to be ready for the American Army when it reached here on December 3, 1944," he said. He couldn't explain what she copied it from, but it was the sentiment that counted.

Wandering through orchards and fields of tobacco, hops, hay, potatoes, and sauerkraut cabbage in the plain, we found reminders of World War II—pillboxes, disabled tanks, and a little plot with 20 wooden crosses.

Fiercely loyal to France, Alsatians are grateful for the part the United States played in their liberation, and for its generous postwar help. Many a street and square in villages and towns has been renamed for *les Américains*.

Alsace's thriving modern capital, Strasbourg, so long a symbol of French de-



**Glacier's Icy Tongue
Licks at Chamonix
on Mont Blanc's Foot**

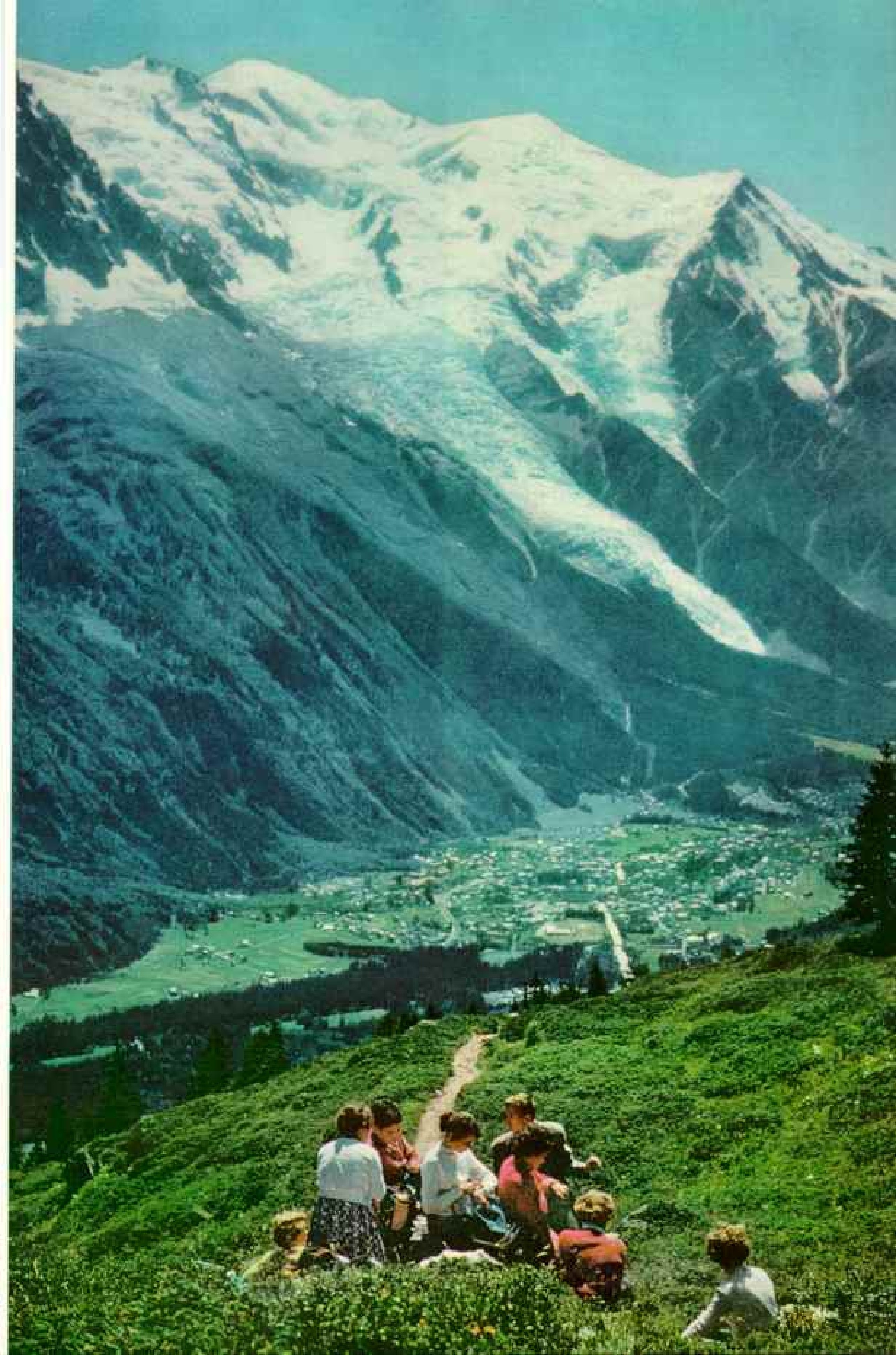
Western Europe's loftiest peak, 15,771-foot Mont Blanc anchors the frontier wall between France and Italy.

Chamonix huddles in a narrow valley crushed between Mont Blanc and Le Brévent. The village became a sports center before 1800.

Yawning mouth of the Mont Blanc Tunnel opens near Chamonix. A 150-year-old engineering dream, the 7¼-mile shaft will be the world's longest highway tunnel when completed in 1961 or 1962. French and Italian engineers, who started digging from opposite sides, expect to meet in the center.

Year-round roadway drilled through granite will pass almost two miles below the Alpine summit. Motorists bound for Rome will enter near Chamonix and emerge 20 minutes later near Entrèves, Italy. Ducts beneath the roadway will provide ventilation.





fiance, important river port and university center, has become since the war the "capital" of Europe. When we were there, the modest headquarters of the Council of Europe was being repaired—not because of war that has so often ravaged Strasbourg, but because of a recent battering by enormous hailstones.

Like Strasbourg, its big sister to the north, the textile city of Colmar is well endowed with delightful architectural gems. Here we found the birthplace of Frédéric-Auguste Bartholdi, Alsatian sculptor of the Statue of Liberty.

The caretaker, a sprightly 90-year-old with a spade beard, showed us plaster models of several versions of the famous symbol of "Liberty Enlightening the World," presented by France to her sister republic in 1886. He told us that the sculptor's stately mother had served as model, and that the intricate engineering problems of erecting so colossal a statue had been solved by Alexandre-Gustave Eiffel, whose equally famous tower was erected in Paris just three years later.

Hard Work Separates Wine From Vine

From Colmar, which is also capital of the Alsatian wine industry, we drove in the vineyards along part of the "Wine Road." We paused in quaint old places like Eguisheim, Turckheim, Riquewihr, and Kaysersberg, birthplace of the famous philosopher and medical missionary, Dr. Albert Schweitzer.

Men and horses were busy in the vineyards, cultivating between the long rows of tall vines from whose big white Riesling grapes would come the aristocrat of Alsatian wines.

All over France the vintage season was approaching. Starting in the south at the end of September, teams of men and women were cutting the ripened bunches, transferring them from small wicker baskets to larger ones, and collecting them by the cart- or truckload. They seemed always in gala mood, sampling the sweet grapes, singing, laughing, and bantering, for this was the culmination of months of serious, painstaking toil.

The extent of this work was detailed for us in Burgundy by jovial Jean Confuron, whose ancestors for several centuries have been viticulturists like himself.

"For a month in the spring we dress the vines, cutting back and removing shoots," he said. "Then we must plow between the rows five or six times during the season. We do several rows at a time with a motor cultivator that straddles the vines. Always the leaves must be thinned out and the branches kept trimmed back until the grapes begin to



Storm Clouds Mass Above Lake Annecy;
Pleasure Boats Flee for Shelter



© NATIONAL GEOGRAPHIC SOCIETY

Glaciers gouged the lake's bed, a nine-mile cleft through tumbled mountains. The Fier River drains these waters into the Rhône. Inns and

villas dot the Roc-de-Chère on the far shore. Soon after the author took the picture, a violent thunderstorm churned the emerald waters.

turn red. We worry during the stormy August weather. A hailstorm can wipe out everything in a moment.

"Come with me," he concluded, "and I will show you how we make good Burgundy."

From the yard behind his house he led us through a big door to his *caverie*, where a dozen large wooden *caves*, or vats, six to eight feet high, lined the walls. At the top of a ladder stood his son, Jean-Jacques, hosing juice into a vat from a pump drawing from the bottom of the same vat. This procedure made better sense when we saw there was a heavy mash of grapes inside.

Wine Ages Three Years in Oak

"The ripe grapes are crushed lightly in these vats, and the juice ferments for about 15 days," M. Confuron explained. "We keep it circulating, as you see, but three times during fermentation we have to break up the crust and mix up the heavy mash.

"After fermentation, the juice is drawn off and pressed from the mash. Then, stored in oak casks in the cellar below, it gradually improves. After aging for two or three years, it is ready for sale, either in the barrel or in bottles. But to attain perfection—that takes another six to eight years."

Most Burgundy wine is made by relatively small producers, like Jean Confuron, who own and cultivate individual holdings in many famous vineyards. His bottles bear some of the truly great names: Chambolle-Musigny, Vosne-Romanée, Nuits-St.-Georges, and one of the finest of all, Clos-Vougeot.

The fame of Burgundy is spread by the ceremonies, skillfully compounded of gravity and humor, of the *Confrérie des Chevaliers du Tastevin* (a little silver cup used for sampling wine). The order, founded in 1934, now is known the world over. Several banquets are held each year in the *Château du Clos de Vougeot*.

I was invited by the Grand Chancellor, M. Camille Rodier, to attend one of them. On the appointed evening I joined the gathering in the old *caverie*. Here, dwarfed by four gigantic wine presses once used by Cistercian

monks, pretty maids in costume were serving newly made wine. We took our places among some 500 chevaliers and guests at one of the tables running the length of the huge 12th-century *cellier*. Then a fanfare of hunting horns signaled the beginning of a feast that lasted nearly four hours.

The menu was as rich in content as it was quaint in form—printed largely in French of the time of Rabelais, to whom the chevaliers look back as a master and source of inspiration. Translated into English of the same period, the first course was "dodynes [coddling] of teales in gely of gode whyte Chablis wyne." Then we marched manfully through "fysshe halles of pyke," "fried Bresse chiks with morel mushromes," "hams braised in the manner of Nuits," and "gode Burgundy cheses."

Each of these and many more masterpieces were accompanied by the appropriate wine, such as "a subtil Meursault-Genevrières 1956," "a silky Savigny-lès-Beaune 1953," and "a deific Clos-Vougeot 1949."

Great hilarity was shared by my immediate neighbors when, in deference to my own abstinence, the wine waiter brought a bottle of water and surreptitiously tried to pour me a glass, below table level.

Rollicking songs by the "Cadets de Bourgogne" (page 754) brought a novel kind of applause. The diners raised hands aloft, pivoted them on the wrists, then clapped in cadence to a catchy tune.

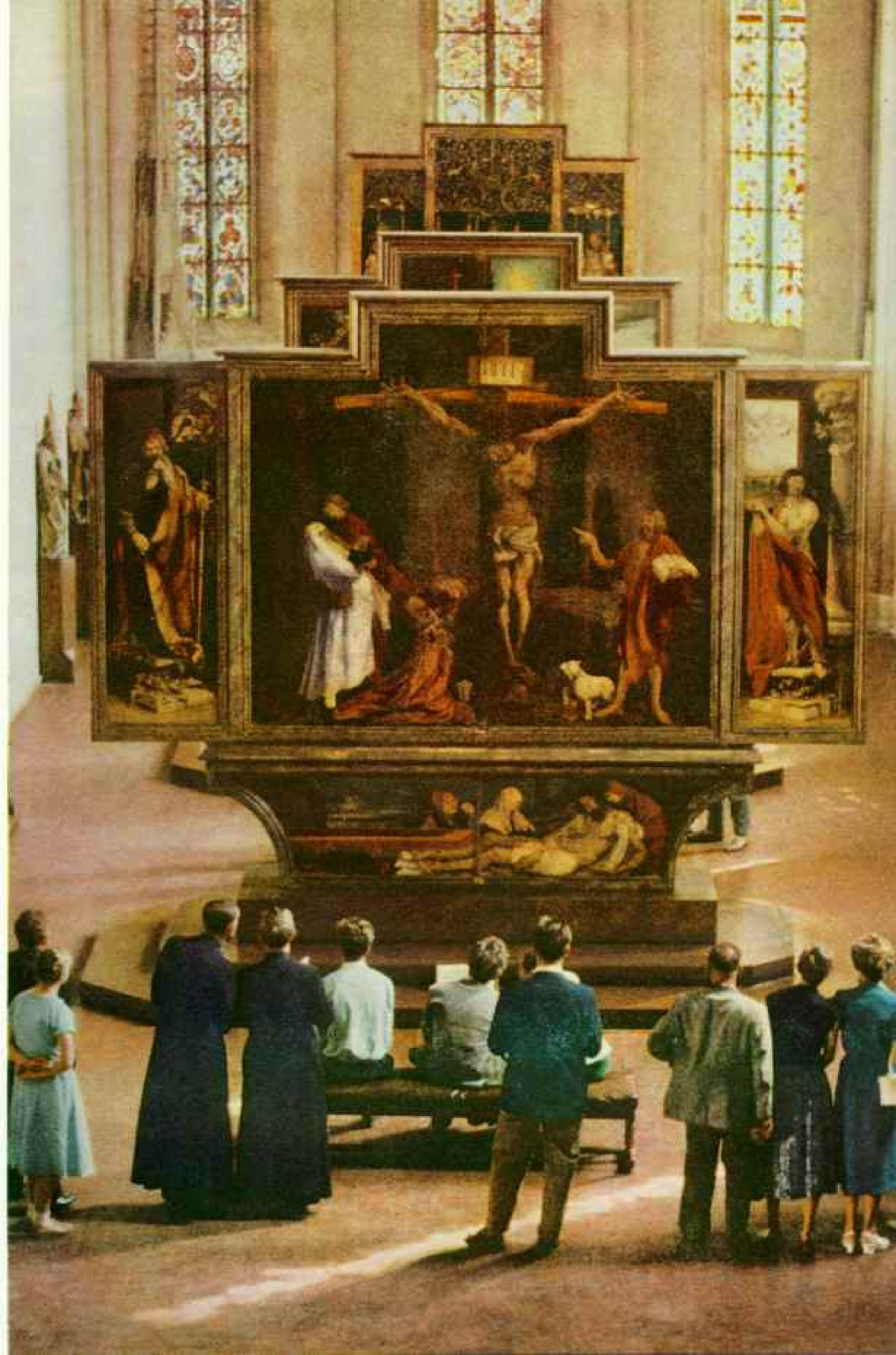
Dessert: A Snail of Ice Cream

Toward midnight, while the last course, ice cream molded to resemble a huge Burgundian snail, was paraded shoulder high between the tables, the lights suddenly went out. When they came on again to the sound of trumpets, four heralds and a mace-bearer were marching down the central aisle, followed by a procession of red-robed figures. A stentorian voice announced: "The Council of the Order!"

In costumes inspired by the robe of Rabelais, these dignitaries grouped themselves around the tall, sedate Grand Master, who held in his hand a gnarled vine-root staff.

Sunlight Illuminates the Somber Majesty of the Issenheim Altarpiece

Early in the 16th century, Matthias Grünewald created this masterpiece of German art for the Antonite Convent at Issenheim. In 1791, during the French Revolution, it was taken to Colmar for safekeeping. Now standing in Colmar's Unterlinden Museum, the altarpiece forms a polyptych of panels, which open and close. The Crucifixion (center) overhangs Christ's entombment.





WALTER BEARDSLEY EDWARDS, NATIONAL GEOGRAPHIC STAFF

Not barn and silo, but a church. The chapel of Notre Dame du Haut crowns a hilltop near Ronchamp. Hallowed since pagan days, the site has held many chapels, but warring armies passing through the Belfort Gap repeatedly destroyed them. This edifice, conceived by the architect Le Corbusier and completed in 1955, applies a modern style to reinforced concrete. Sloping walls descend from a roof that sags like a tent. Tower at left admits light. The roof drains rainwater into a concrete tank. Pilgrimage ceremonies attract crowds as large as 15,000, who hear outdoor sermons from the pulpit above the men at right.

The initiation ceremonies were about to begin.

As each new chevalier was called, a witty discourse on his qualifications was read in mock solemnity by the Grand Chamberlain. The Grand Master gave each initiate the accolade, with a ceremonial kiss on each cheek, and finally the insignia of the order, the silver *tastevin* on a scarlet-and-gold ribbon, was hung round his neck. Many distinguished names have been heard at these ceremonies, including those of more than one United States Ambassador.

A few days later, in Épernay, we visited the old firm of Moët et Chandon, and learned what makes champagne so different from still wines like Burgundy.

"To consider them together is like trying to marry a rabbit and a carp," said our host, M. René Sabbe.

"Both wines start with grapes," I remarked.

"Yes, but the processes are completely different. To make champagne, we press the grapes immediately—very gently, to avoid coloring the juice with



the skins. The juice ferments in glass-lined vats for seven to twelve days and then is stored for the winter as a still wine. In the spring it is blended with other champagne vintages."

The second fermentation, which gives champagne its bubbles, takes place in the bottle, M. Sabbe explained; still wine ferments in the barrel, and the gas escapes. After several years, skilled men coax the accumulated sediment into the necks of bottles by turning and twisting them daily for three or four months, inverting them little by little until they are racked with necks down.

We saw how, by freezing only the wine in the neck of the bottle and then removing the cork, the gas pressure expels the plug of frozen wine and with it the sediment. The

slight deficit is then replaced with champagne from stock, with cane sugar syrup sometimes added. We heard more corks popping in ten minutes than we'd heard in our entire lives.

Back in Paris after four months of motor-ing through the country, Mary and I summed up what we had seen. We concluded that in the fast-moving postwar world, France had kept pace—somehow without seeming to change at all. We had seen new developments, true, but these were principally in the fields of technology. And even here the engineers had worked their miracles in a style as old as France itself—with flair, with imagination.

For instance, we had ridden the *Mistral*, the train that travels from Paris to Nice, 676 miles, with several stops and a change of en-

As if squeezed from a toothpaste tube, France's longest dwelling uncoils in the Paris suburbs of Pantin and Bobigny. Its serpentine shape leaves lawn space for children to play. Some 1,500 persons dwell in the 1,837-foot-long structure.

ROBERT COHEN, BLACK STAR



gines at Avignon, at an average 63 miles per hour. We learned that two French trains, drawn by electric locomotives in a test, held the world record of 206 miles per hour. French engineers have developed a new rail, welded in half-mile lengths, that eliminates the familiar clickety-clack and considerably reduces wear on both rail and rolling stock.

We could see French genius in everything from the architecture of the vast new Palais des Expositions in Paris to the air-oil suspension system and radical design of the Citroën car we were driving.

Through a kind letter from Hervé Alphand, French Ambassador to the United States, I was privileged to see still another outstanding example: the turbine-powered Alouette II, which holds the world altitude record for helicopters. As guest of France's oldest military arm, the Gendarmerie Nationale, I had ample opportunity during 11 hours of flying to experience the versatility and maneuverability of this remarkable whirlybird. At Le Bourget I experienced the aerial acrobatics of a two-place helicopter called a Djinn. Made by the same state-owned company, Sud-Aviation, it operates on the principle of a lawn sprinkler, ejecting compressed air from the tips of its rotor blades.

Plate Glass by the Mile

Accompanying me on my helicopter flights was the young Viscount de Tascher, of Sud-Aviation, who prefers to be called Harry. He plied me with facts: The port of Le Havre boasts the world's longest quay, handling its transatlantic ships. The world's first tidal power station rises on the Rance River in Brittany. The world's longest ocean liner, the *France*, will soon be sailing the Atlantic; the use of special light alloys, and a welding technique instead of rivets, saves 20,000 tons in weight. A Frenchman, Eugène Freyssinet, developed the system for prestressing concrete that is being used more and more in the United States.

"Have you seen the Renault automobile engine factory at Billancourt, near Paris?" Harry asked. "It is one of the most automatic

in the world. A young engineer named Bézier thought out the system while he was a prisoner of war in Germany."

Together we visited Billancourt and saw lines of engine blocks passing from machine to machine automatically, controlled by a man at a switchboard. Men tested finished engines, as they came around on a large turntable, by listening to them with a device that resembled a doctor's stethoscope.

At the Chantereine plate-glass factory of the huge Saint-Gobain company, I witnessed another impressive example of automation. Flowing continuously from a giant furnace, a 3½-mile ribbon of glass 100 inches wide rolls out every 24 hours. The entire operation is automatic, from unloading, weighing, mixing, and pouring the raw materials, to the grinding, polishing, and cutting of the glass ribbon.

Near Toulouse I saw mass production of the world's first medium-range twin-jet airliner, the sleek Caravelle. Attaching the engine pods to the fuselage instead of the wings is another example of French originality.

New Energy Sources Feed Industry

Since the war France has about doubled her already large hydroelectric capacity. We had seen the great Donzère-Mondragon Canal and power plant north of Avignon, part of a gigantic undertaking to tame the mighty Rhône that eventually will generate yearly 13 billion kilowatt-hours of electricity and irrigate about 750,000 acres of land.

We had seen the Grand Canal of Alsace, wider than that of Suez, and visited the huge new power plant at Ottmarsheim, which alone produces a billion kilowatt-hours a year as part of the system being built to harness the Rhine between Basel and Strasbourg.

Projects like these, together with new atomic-energy power plants and fresh sources of oil and gas, will help to feed French industry, growing at a phenomenal rate. They hold the promise of a bright new era for France—one that makes it "exciting to be a Frenchman these days," as a friend put it. Yet the essence of France remains unchanged. To be a Frenchman has *always* been exciting.

With This Plutonium Maker at Marcoule, France Joins the Atomic Fraternity

Heat from a uranium chain reaction produces steam to generate electricity. Neutron bombardment turns some of the uranium into plutonium, the explosive in the atomic bomb detonated in the Sahara last February. Workmen inspect the fuel-loading face of G-2, one of Marcoule's three reactors. Blue cylinders strengthen its shell.





THIS SUMMER the flood grows larger; record swarms of tourists pour into Europe—an estimated 750,000 visitors from the United States alone in 1960. Many will be visiting the countries shown on the National Geographic Society's newest 10-color map, France, Belgium, and the Netherlands.

Seventeenth in The Society's Atlas Series, the new map reaches two and a half million member-families as a supplement to this issue of their magazine. Whether they travel in fact or in fancy through the pages of their NATIONAL GEOGRAPHIC, members will find this a valuable addition to their collection

Europe's Door: France and the Low Countries

of Atlas Series Maps. In the Atlas Folio it becomes Plate No. 32.*

This colorful, thoroughly up-to-date map takes in most of England and parts of Germany, Switzerland, Italy, and Spain, in addition to today's energetic France and the tidy, industrious Low Countries—the Netherlands, Belgium, and Luxembourg.

In the land of canals and tulips, windmills still wave their giant arms. Belgian beach resorts offer sun-swept surf. Tiny Luxembourg's 130 castles extend a romantic welcome.

The Alps form one topographical extreme on the map; the other lies near Amsterdam, whose Schiphol Airport lies far below sea level on reclaimed land. Boats and barges on near-by canals float 13 feet above the airliners that land here.

New communities—Emmeloord, Dronten, Lelystad—have sprung up as bustling monuments to Dutch engineering skill. They lie on polders, land reclaimed from the dammed-off Zuider Zee. That salty intrusion of the North Sea has been replaced by a smaller

fresh-water lake, IJssel Meer. An entirely new seaport—Europoort—takes shape west of Rotterdam. When opened in 1965, it will boast new steel, chemical, and oil-processing plants, and the largest dry docks in the world.

In the Netherlands' southwestern delta, the Dutch toil on a massive project of sea walls and sluice gates. The objective: To prevent disasters like the flood of 1953, caused by dike-bursting storms that killed 1,800 people and salt-poisoned thousands of fertile acres.

Amsterdam's environs, with those of Brussels and Paris, are magnified in three insets. The main map's scale of 54 miles to the inch permits individual designation of all 89 continental departments of the map's dominant country, France.

The map reflects French industrial vigor, too. Tiny derrick symbols locate newly tapped oil deposits near Bordeaux and Paris. Natural gas has started to flow from vast fields in the Pyrenees foothills, near Lacq. This reservoir contains enough gas to meet the nation's needs for the next 30 years.

Western Europe's largest dam, the Serre-Ponçon athwart the Durance River in the French Alps, will convert an annual flood menace into productive kilowatts. But behind this structure the town of Savines—already erased from your National Geographic map—is doomed to drown in a 12-mile-long lake that will rival scenic Annecy.

Members who study the map with European travel in mind will note the black lines tracing the routes of fast, modern railroads that whisk visitors across storied countryside. Red stars mark commercial airports. Red lines trace all major roads; double lines indicate superhighways and autobahns.

A century and a half after the notion was first broached to Napoleon, the idea of a tunnel under the Strait of Dover is now being seriously considered. Experts have sampled the soft chalk of the English Channel floor with a view to building a 36-mile electric railway tube between Folkestone, England, and Cap Gris Nez, France. Britons already have a name for the project: "the Chunnel."

* It is still possible to obtain the convenient Atlas Folio and a complete collection of the 17 maps issued thus far in the Atlas Series. Individual maps, 30¢ each; the Folio, \$4.85. A packet of the seven 1958 maps or the seven 1959 maps (folded once), \$3.00; both packets, \$5.50; both packets (14 maps) with Atlas Folio, \$9.95. All are available from National Geographic Society, Dept. 41, Washington 6, D. C.



Barbed wire of war coils around Algiers, whose sparkle belies her troubles. Here

ALGERIA

FRANCE'S STEPCHILD,
PROBLEM AND PROMISE

THE BATTLE, when it came, was short, sharp, and typical.

All afternoon the French commandos—30 sweating men in camouflaged fatigues—had pressed into the stark, lonely mountains of northwest Algeria. Their mission: to intercept a rebel band about to raid the fat farmlands of the Chélif Plain.

A wound suffered in Indochina had left the captain with a small scar below his right eye and a permanent tic. He glanced at the darkening sky.

"Once the sun sets," he told me, "they'll slip past us like shadows. If we don't find



BOULMONT © NATIONAL GEOGRAPHIC SOCIETY

France directs twin efforts to crush revolt and to lift Algeria into the 20th century

them soon, we'll have several dead farmers by morning."

The skirmish line topped a rise and someone shouted: "There they are!" Simultaneously, the green-clad rebel band spotted the French. Machine guns clattered; rifle bullets cracked past my ears; grenades exploded gruffly, their fragments whining overhead. Then, as dusk deepened into night across the hills, the firing died.

"They've fled, *mon capitaine*," a corporal reported. "Back up into the mountains. We might have hit one or two, but in this light it's hard to tell."

By HOWARD LA FAY

National Geographic Editorial Staff

*Illustrations by National Geographic
photographer ROBERT F. SISSON*





HIGH SPEED ESTACHEIRE (APPEL) AND BODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Veiled shoppers in the Casbah buy chickens at a hole-in-the-wall shop. Algiers' teeming Arab quarter, romanticized in novel and movie, will soon see drastic face lifting under plans to replace its crowded hovels with tiered flats. Today 1,600 persons per acre jam the labyrinth of hillside streets. The basket carrier combines traditional headdress with Western sweater; the girl behind her is too young to wear the veil.

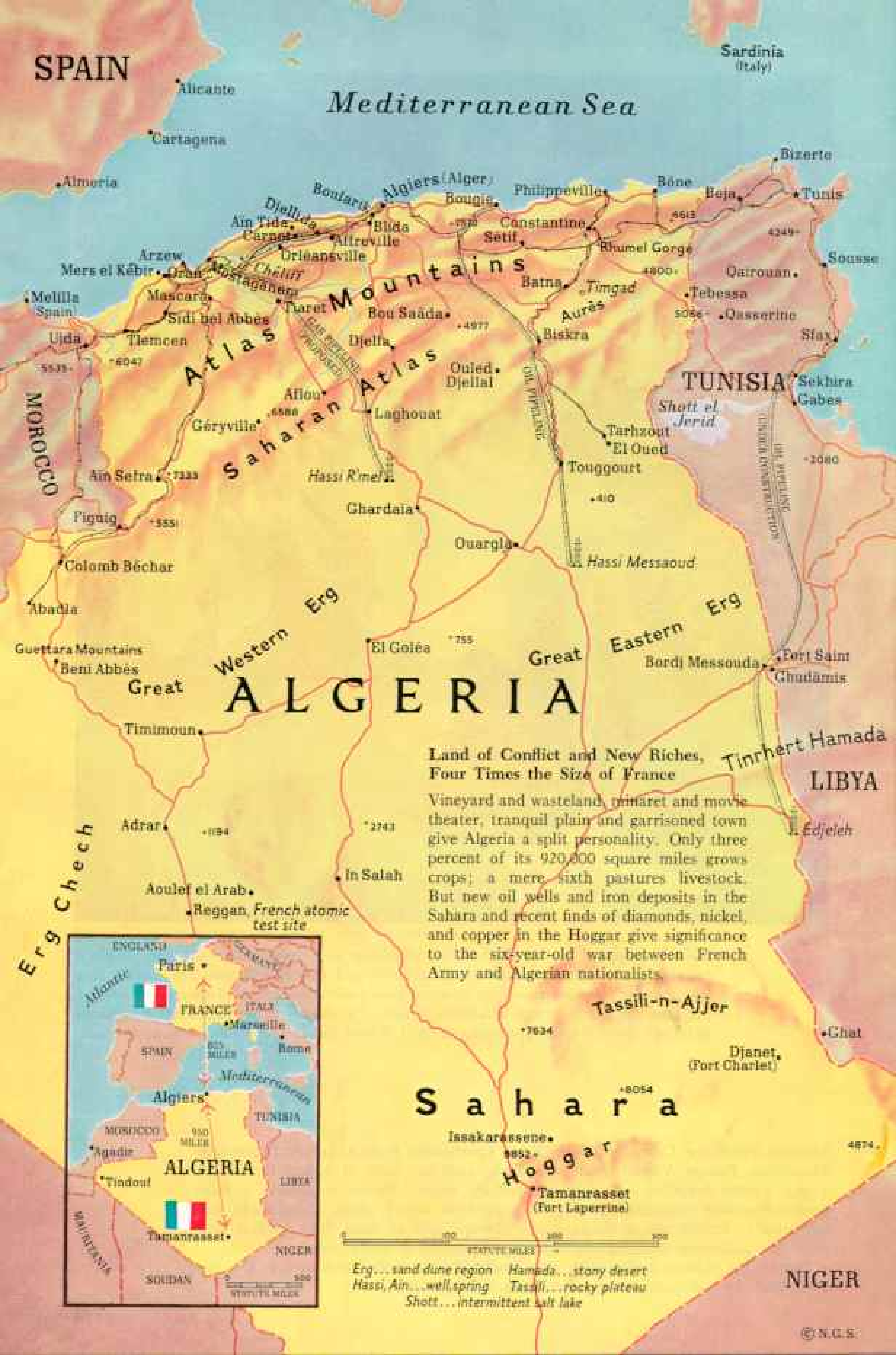
Minutes From the Casbah's Maze, Trim Apartments Face a Sunny Promenade
Phoenician, Roman, Vandal, Arab, and Turk—each has ruled in Algiers for a time. Today France keeps control only by military might. Terror bombings by independence-seeking nationalists make the capital an armed camp. Roadblocks lace key streets. Patrols search theater-goers. Troops such as these three soldiers walk beats like policemen, carrying submachine guns instead of night sticks.

Despite the violence and tension, neat blocks of apartments mushroom as this city of 600,000 tries desperately to overtake its housing needs.

SPAIN

Sardinia (Italy)

Mediterranean Sea



ALGERIA

Land of Conflict and New Riches, Four Times the Size of France

Vineyard and wasteland, minaret and movie theater, tranquil plain and garrisoned town give Algeria a split personality. Only three percent of its 920,000 square miles grows crops; a mere sixth pastures livestock. But new oil wells and iron deposits in the Sahara and recent finds of diamonds, nickel, and copper in the Hoggar give significance to the six-year-old war between French Army and Algerian nationalists.



Erg... sand dune region Hamada... stony desert
 Hasi, Ain... well, spring Tassili... rocky plateau
 Shott... intermittent salt lake

NIGER

The captain shrugged. "No luck. Well, take a squad and set up an ambush between here and the highway in case they try again. Keep me informed by radio."

As we trudged back the long, weary way we had come, the captain said, "It's always like this. You catch them, and they melt into the ravines. It's like trying to grab a fistful of quicksilver." He peered up into the black fastness of the mountains. "But don't think it's so easy for them. Cold, hungry, short of weapons, hunted like animals. Sometimes I think they're as sick of it as we are."

Terror Becomes a Way of Life

After almost six years of rebellion, all Algeria is sick of war. Daily acts of terrorism cloud the lives of the 10,600,000 people—90 percent Moslem, the remainder European settlers—who inhabit this country more than four times the size of France (map, opposite). The smoking bomb rolling into the cafe, the ambushed bus, and the morning obituary are the facts of Algerian life. So is the ominous predawn knock of police on a suspect's door.

The start of what Algerians call *les événements*—the events—on November 1, 1954, ushered in a grim struggle for independence by the Moslem Front de Libération Nationale, or F.L.N. The settlers just as grimly guard the old status quo. Caught between these implacable foes, the French Army fights thanklessly to pacify the bleeding country. Facing an estimated 50,000 F.L.N. guerrillas are 450,000 French troops; surprisingly, 150,000 of them are Moslem volunteers.

Other paradoxes abound. The anticolonial F.L.N. has slain nine times as many Moslems as Europeans, while the settlers who rally to the cause of French Algeria have twice taken up arms against France—toppling the Fourth Republic in May, 1958, and shaking the Fifth Republic in January, 1960. Finally, fewer than half these settlers are of French descent; most of the rest have Spanish, Italian, or Maltese origins.

But war and its contradictions are nothing new to Algeria. The light-skinned, independent-minded Berbers, who have ranged its mountains since long before Christ, have seen Roman, Vandal, Byzantine, Arab, Turkish, and French invaders sweep across their land. In November, 1942, an Anglo-American invasion force seized Algiers, and the city became General Dwight D. Eisenhower's headquarters for the North African campaign.

Historically, Algeria has always been a have-not area. While a chronically underfed population farmed the narrow Mediterranean coastal areas, the bleak Atlas Mountains and the vast Sahara—90 percent of the country—remained an economic wasteland.

But today Algeria foresees a tremendous boom. "We stand," explained an Algerian friend, "where the American West stood a century ago. Oil has just started to flow out of the Sahara. We've barely scratched our enormous mineral resources. Once we pipe the natural gas of Hassi R'mel to the coast, we'll have enough cheap fuel to spark an industrial revolution."

I commenced my tour in Algiers. Situated midway along the country's 620-mile Mediterranean coast, the Algerian capital is a sun-splashed city of winding, hilly streets and towering apartment buildings. From the small, flat focus of its ancient port, the city slopes up into the surrounding hills like an immense white amphitheater.

Although Algiers furnished an anchorage for Phoenician merchantmen and, under the name of Icosium, exported wheat to Rome, the city first gained fame as a haven for the Barbary pirates. From the 16th to the 19th century, these Moslem corsairs terrorized the Mediterranean and exacted tribute from the maritime powers of Europe.

U. S. Navy Ended American Tribute

In 1796 the young United States Congress voted one of the largest and most humiliating expenditures in its history: nearly a million dollars in cash and goods as tribute to the Dey of Algiers. But in 1815 a smarting U. S. declared war, a fleet descended upon Algiers, and Commodore Stephen Decatur dictated peace terms that ended American vassalage once and for all. Later, in 1830, Algiers and its hinterland passed into the French Empire.

Today an estimated 600,000 inhabitants overflow the streets of Algiers; last year 11,000 ships nosed into its harbor, and more than five million tons of merchandise passed across its wharves. The 5,500 students of the University of Algiers—which numbers among its alumni the late Nobel laureate Albert Camus—make it one of the most important in the French-speaking world.

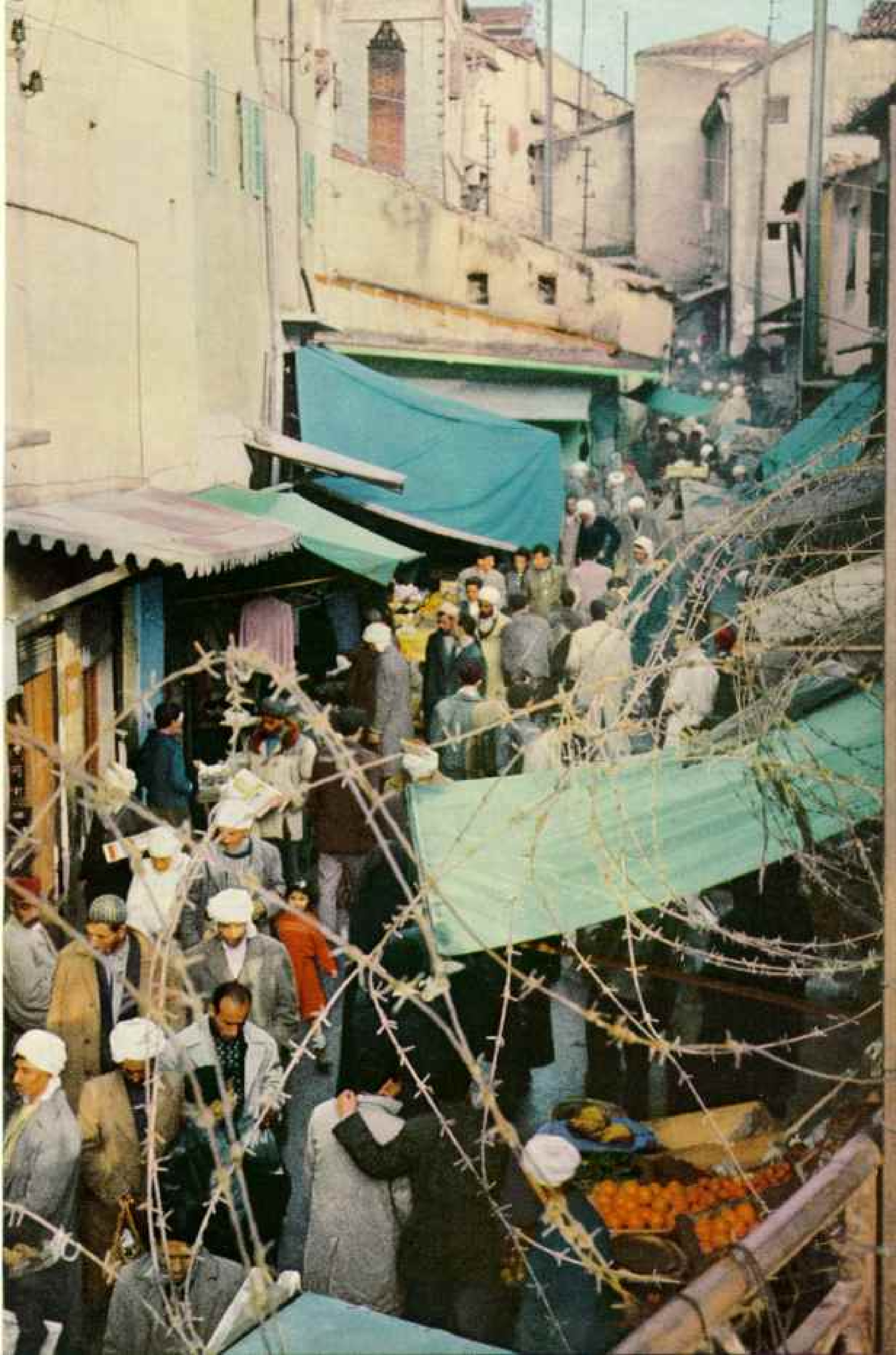
The city is a heady blend of East and West, Africa and Europe. In the Place du Gouvernement, blind musicians chant Arabic sagas while students unravel atomic mysteries



BOGAZINHO (REVE); AND NE ESTACHEME © NATIONAL GEOGRAPHIC SOCIETY

A bit of Paris in Algiers draws government typists and university students to a sidewalk cafe. They trade Saturday gossip and sip vermouth and soda. Tree-shaded tables line fashionable Rue Michelet, whose luxury shops offer the latest modes from the French capital. White-robed Arab woman provides a non-Gallic note.

Shoppers ignore a barbed fence in Constantine, hotbed of rebellion in the country's northeast. Strife frequently flares here in Algeria's third largest city. At such times soldiers rush to close the gates, and wire-toothed fencing seals off the old quarter. These buyers throng Rue Saïd ben Tchicou's awninged stalls and stores, whose goods range from oranges to hand-worked brass and gold bracelets.



Camel Soldiers Dismount to Thread Razor-sharp Stones of the Hoggar

Ancient volcanoes and endless erosion shaped the region of desolation that stretches 300 miles across southern Algeria.

Temperatures in the Hoggar can vary 80 degrees from noon to midnight. At times sunset brings a 30-degree plunge in 10 minutes; then cooling rock cracks like rifle fire. The noisy staccato led early explorers to believe themselves ambushed.

Inhospitable to most men, the Hoggar shelters the veiled Tuareg, last of Algeria's tribesmen to accept French rule. Now troopers from this fierce Hamitic tribe help patrol the desert.

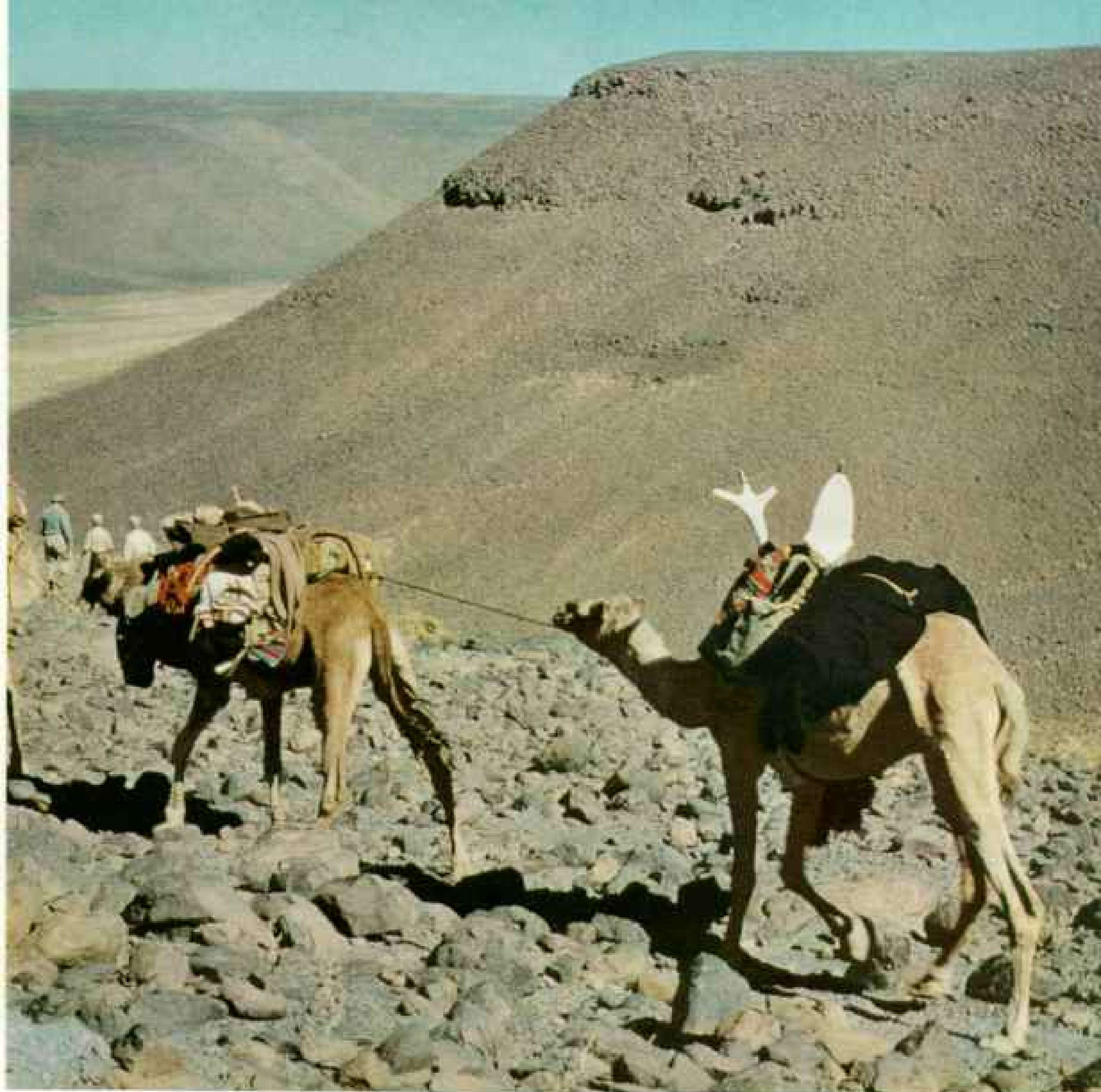
Here a detachment of the Méharistes, or Camel Corps, descends to a dry stream bed. The camel at right bears a saddle with traditional cruciform pommel. Some students ascribe the emblem to possible Christian ancestry of the Tuareg; others say it signifies the Southern Cross, starry beacon over the Sahara.

Author La Fay and photographer Sisson traveled across the Hoggar with this squad, dining on gazelle meat and macaroni.

Foreign Legion trainees sprint to a weapons carrier in a practice strike against guerrillas. Eagle and snake of the 1st Regiment deck the gate of this post near Sidi bel Abbès, Legion headquarters.

Recruits from more than 40 lands form the indomitable corps. In the Indochina war alone, more than 10,000 legionnaires perished.





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in the university's near-by Institute of Nuclear Studies. On the terraces of chic cafes along the Rue Michelet, Europeans idle over apéritifs while chastely veiled Moslem women glide past their tables (page 774).

Nylons Add Modern Touch

The cultures also blend: women may complement their veils with high heels and nylons; berets are standard headgear among Moslem men. I remember a turbaned Arab patriarch, his face that of an old and weary eagle, buying chewing gum for his grandson in the Parc de Galland; the boy wore a sailor suit and a hat with a red pompon.

In Algiers you are never far from the stric-

tures of war. Roadblocks bar every access to the city; soldiers with submachine guns patrol the thoroughfares, a nightly curfew clears the streets. To guard against time bombs, shoppers are searched at the entrances to stores, movie-goers are forbidden to leave before a film ends, and the post office accepts no package not wrapped in the presence of a clerk. A doorman even searches the dinner-jacketed patrons of the city's plush casino before allowing them to try their luck at roulette.

Nonetheless, Algiers is a boom town. Soldiers, oilmen, refugees from the mountains choke the streets. New apartments spring up, but waiting lists continue to grow. Hotels are so overtaxed that every night some 600 visi-



tors fail to find rooms. Harried city officials lodge them in passenger liners moored in the harbor.

The harbor itself, protected by three miles of jetties, is actually the dominant commercial pulse of the city, and its activities provide a revealing glimpse of the Algerian economy. Great ships glide in daily to disgorge coal, wood, steel, and cement, then cast off to replenish Europe's larder with fruits, vegetables, and wine.

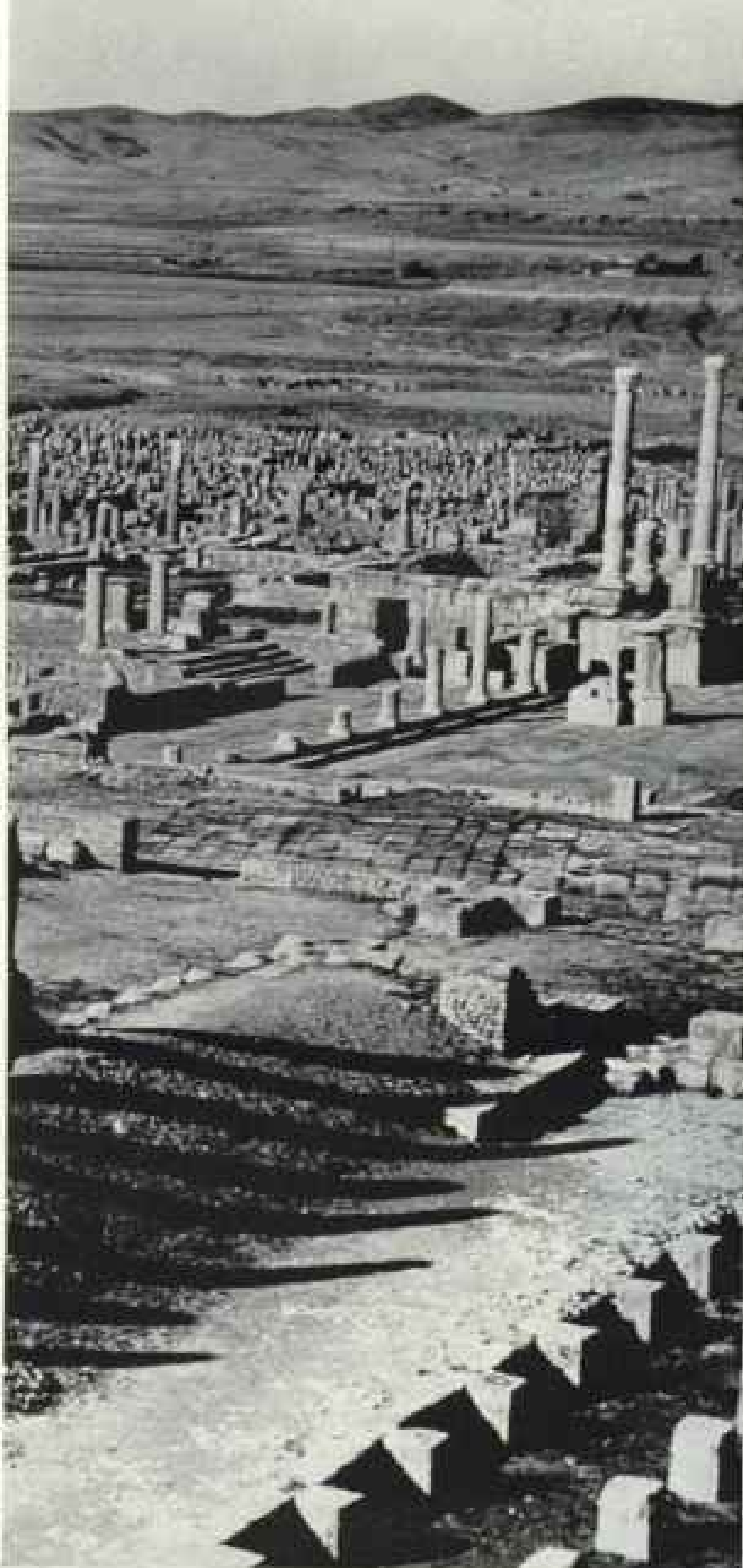
The port's Chief Engineer, André Jacquet, led me through his bustling domain.

"Wine is our principal export," he told me,

"We send more than a million quarts a day to Europe, mainly to France. I will show you how we handle it."

We passed into a warehouse where a man at an electronic console manipulated dials, while red, green, and white lights flashed across the wall in complex patterns (page 793). The air was heavy with the scent of wine.

"*Voilà!*" cried M. Jacquet. "A completely automated operation! An underground system of plastic pipes carries the wine from storage tanks in this building to loading points on the piers. By simply pressing buttons



here, one man can fill an entire ship's hold. These lights trace the progress of the wine every inch of its route."

"As a man who controls a million quarts of wine a day," I asked, "which type do you like best?"

"Personally," he replied, wrinkling his nose at the aroma that permeated the room, "I drink only water."

Rising steeply from the harbor is Algiers' oldest quarter—the mysterious Casbah (page 771). Here, in one-twentieth of a square mile of narrow, eternally shaded streets, dwell more than 50,000 people. "Two-thirds of them,"

Timgad's Headless Columns Tell a Story of Fallen Might

Nineteen centuries ago Emperor Trajan ordered a Roman outpost built in what is now northeastern Algeria. His soldiers planted their town at the junction of six roads on a high plain, a hundred miles from the sea. Many legionaries married and settled there.

At Timgad's height, 15,000 people frequented its colonnaded streets and buildings. Chariots rumbled past swaying camel trains that carried Africa's wealth toward Rome.

A flagstone in the Forum bears the legend: "To hunt, to bathe, to play, to laugh, this is to live."

Berbers sacked Timgad in the 5th century. The last inhabitants apparently fled 200 years later before Arab invaders.

This view from the stage of a 4,000-seat theater looks toward the sandstone and marble of Trajan's Arch, which appears on Algerian currency. Standing here, author La Fay heard French bombs blasting rebel strongholds in the distant mountains.

a resident wryly informed me, "make their living by selling to the other third."

From a rooftop at the Casbah's highest point, I looked out across the jumbled plaster houses. Women, unveiled in the security of their homes, sought fresh air on the flat roofs. Lounging in the sunshine, one fondled a cat; another combed her long black hair. It could have been a scene from the Algiers of centuries before—the stronghold of the Deys—save for one jarring note: Virtually every roof sprouted a television antenna.

Casbah at Liveliest on Sunday

Sunday is the best day to visit the Casbah. Torrents of Moslems ebb and flow along a cramped main street, Rue Randon. Butchers shout the praises of the goat meat hanging in their stalls; in a minuscule restaurant the waiter scoops up a bowl of couscous—crushed wheat steamed in broth—levels it with his hand, and serves a hungry client. Turkish baths are everywhere; women bathe in the morning, men in the afternoon, and at night,

for a small fee, the homeless can sleep there.

Amateur merchants—most hawking one jacket, one coat, or one pair of trousers—compete raucously with the professionals who display their wares in pushcarts or on a square foot of pavement. Talking feverishly, a merchant dangled one sock before me. Asking price: eight cents. I inquired about its mate. There was none; the price dropped to five cents. "Everybody," he told me with a pained expression, "needs an extra sock."

Fever Felled First Colonists

It was not always like this. When the first French colonists arrived in Algeria after the 1830 conquest, they pressed south of Algiers into the fever-ridden swamps of the Mitidja Plain. Of the first 250 families, all were decimated by malaria. But more followed, and working doggedly they drained the marshes. Vines, orange trees, vegetable gardens grew and prospered.

Today an acre of Mitidja's rich, black soil costs from \$820 to \$2,050.

Boufarik, in the center of the plain, is a tranquil city of wide streets shaded by plane trees. I drove through it one sunny morning and out a gently winding road to the Experimental Station of Arboriculture.

Director Louis Blondel whisked me off on a tour of his 114-acre preserve. "The government founded the station in 1927 to improve the yield and quality of Algerian citrus fruits," he explained. "Citrus orchards are tremendously important to us. They cover 91,000 acres and provide us with as many as 300,000 tons of exports a year."

Beyond the laboratories, where M. Blondel's staff carefully evaluates the yield of every tree at the station, we turned into a lane bisecting the orchards. On either side stood orange trees in labeled sections. Some of the names seemed familiar: Thomson Navel, Hamlin, Valencia Late. "We study more than 80 varieties here," M. Blondel said, "and we've had very good luck with some of your American oranges, particularly the Washington Navel from California. The Cali-



Smock Replacing Veil, a Young Arab Nurse Treats a Berber Child

Women increasingly serve on both sides of the Algerian conflict as nurses, aides, and couriers, though most Arab daughters still live secluded lives centered in the home.

Here a traveling nurse, member of a government team, administers eye drops to a victim of trachoma, a widespread menace to health.

Beauty-mark tattoos adorn Berber mothers at Ain Tida, one of 160 new villages where the government is resettling mountain tribes. Smiles bespeak the women's joy in greeting Françoise Carbon (in sweater), who has won their affection as a nurse in the area.

French francs pour into health centers, roads, and utilities in an effort to pacify the northern mountain country, home of Berbers for three thousand years.

fornia climate, you see, is rather like that of Algeria."

Suddenly we came to a double line of tall, leafless giants arching over the roadway. "Here," said M. Blondel, "you see the only mature pecan plantation in all of Europe and North Africa—10 acres of trees. I foresee a brilliant future for pecans in Algeria. Our valleys have the deep, moist soil in which they thrive."

We paused to watch a crew stripping juicy, golden Hamlins from a tree. M. Blondel picked up one of the oranges and hefted it fondly.

"Tell me," I asked, remembering water-drinking M. Jacquet at the port, "do you eat oranges yourself?"

"Two with every meal! Oranges are the perfect food. No fat to speak of, yet rich in carbohydrates, calcium, and vitamin C. There's even a bit of protein. Everyone," he added pointedly, "should eat oranges."

At dinner that night in a Boufarik restaurant, when it came time to choose a dessert,

I wavered between peach melba and an apricot tart coated with honey. But in the end, with M. Blondel's words ringing in my ears, I manfully ordered two oranges.

From the lush Mitidja to the Atlas Mountains is no great distance, but in human terms it spans a thousand years. Until the start of "the events," isolated families of Berbers and Arabs followed their flocks across the bleak massif or sowed a sparse crop on some rocky slope. Now, however, the French have mounted a massive campaign to lift Algeria's nine million Moslems from the poverty that has ground them for centuries. The result, they hope, will be to win the allegiance of those who support the rebellion.

Death Is Always Close at Hand

As a first step, the army gathers all families in a given area into a "regroupment village." There soldiers, civilian volunteers, or officers of the government's Specialized Administrative Sections begin the war upon misery. Since many if not most regroupment

KUDACHIKOVA © NATIONAL GEOGRAPHIC SOCIETY





Masked to the eyes, a Tuareg cavalryman seldom reveals his face, even to a blood brother. Though nominally Moslem, the tribe's women go unveiled.

Hard-riding Tuareg raiders terrorized the desert in the days before French rule.

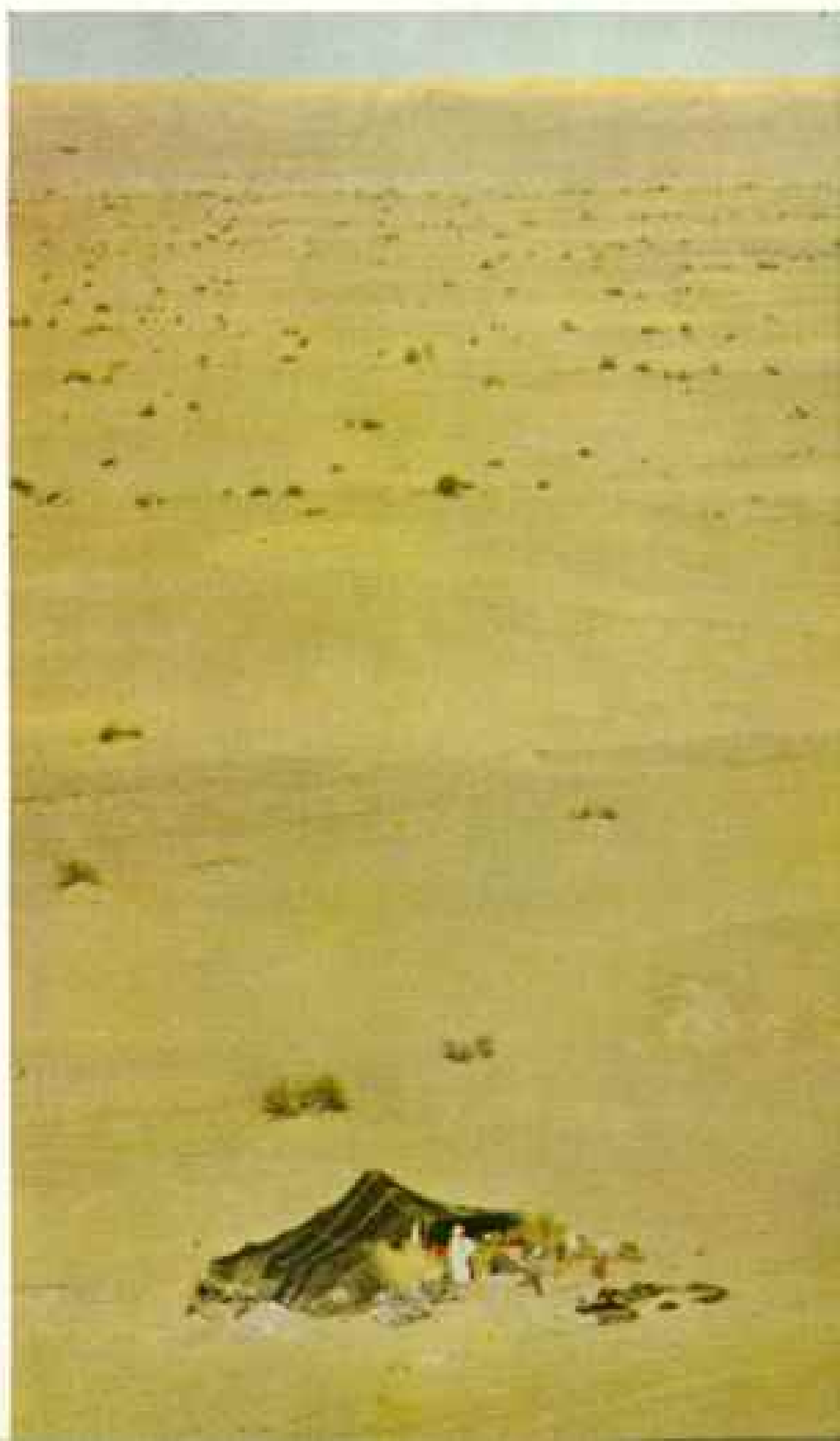
Plumes of Fire Roar at Hassi Messaoud; Its Oil Flows 415 Miles to the Sea

New Saharan fields, drilled at tremendous cost, increase Algeria's value to France. At Hassi Messaoud, some 60 wells dive two miles under the sand to tap a pool half as big as Rhode Island. Plans call for a city of 40,000 here.

Nomad tents dot the wastes a dozen miles from Hassi Messaoud. Here wandering Arabs and Berbers subsist largely on herds of hardy goats and sheep.

Most of the Sahara consists of sand-and-gravel plains such as this one, broken by islands of rugged peaks. The fearsome *ergs*, or regions of shifting sand dunes, make up

782 little more than a seventh of the desert.





villages are in rebel-infested territory, the danger is great. Death lurks no farther than the next clump of trees.

Still, the program has caught the French imagination. Every year hundreds of youths from both Algeria and metropolitan France enlist for the risky business of nursing and teaching the Moslem population. One such is Mademoiselle Françoise Carbon, a young graduate of the Sorbonne's Faculty of Letters, who spent several months as a volunteer nurse in the regroupment village of Aïn Tida.

With Mile. Carbon I set off one day to see the program in action. From Algiers we went by train to Affreville. A government official, wise in the ways of survival, suggested that we take the *inoxidable*, the express with stainless-steel coaches. "Though one must pay a supplement," he explained, "the inox gives much more protection than wooden coaches if it strikes a mine."

Via inox, therefore, we proceeded to Affre-

ville, thence to the dusty agricultural town of Carnot, where we joined the weekly truck convoy bound to Aïn Tida, high in the hostile Dahra mountains. The convoy—bristling with machine guns—had formed in front of Carnot's school for girls. Inside the big glass windows I could see European girls, their hair in pigtails, and Moslem girls, their hair hennaed a vivid red, sitting at double desks.

Captain Charles Boyer—Artilleryman

To my surprise, Charles Boyer commanded both the convoy and Aïn Tida. But this Charles Boyer, I soon learned, had never seen Hollywood; he was a sinewy captain of the 42d Artillery Regiment. As the trucks growled up into the brown hills, he told me: "I've been in the army for 14 years now. And always there's been a war. First Germany, then Indochina, now here. France is the one place a French officer rarely visits any more."



As our convoy wound higher into the hills, a silver fighter plane kited in from the south to fly cover. Zooming low, the pilot hedgehopped the road ahead, searching for any sign of a rebel ambush. Periodically, he flashed an "all clear" on the radio.

When we finally swept into Aïn Tida, a tidal wave of children engulfed Mlle. Carbon. While she renewed acquaintance with her onetime patients, Captain Boyer showed me through his village of 150 mud huts—called *gourbis* in Arabic—housing 790 people.

He knocked on a door. After a moment it opened, and a smiling Berber woman invited us into her windowless habitation. The air was close, furniture was pitifully scarce, but the house was as clean as hands and brooms could keep it.

"These *gourbis* are temporary," the captain said. "We hope eventually to provide every family with a new two-room house. Meanwhile, we've built a school and an infirmary,

and we've set up one of the villagers in the grocery business."

In the one-room school the volunteer teacher, an 18-year-old university student from Oran, was conducting a reading lesson. Boys and girls in bits and tatters of clothing, most of them barefoot, sat at rigid attention. One by one they rose to follow aloud the progress of the teacher's pointer across the sentences chalked on the blackboard. "*L'image . . . d'Ali . . . est . . . belle. C'est . . . le . . . crayon . . . d'Omar.*" ("Ali's picture is beautiful. This is Omar's pencil.")

The young teacher played magnificently at being stern, and there was something unbearably poignant about the ragged moppets eagerly stumbling over the written words. So, in schools all across Algeria, an entire generation is discovering the 20th century.

Captain Boyer and I watched from the back of the classroom. "The saddest part," he whispered, "is that we have room for only one child from each family. It's the absolute limit of our capacity. This way we can ensure that at least one in each family will read and write."

In the infirmary, Mlle. Carbon had pitched in enthusiastically to aid the two volunteer nurses who now visit Aïn Tida one day a week (pages 780-81). Thanks to such regular medical care, the diseases that once ravaged the Algerian population—malaria, typhus, smallpox—have been all but wiped out. Nevertheless, there is a long road yet to travel. Among the patients in the infirmary was a man who had treated chills by rubbing his chest with gasoline and setting it afire.

Captain Boyer's pride and joy proved to be a pipeline that his men had built between the

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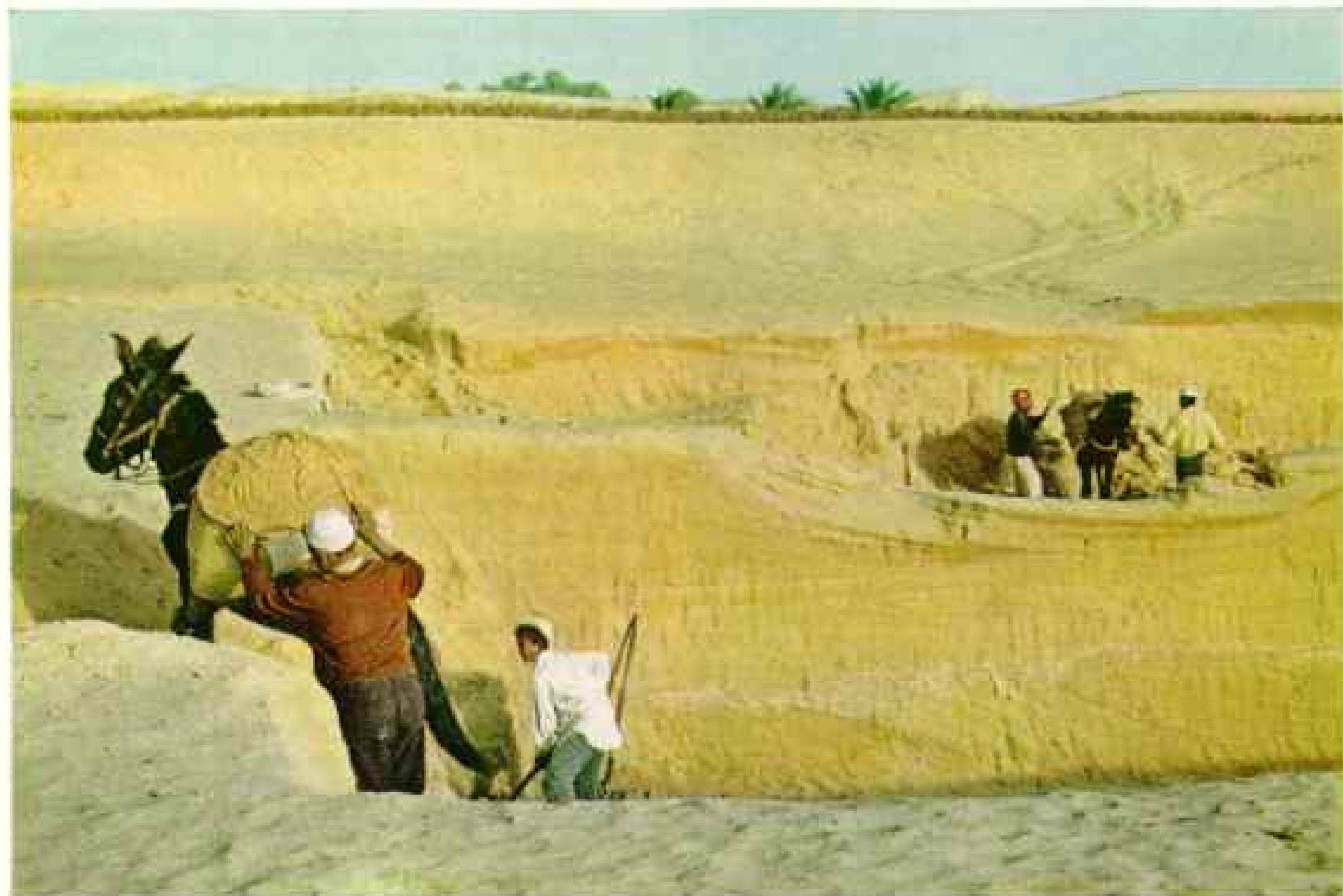
Burnoose-clad customers at El Oued's Friday market inspect hillocks of oranges and greens. In an oasis where timber is scarce, adobe construction predominates. From the air, the abundant mud domes suggest a pile of halved grapefruit. Though years pass with no rain, occasional torrential storms literally dissolve Saharan towns.

At El Oued the railroad ends on the fringe of a 200-mile swirling wasteland known as the Great Eastern Erg. One of the world's biggest expanses of sand, it contains dunes more than 600 feet high.



Encroaching dunes threaten date palms in a man-made sink at Tarhazout, in a region where oases nourish three million trees. This pit shields 60-foot palms from searing winds. Team hauling sand (above) fights the ceaseless battle;

diggers (below) carve a new planting basin. Distant fence of fronds slows drifts. Legend tells of cavern-locked seas beneath the Sahara, but surveys deny their existence. Probing for moisture, plants sometimes send down 100-foot roots.



village and its spring, some two and a half miles distant. "The women of Aïn Tida," he told me, "no longer have to trudge five miles a day for water and carry it home on their shoulders. Now water is no more than 100 yards from any house.

"Of course, the rebels harass us. Once they cut the pipeline, but we managed to repair it in an hour. Another time they fouled the spring itself. All they accomplished in both cases was to alienate the villagers.

"Soon," he added enthusiastically, "I'm going to use the surplus water to irrigate these slopes. Someday Aïn Tida will be the most prosperous village in the Dahra!"

"For a professional soldier," I observed, "yours is an odd assignment."

"True," he grinned. "But this is an odd war." As I left for Carnot in the returning convoy, Captain Boyer's villagers were happily flocking into the Army mess hall to see their weekly motion picture.

Sooner or later, and probably sooner, Aïn Tida will get its new houses. Neat white duplexes with blue doors—Arab tradition has it that blue repels flies—are replacing Algeria's gourbis at the rate of 20,000 a year. A Moslem community need only offer the necessary land; the state then provides men and material to transform the serried hovels into a tidy village. In exchange for one month's manual labor in building his new home, a tenant can become the owner.

French Risk Lives for a Better Land

Behind this vast project is Commissioner of Reconstruction Louis Gas, a tall man who is proud of his department and his adventurous young assistants. "Every day," he told me, "they risk their skins in the bush because they believe in the new Algeria they're building.

"Our goal is to build 1,000 new villages, each with an infirmary and a school. Over the whole country, we're opening 10 new classrooms a day.

"As for housing, with six million people in desperate need of shelter we have neither the time nor the means for anything elaborate. You've seen our villages; you know they're no showcases—just sturdy, clean settlements in which families can live with dignity."

South of the Atlas Mountains, sheltered from "the events" by distance and topography, stretches the Sahara. Of this vast, parched sea of sand and rock, about 835,000 square

miles lie within Algeria's borders. Temperatures here range from 16° to 135° Fahrenheit; rainfall averages around four inches annually, but for years at a time not a drop falls. The relative handful of nomads who drift across the desert inhabit what is one of the earth's most thinly populated regions.

Tuareg, Once Warlike, Still Roam Desert

Nine hundred miles south of the Mediterranean, the glaring dunes and barren plains of the Sahara explode into the weird, tormented mountains of the Hoggar. Once, in the mists of prehistoric time, rivers coursed from the Hoggar to water all the desert; today the mountains are as arid and forsaken as the moon. But there, in savage grandeur, lives one of Africa's proudest peoples, the Tuareg. While the days of their warlike glory—the swiftly raided caravan, the plundered oasis—have faded away, 10,000 tall, regal Tuareg, mysterious in their blue-black veils, still wander across the wastes like men of dreams (page 783).*

The Hoggar's largest oasis, Tamanrasset, possesses a striking architectural harmony. The homes of its 1,500 inhabitants, the hotel, and even the hospital are all constructed of the same material—mud.

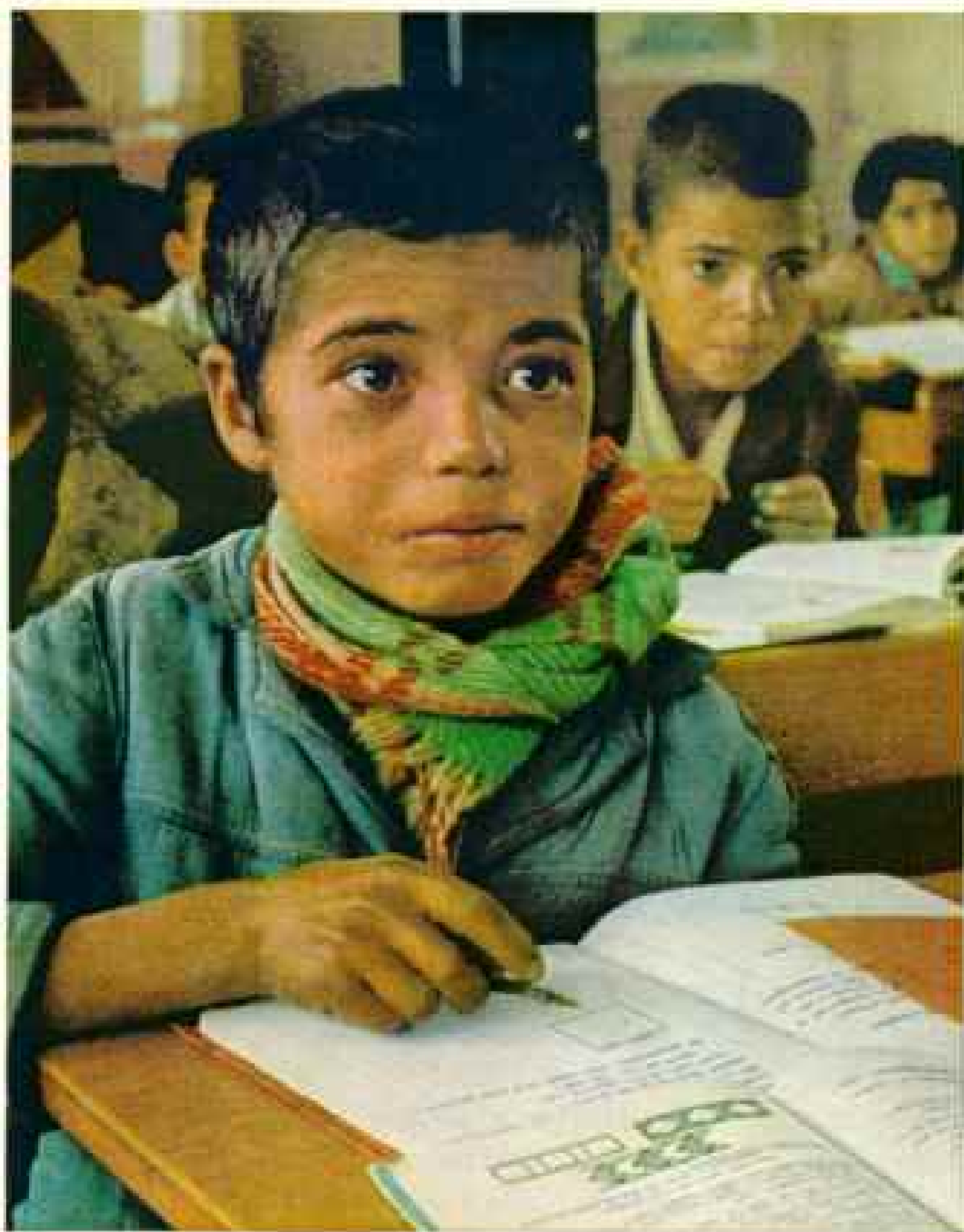
"One good rainstorm," ruefully admitted a resident, "would do more damage than a hydrogen bomb."

Capt. Pierre Denis, commander of the local Méhariste, or Camel Corps, company, was my host in Tamanrasset. Under French officers, the 220 Tuareg and Arabs of his unit control a largely uncharted area nearly the size of Montana. Their name, Méhariste, derives from their traditional mount, the swift white racing camel—*méhari* in Arabic.

"Two of my four platoons are motorized now," Captain Denis said regretfully. "But some parts of the Hoggar are accessible only by camel. The mounted platoons spend as long as a year in the desert without ever contacting a base. They live largely off the land, and mail arrives only once a month.

"To keep your sanity," he continued, "you've got to have a hobby. Mine, when I commanded a platoon, was prehistory. Once, perhaps 6,000 years ago, the Hoggar was well populated. There were lakes and grass,

* For detailed accounts of Sahara life, see in the NATIONAL GEOGRAPHIC: "Sand in My Eyes," by Jinx Rodger, May, 1958; and "Oasis-hopping in the Sahara," by Maynard Owen Williams, February, 1949.



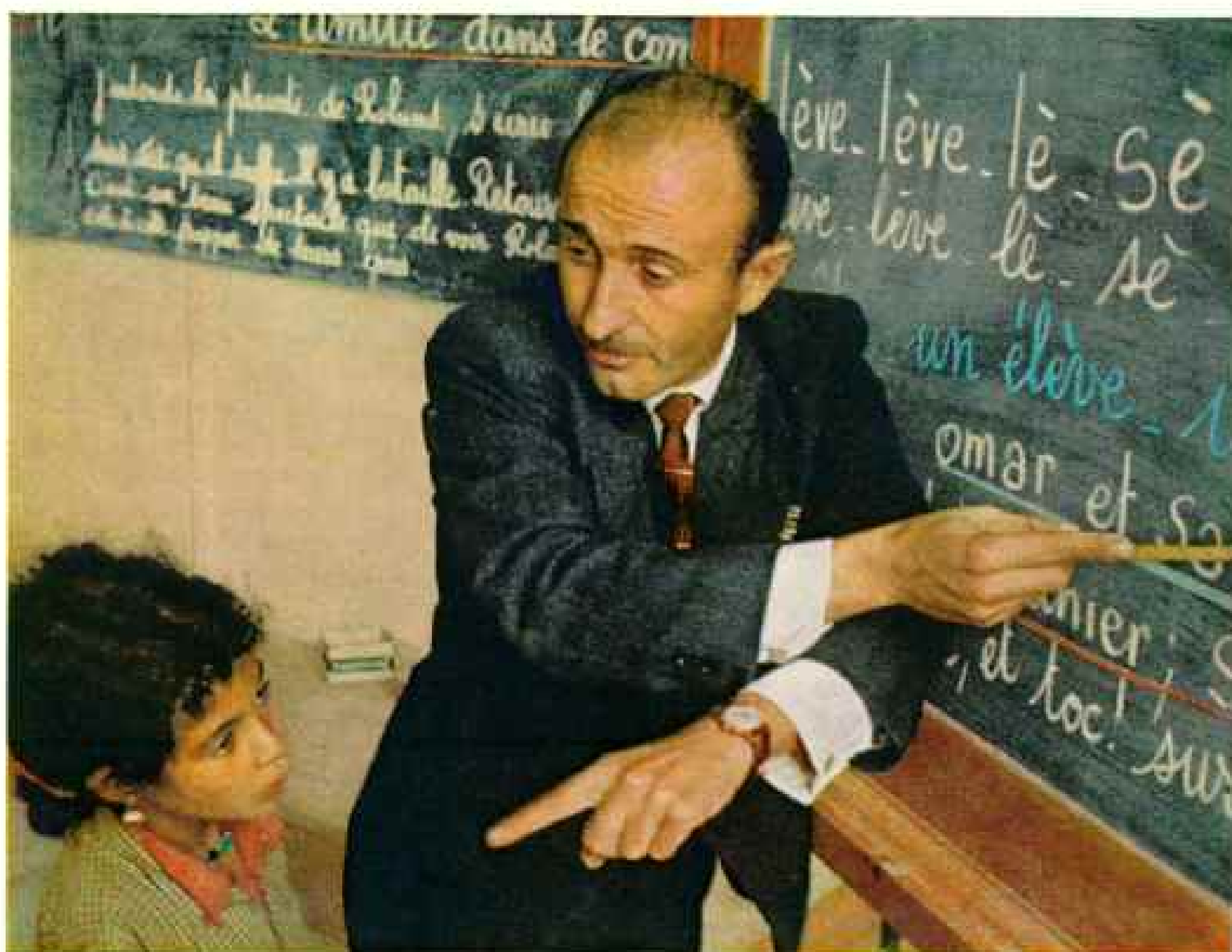
School ends a roving life for Berber boys; these lads ponder arithmetic problems at Djellida, a new upland village for onetime nomads.

Where schools are available, Algerian children must attend to age 14. The government built 10 new classrooms a day in 1959, and plans to have two-thirds of the country's youngsters enrolled within three years.

Berber girl masters French at school, her own tongue at home. In a drive to westernize family life, educators stress learning for once-neglected girls. The curriculum excludes Arabic and Berber in favor of French.

The teacher's lapel ribbons signify distinguished military service. Expanding schools use a thousand instructors still in uniform.

Blackboard at left deals with the French medieval classic, "Song of Roland."



and giraffes and elephants roamed the plateaus. Now, wherever you look in the Hoggar, you find the remains of a flourishing neolithic culture: arrowheads, flint knives, pottery, even fossils of fish.

"The Tuareg are the poorest and the happiest people in the world. I've been in their tents, and I envy them. If a chief passes by, they brew some tea; for a great chief they may even kill a camel and eat some meat. But day in and day out they're content with a cup of camel's milk and a handful of grain. Why? Because they have the only true liberty. They do as they please; they are the masters, not the slaves, of time."

Camels Go Where Vehicles Can't

I set out in a truck with Chief Sgt. Christian Couderc to get a taste of life in a Méhariste platoon. All day the truck pounded across the rocky Hoggar, winding between peaks twisted and distorted by some ancient volcanic agony. Once we passed a solitary Tuareg striding purposefully from nowhere to nowhere, a long wicked sword strapped at his side. Finally, at the *gueltas* of Issakarassene, we rendezvoused with Sgt. Gaston Chevalier's 2d Platoon.

This rocky basin, fed by infrequent rains, was typical of dozens scattered across the Hoggar. Issakarassene was a startling wonderland of green bushes, nodding trees, and chirping birds. But the thing that enthralled me most was the discovery that here—in the middle of the Sahara—small fish were darting through cold, clear water.

We formed a small caravan. Alternately riding and leading our camels, we threaded our way across the tortured terrain on the first leg of a wondrous odyssey (page 776).

Twice daily we dined on the meat of freshly shot gazelles, together with macaroni spooned out of a common bowl. Evening brought tribal chants and dances by the platoon's Tuareg. It also brought tales of life—and near-death—in the Méharistes.

"Every year," Chevalier said, "twenty or thirty nomads die of thirst in our district. In the hottest part of summer, a single day without water can kill you. Last August we were in the Tassili-n-Ajjer when our water ran out. We spent a day searching for springs; finally, the troops began to collapse. As one of the Tuareg flopped down by a bush, he spotted jackal tracks. He followed them and there, not 20 yards away, was a tiny, hidden spring.

Another hour and it would have been too late."

Later, after the stories, we rolled into blankets and slept beneath the chill light of the Southern Cross, as a lone veiled sentry paced the perimeter of the camp.

By day we visited other *gueltas*, and once stopped in the shade of a rock covered with carved giraffes, jackals, and lyre-horned cattle painstakingly chiseled by a Stone Age artist. Another time, crossing a dry stream bed, I picked up a chipped hand ax that had served some neolithic hunter.

Finally, after days immersed in the languid rhythm of desert life, we left Sergeant Chevalier at Issakarassene. As our truck wheeled over a rise, he stood among his Méharistes—bronzed, barefoot, wearing a bur-noose against the evening chill—to wave farewell. He would not see civilization for another year or two. But, like the Tuareg, he had found freedom.

Change, however, is overtaking even the changeless Sahara. Africa's first atomic weapon exploded this year above Algerian sands, and south of Reggan, French rockets scream the length of a secret range.

Industry, too, is marching into the desert. Geologists have discovered a million tons of manganese ore in the Guettara Mountains, 100 miles south of Colomb Béchar. Southeast of Tindouf an immense vein of iron contains an estimated two billion metric tons of ore.

Liquid Gas Destined for Europe

Hassi R'mel's staggering 28 trillion cubic feet of natural gas will soon contribute to Algerian industrialization. In addition, a plant at Arzew will liquefy as much as 100 million cubic feet a day and ship it to Europe: Capt. Jacques-Yves Cousteau has surveyed the Mediterranean to determine the feasibility of a submarine gas pipeline.

In September the 150 million tons of petroleum reserves near Edjeleh will start to flow to the Gulf of Gabes in Tunisia. Already the mammoth 500 million tons found at Hassi Messaoud are pulsing 415 miles through a 24-inch pipeline to the port of Bougie.

To the French Government, Hassi Messaoud symbolizes the bright economic promise of the Sahara (page 782). There, more than 60 wells extract a crude oil so light that workers pour it directly into the tanks of their diesel trucks.

Only four years ago, Hassi Messaoud—pro-



Madonna in Stone Blesses Busy Oran,
Where Spain's Influence Lives On

Bullfights, gypsies, and lisping Castilian remind visitors that Oran lived under Madrid from the 16th to the 19th century. Many of the



WILLIAMSON © NATIONAL GEOGRAPHIC SOCIETY

residents still speak Spanish, despite 170 years of Turkish and French rule. A metropolis of 300,000, Algeria's second city remains prosperously

aloof from fighting and curfews. Here, workmen build a Moorish-domed Catholic church with a French-Spanish name: Notre Dame de Santa Cruz.

phetically enough, the name means "blessed wells" in Arabic—was a wind-swept caravan stop. Then, on June 15, 1956, an exploration crew struck oil at 11,000 feet.

Today, Hassi Messaoud would dazzle the eyes of any caravan. Two air-conditioned hotels welcome guests, 7,000 workers swarm among tanks and derricks, and last year a sports-car rally brought a fleet of motorists down from Algiers on a newly paved road. The Compagnie Française des Pétroles (Algérie) even provides its employees with a swimming pool, tennis courts, a theater, and a garden with 500 specially imported birds.

Spanish Flavor Clings to Oran

The well-paid *pétroliers* of Hassi Messaoud stay on the job for 21 consecutive days, then receive a week's vacation with free transportation to and from Algiers. However, those in search of gaiety generally keep right on going until they reach Oran—Algeria's second city and the only sizable coastal settlement without a curfew (page 790).

Founded by Moorish sailors from Andalusia in the early 900's, Oran passed under Spanish rule in 1509 and remained so—with one brief interruption—until an earthquake drove the Spaniards out in 1790. French troops took over in 1831.

Still, the Spanish cachet lingers on. Valencian *paella* is a feature of several restaurant menus, and most of the night-club dance floors offer a diluted version of flamenco. The 15,700-seat bull ring last year offered ten *corridos*—and one basketball game starring the Harlem Globetrotters.

Dominating Oran, the stern fortress of Santa Cruz, built by the Spanish in the 16th century, crowns the 1,300-foot peak of Aïdour. After touring the castle's vaulted gloom, I mounted the ramparts. Gazing out across the blue peace of the Mediterranean, I saw a submarine surface in an explosion of spray, then glide into the great French naval base at Mers el Kébir, four miles west of Oran.

One of World War II's darkest tragedies unfolded at Mers el Kébir. Here, on July 3, 1940, British warships shelled French Navy vessels to keep them out of Nazi hands. When the smoke cleared, the French ships were a shambles, and 1,200 sailors were dead.

An hour's drive south from Oran brought me to a small, walled city steeped in romance: Sidi bel Abbès, home of the French Foreign Legion. Bel Abbès, as legionnaires call it,

owes its existence to the Legion; legionnaires built the city as a garrison in 1847, and the training of Legion recruits remains its chief industry.

Behind an imposing sand-colored wall in the center of Bel Abbès, young men—and some not so young—receive an arduous initiation (page 776). Founded in 1831, the Legion has left its dead on battlefields from Norway to Madagascar. The flag of the Legion's 3d Foreign Regiment is the most decorated in the French Army.

Twenty thousand men from more than 40 nations now swell Legion ranks. Thousands serve under assumed names. "The Legion," an officer told me, "is a thermometer of the economic and political ills of Europe. After the Spanish Civil War, we had an influx of Spaniards; the post-World War II period brought us Germans and Italians; recently we've been doing very well with Hungarians."

The Legion motto, *Legio Patria Nostra*, means "The Legion is our Homeland," and for the dispossessed it is just that. The Legion feeds its men, clothes them, pays them, even gives them an annual Christmas present. In return, legionnaires swear allegiance: not primarily to France but to the Legion.

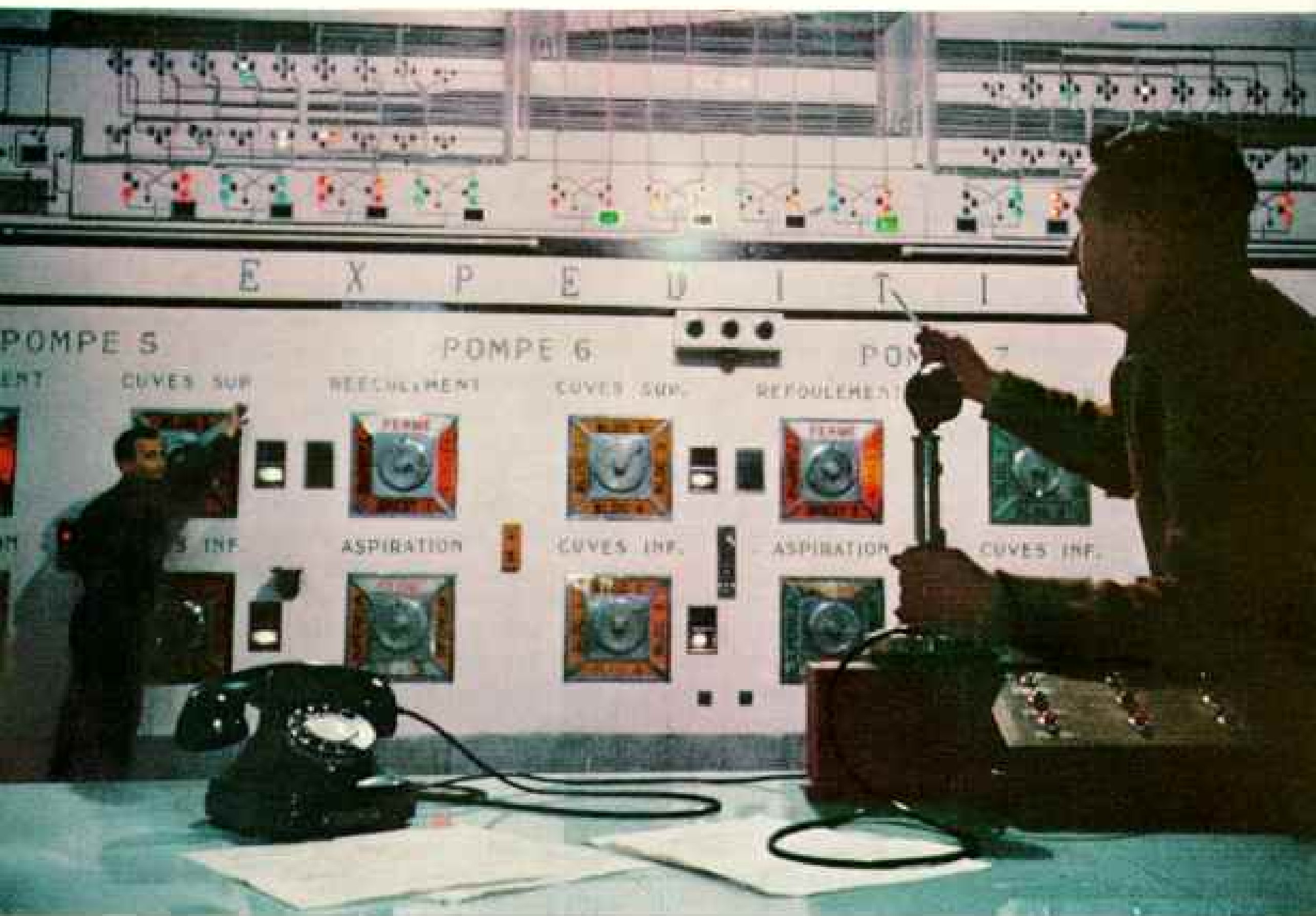
In the garden outside the Legion Museum in Bel Abbès, I paused before a weathered brass plaque in the adobe wall. It announced that here rested the ashes of William Moll, an American ex-legionnaire who died in Chicago in 1937 and whose last wish was to repose forever among his former comrades. Americans, however, have never been numerous in the Legion; only about ten are currently enrolled.

As in Indochina, where casualties numbered 10,363 killed and some 20,000 wounded, the Foreign Legion bears the brunt of the Algerian war. "In 1954 when the rebellion started," a British diplomat told me, "twenty British legionnaires were registered with our consulate in Algiers. Only two are still alive."

Legion a Refuge for Romantics

Why, given this terrible mortality, do recruits continue to pour into Bel Abbès to follow a flag not their own? "Because," smiled a Czechoslovakian captain, "we are all searching for something. Something intangible. The Legion gives it to us."

Or perhaps, as it seemed to me, Foreign Legionnaires are the world's last romantics—men wholly in love with war and half in love



Push-button Controls in Algiers Pump Wine Into Ships

One operator at the console of this fully automated facility can load several tankers a day. The panel's winking lights report the wine's journey through buried pipes.

Solar furnace near the capital produces temperatures of nearly 6,000° F., half as hot as the sun's surface.

Scientists seek to use Algeria's sunlight in making nitric acid from oxygen and nitrogen in the air. Success would make possible production of sorely needed nitrate fertilizer.

Solar energy can cool, too. It runs air conditioners at the French atomic test site in the Sahara.



with death. An American member, the poet Alan Seeger, once wrote:

*I have a rendezvous with Death
At some disputed barricade,
When Spring comes back with rustling
shade
And apple-blossoms fill the air—**

Legionnaire Seeger kept his rendezvous at Belloy en Santerre on July 4, 1916.

Barbed Wire Guards an Ancient City

In Algeria the Legion does the bulk of its fighting in the east near Constantine, where the European population is submerged in a sea of hostile Moslems.

I found Constantine a city besieged. Concertinas of barbed wire stood ready to seal off each street leading into the central Place de Nemours (page 775). Elaborate screens protected every large cafe from grenades. The police, bedeviled by a terrorism that has killed or wounded thousands since 1954, had completely barricaded certain sections of the Moslem quarter. To go from one house to its neighbor, I frequently had to detour completely around a district.

Nonetheless, the city—which straddles the wildly beautiful Gorge of the Rhumel—is perhaps the most colorful in Algeria. A Jewish community arrived with the Arab invaders of the seventh century and still guards its ancient customs. In the Jewish open-air market I saw women, some in traditional black headdress, examining an orange here, squeezing a chicken there.

In the Moslem market, an enterprising merchant had fastened handles to quart tin cans, neatly converting them into colorful mugs. But the label on the red, white, and blue tankards would strike mortally at the thirst of any American: Esso Extra Motor Oil.

Constantine traces its history back to the third century B.C. when, as Cirta, it was the capital of Numidia. In 46 B.C. the region became a Roman province, experiencing a golden age of peace and plenty until the Vandals overran it in the fifth century.

* Reprinted with permission of Charles Scribner's Sons, New York, and Constable & Co. Ltd., London.

To protect their African province from the unruly tribes of the Aurès mountain country, the Romans dispatched the Third Legion to the south of Cirta. There on a plain 3,500 feet above sea level, the legionaries built the city of Timgad in the year 100 (page 778).

Today the skeleton of that proud city looms in lonely splendor above the weeds that clog its streets. From afar I saw the two remaining columns of the Capitol's Temple of Jupiter that jut into the empty African sky—crumbling sentinels of a vanished empire.

Slowly I passed between the ruined buildings on either side of the chariot-rutted *Cardo Maximus*. The rains of almost 1,900 winters had eroded the "Pompeii of Africa," yet the Roman foundations stood firm and strong; ovens still stood ready for the housewives' bread, the arena for some ghostly games. A wind from the Aurès sighed across the empty Forum, ruffling the wild grass that fought for life between the flagstones. Staring at the great Arch of Trajan, I fancied I could hear the clatter of war chariots and the tramp of Roman feet in triumphant entrance.

Long ago Timgad forgot war, but war has not forgotten Timgad. As I watched, a French patrol, submachine guns at the ready, turned from the *Cardo Maximus* into the Forum.

Tragedy Stalks Algeria

What, in the end, are the images that one carries away from Algeria?

... A bitter Moslem in a village square pointing to the blind and the lame pleading for alms. "For centuries of this," he says, "there is a justice that awaits us. The Europeans exploit us. They grow richer while we grow poorer. But now we will have justice."

... A small, pretty girl in a pinafore amid the throngs on Algiers' Rue d'Isly. A rebel bomb has just killed her. The girl is eight years old. The day is Christmas Eve.

... A young couple on the Oran-Algiers train—the *inox*, of course. The girl stares out the window. Leaning over, her escort asks, "Why so sad, *chérie*?"

Without turning her head she replies very softly, "Because this is a sad country."

Perky French Poster Children Brighten Algiers' Biggest Department Store

In the Galeries de France, wives of Islam buy such items as nylon hose and spiked heels; some wear their purchases with veil and robe. Shoppers undergo search at the door to prevent terror bombings. Last year, a bomb just outside killed five people.

Yuletide posters of French provincial costumes hang beneath Moorish skylights.





R. ARTHUR STEWART

The Smithsonian, Magnet

By LEONARD CARMICHAEL, Secretary, Smithsonian Institution, and Member of the Board of
Illustrations by National Geographic photographer

ONE CLOUDY MORNING some months ago, a blue-clad postman walked briskly into the Natural History Building of the Smithsonian Institution on Washington's Mall. Making his way through a throng of guards, guests, and onlookers, he entered the Hall of Gems and Minerals. As cameras flashed, he handed me a simple brown parcel bearing \$145.29 in metered postage

and held out a registry receipt for me to sign.

Carefully we snipped the strings, unfolded the wrappings, and drew out a flat leather case. A hush fell over the room as I raised the lid and held up the case for all to see.

Inside, on a pillow of white satin, the fabled Hope Diamond winked its magnificent blue eye at the crowd. Worth an estimated million dollars, this largest of all blue diamonds



WILLIS D. WOODRIF

on the Mall

Trustees, National Geographic Society

VOLKMAR WENTZEL

had come to the Smithsonian as a gift to the Nation from Harry Winston, the New York jewel dealer (page 817).

The stone's dark gleam gave only a hint of the sinister legends that haunt it—stories that it was snatched from the brow of an Indian idol three centuries ago, and that its curse has caused at least a dozen tragic deaths and has toppled two royal thrones.

HAYES LITTLEHALES (TOP) AND DANNY BISHOP © N. G. S.



Horned dinosaurs and shrunken heads, antique cars, Inca silver statuettes, and Peruvian grave dolls—these but hint at the fantastic array of exhibits millions of visitors see at the Smithsonian Institution, America's treasure house. There is something for everyone in its three museums, three art galleries, and zoo in Washington, D. C. Behind the scenes, the Norman castle and other Mall buildings hold immense scientific collections.

Dr. Alexander Wetmore (above), the Smithsonian's former Secretary, continues the ornithological research for which he is world famous.

Far from being a symbol of dread and death, the 44½ carats of shimmering splendor seemed to me a good omen. The Hope Diamond typifies an ever-increasing flow of valuable gifts coming to the Smithsonian from benefactors all over the globe. And its beautiful setting in the new Hall of Gems and Minerals symbolizes the rapid transformation taking place in our museum halls.

Mark Twain, in *The Innocents Abroad*, wrote in 1869 of "that poor . . . mildewed old fossil, the Smithsonian. . . ." In more recent times newspapers have called us "the Nation's attic." But no longer. Our handsome, modernized halls are fast becoming the Nation's showcase. In Washington, no other attrac-

The Smithsonian Institution comprises these distinct Government bureaus:

United States National Museum (including the Museum of Natural History and the Museum of History and Technology)

National Air Museum

National Gallery of Art

Freer Gallery of Art

National Collection of Fine Arts

National Zoological Park

Bureau of American Ethnology

Astrophysical Observatory

Canal Zone Biological Area

International Exchange Service

tion surpasses the Smithsonian as a magnet for tourist and visiting dignitary alike.

Nowhere else in the world will you find so broadly based a group of museums with so varied a collection, ranging across the natural sciences, history, art, and technology. All this is displayed to give the Institution's millions of visitors a more patriotic appreciation of America and a better understanding of the world.

There are huge objects—the biggest of elephants and the biggest dinosaur bone ever found (seven feet long). And tiny things: hummingbirds' eggs and butterflies hung like mobiles on wires.

Live animals (an observation hive of bees)

and dead ones (including Winchester, the horse General Sheridan rode in the Civil War).

A 2,573-pound meteorite, perhaps as old as anything on earth; mammoth hair and flesh deep-frozen for thousands of years; a skeleton of the extinct dodo.

Immense stone images from Easter Island. A Buddha in whose lap cleaning women occasionally find coins. Cigar-store Indians and Egyptian mummies. Maya and Aztec carvings.

A model of the Parthenon and a copy of the Rosetta Stone. Models of naval vessels and sailing ships accurate to the last detail.

A \$10,000 bill in U. S. currency. A necklace of human fingers. A drinking cup cut from solid emerald. A page from a Gutenberg Bible. Half a million different postage stamps.

And priceless relics of America's growth: the 1893 Duryea, a pioneering horseless carriage; an 1837 Morse telegraph ("What hath God wrought?"); many of the early telephones developed by Bell ("Mr. Watson, come here, I want you!"); Edison's early incandescent lamps and phonographs; Howe's tiny but revolutionary sewing machine; a cannon ball fired from Fort Sumter; the wooden wheel of the battleship *Maine*; a replica of the Grapefruit satellite.

Especially significant, I think, was the remark of an Iowa visitor who chanced to stand at my side that morning as the Hope Diamond was placed for the first time in its glass-fronted vault. "It's something to tell our grandchildren," she said simply.

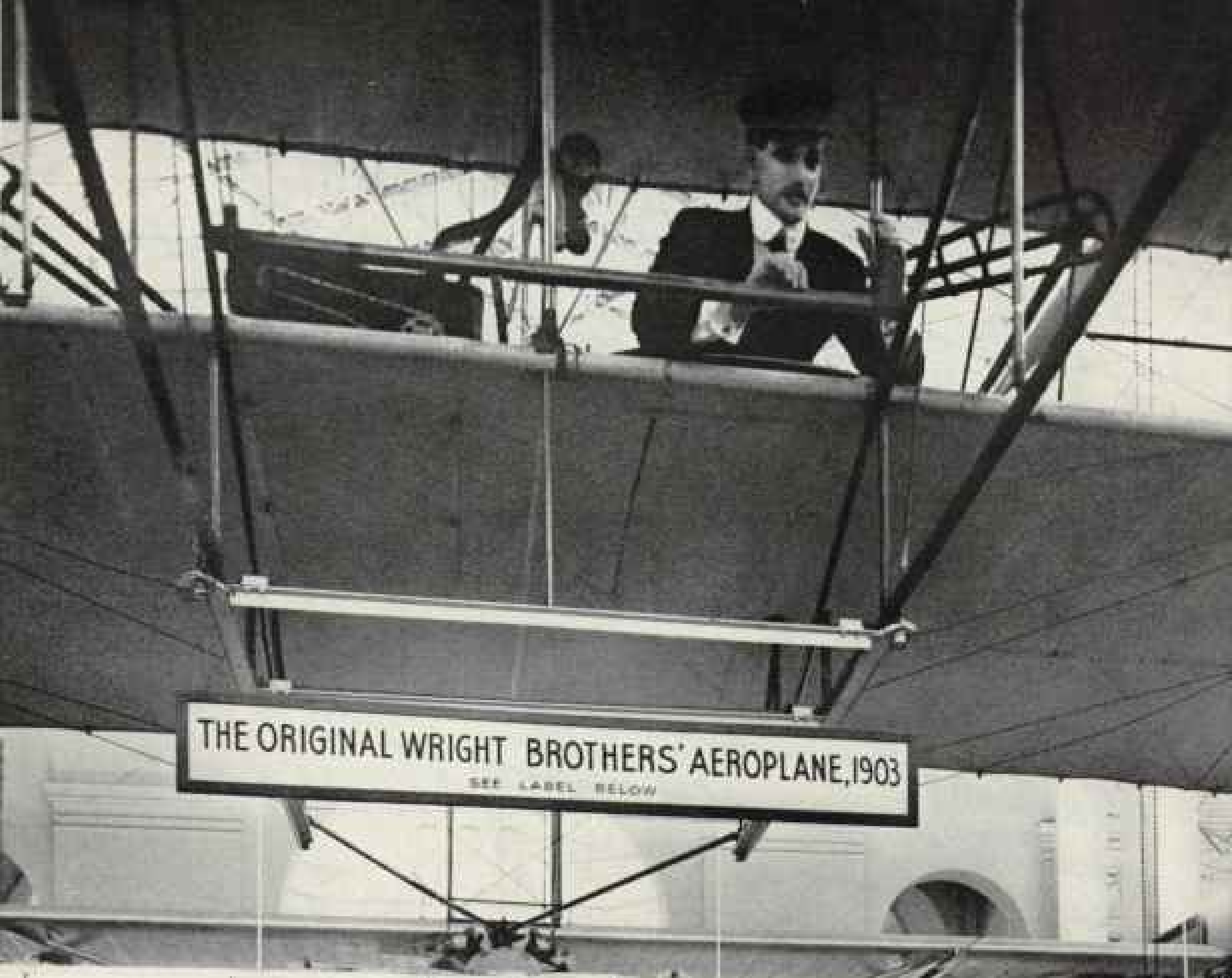
That pleasant lady spoke more profoundly than she knew. Unwittingly she summarized the genius of the Smithsonian Institution. Conservator of America's cultural heritage, the Smithsonian speaks in a powerful voice to all the generations of the future. Like Colonial Williamsburg, the Institution exists "that the future may learn from the past."

The Smithsonian's beginnings go back nearly 134 years to a scene in a fashionable London flat. A lonely man, frail and ill at the age of 61, sat at his writing desk. Outside, in the darkness of an autumn evening, rain spattered the stones of Cavendish Square. Inside, a flickering fireplace provided the only note of cheer. Quill in hand, the English-

(Continued on page 807)

Aloft in a Museum, Kitty Hawk Flyer Blazes Trail for Spirit of St. Louis

Imaginative youngsters (and their parents) can relive the splendid moments of aviation with the Smithsonian's unparalleled collection of historic planes. Here, with Orville Wright at the controls, visitors make man's epochal first flight above the North Carolina sands; with Lindbergh's *Spirit of St. Louis* they make the pioneering solo hop across the Atlantic. Other craft await construction of a new Air Museum.



THE ORIGINAL WRIGHT BROTHERS' AEROPLANE, 1903
SEE LABEL BELOW



I James Smithson son to Hugh first Duke of Northumberland
 & Elizabeth heiress of the barony of Studley &
 niece of Charles the Proud Duke of Somerset now
 residing in Bontinck Street Coventry Square, do this
 twenty third day of October one thousand eight
 hundred & twenty six, make this my last will
 and Testament. I bequeath the whole of my
 property of every nature & kind now found at
 the united states of america, to found at
 Washington, under the name to the Smithsonian
 institution, an establishment for the increase
 & diffusion of knowledge among men...

James Smithson.



James Smithson, an Englishman, penned one of history's most unusual wills in 1826 when he left his fortune of half a million dollars to the United States "to found . . . an establishment for the increase & diffusion of Knowledge among men."

Despite his wealth, and prestige earned for research in chemistry and mineralogy, Smithson died a lonely, unhappy man. The artist shows him as an Oxford student.

Author Leonard Carmichael is seventh in a line of scientists to be Secretary of the Institution founded by Smithson's bequest. Today's extensive renovations are swiftly turning "the Nation's attic" into the Nation's showcase, bringing floods of visitors and gifts. Statue of Joseph Henry, first Secretary of the Smithsonian, stands between the headquarters building (foreground) and the domed Natural History Building. James Smithson lies in a tomb just off this vestibule.



"Fisheye" Camera,
Staring Down From a Dome,
Probes a Museum's Vitals

Four halls show simultaneously in this extraordinary photograph of the rotunda in the Arts and Industries Building.

To the north (top) hang the *Spirit of St. Louis* and the *Kitty Hawk Flyer* (page 799). Cases beneath the planes hold swords and uniforms of naval and military heroes and memorabilia of statesmen and explorers.

To the east, beneath Langley's "aerodromes," the Hall of Land Transportation displays *John Bull*, oldest complete locomotive in North America (1831), amid a welter of oxcarts, shays, sleighs, and fire engines.

To the south, a brilliant new Hall of Textiles traces the story of spinning and weaving. Its prizes include Whitney's model of the first cotton gin and the patent model of Howe's lock-stitch sewing machine.

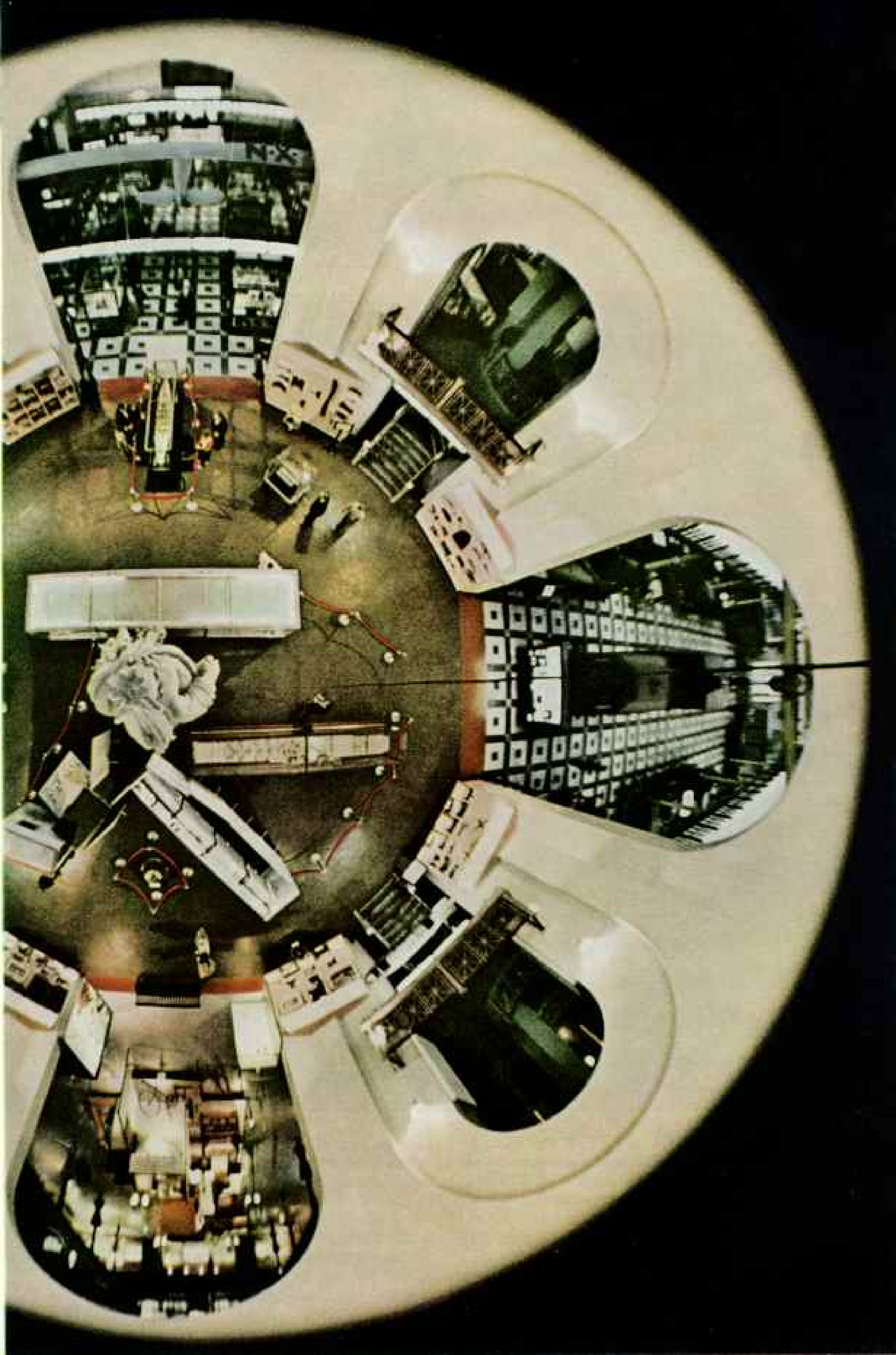
To the west, a Vanguard rocket rears 72 feet, all but blocking view of the Lincoln exhibit.

Directly below the camera stands the model for the bronze Statue of Freedom atop the National Capitol. Other rotunda exhibits include scale models of the World War II carrier U.S.S. *Yorktown* (right of statue) and of U.S.S. *Pennsylvania*, on which Eugene Ely in 1911 made the first airplane landing on a ship.

Horseshoe arches between the halls lead to gallery exhibits.

The Fisheye's extreme-wide-angle lens encompasses 180 degrees, seeing everything in front of it. Only two such lenses exist in the United States; Nikon, Inc., lent one for this picture.





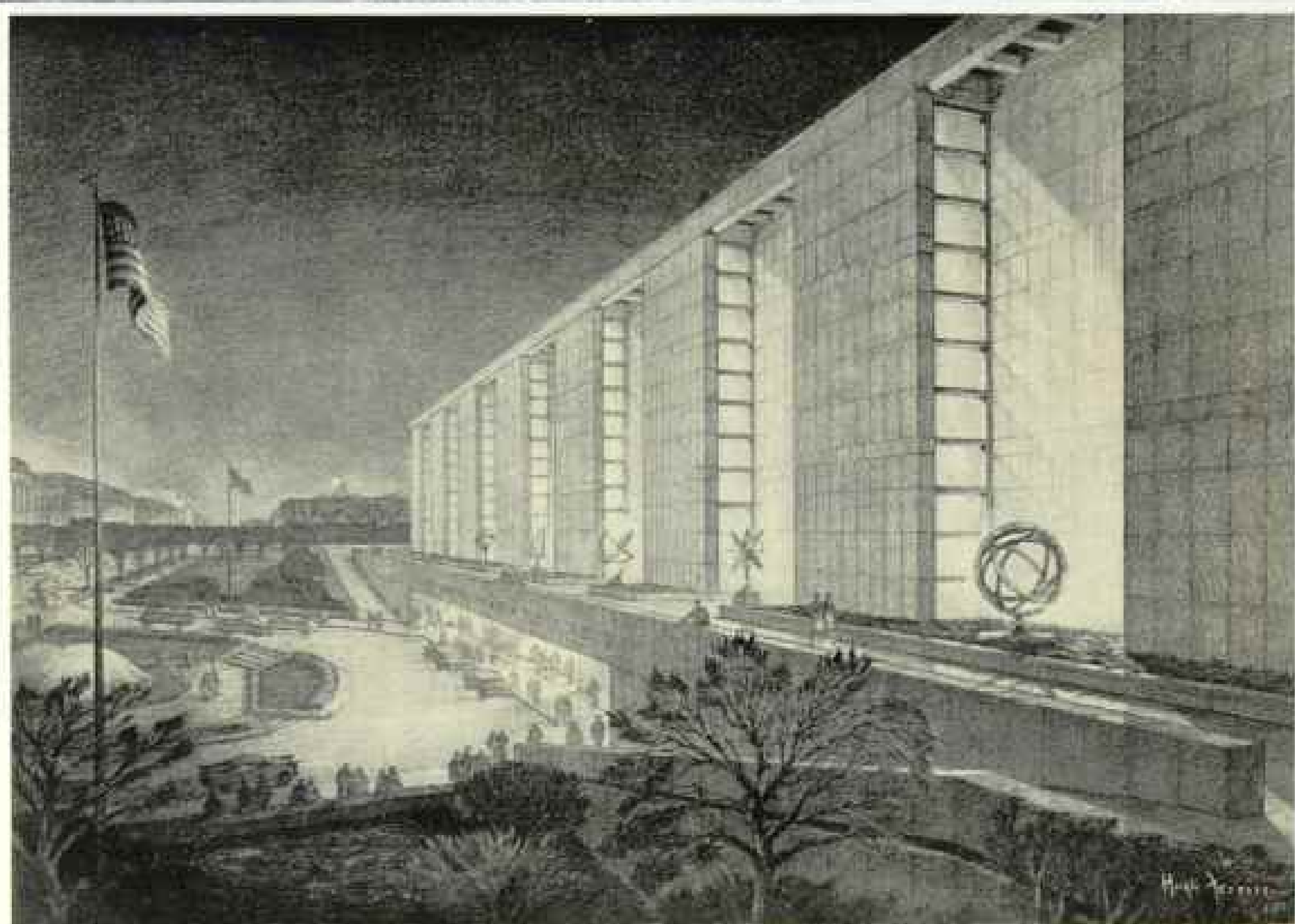


NATIONAL GEOGRAPHIC PHOTOGRAPHER DAVID DENNIS

Smithsonian's domain, seen from the Washington Monument, spans 10 blocks eastward on the Mall toward the Capitol, whose dome is scaffolded for repair and darkened by an undercoat of anti-rust paint. A two-block pit (1) marks the site of a new Museum of History and Technology (opposite). Proposed wings will expand the Natural History Building (2). Across the Mall from the marble dome of the National Gallery of Art

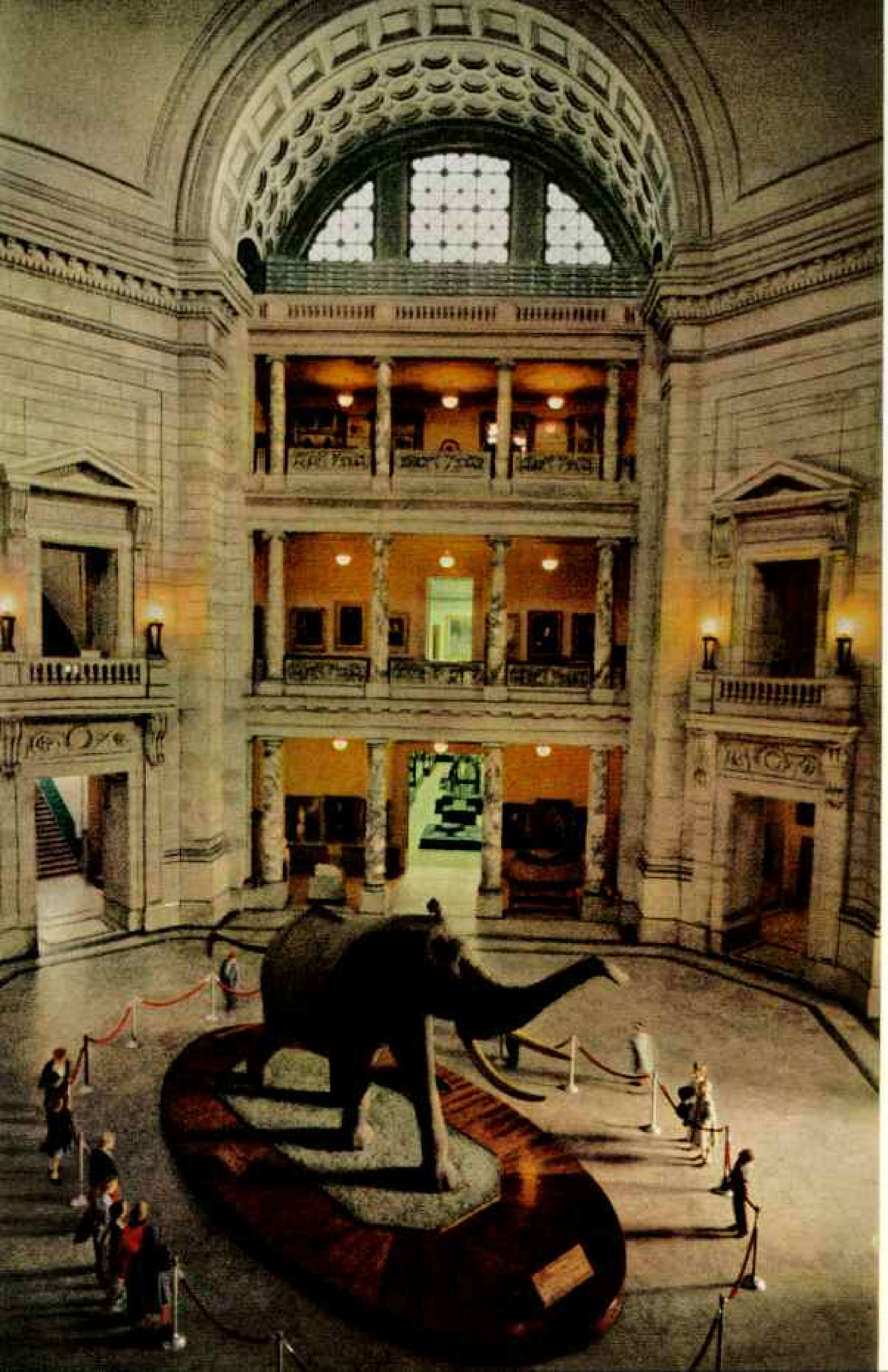
(3) will rise the new Air Museum building (4).

The slim white pencil of a Jupiter-C missile stands beside the Arts and Industries Building (5), which, with the Aircraft Building (6), shelters a few of the National Air Museum's historic craft. Oriental art fills the Freer Gallery (7). Headquarters building (8) resembles a Norman castle. Pillared façades of the Federal Triangle (left) border Constitution Avenue.



ARCHITECT: H. W. YERGEN BY WASH. POST/ASA. COURTESY: NATIONAL INSTITUTION

In 1962 the new Museum of History and Technology will shelter the Nation's treasures. Its imposing Constitution Avenue façade will blend with classical Government buildings facing it.



man wrote: "I James Smithson son to Hugh first Duke of Northumberland & Elizabeth heiress of the Hungerfords of Studley. . . ."

So, on that October evening of 1826, a few pen scratches outlined one of the most remarkable bequests of all time.

" . . . In the case of the death of my . . . nephew without leaving a child . . . I then bequeath the whole of my property . . . to the United States of America, to found at Washington, under the name of the Smithsonian institution, an establishment *for the increase & diffusion of Knowledge among men.*"

Donor Resented Social Slights

Why should a wealthy Englishman of the 1820's decide to give his fortune to a young republic far across the seas, a land he had never seen? Queen Mother Elizabeth of Britain, on the occasion of her 1954 visit to the United States, asked me that question. I could give her no certain answer.

All we know is that the lonely Englishman in his cheerless bachelor lodgings had reason for bitterness. Because he bore the life-long stigma of illegitimacy, he had been denied his father's title and place in society. Substantial wealth inherited from his father, one of the leading peers of the realm, and from his mother, a descendant of King Henry VII, did not keep the injustice of his social position from rankling deeply.

An industrious student, Smithson resolved to achieve honor in his own right. He became proficient in the new sciences of chemistry and mineralogy; once he caught a tear on a lady's cheek and analyzed it chemically. His wide investigations were recorded in scores of manuscripts and 27 published papers. He was elected a Fellow of the Royal Society.

Having achieved a name, Smithson determined to perpetuate it. He wrote: "The best blood of England flows in my veins; on my father's side I am a Northumberland, on my mother's I am related to Kings, but this avails me not. My name shall live in the memory of man when the titles of the Northumberlands and the Percys are extinct and forgotten."

Smithson died in 1829. Six years later his nephew died childless, and Washington learned

to its amazement that the United States was heir to more than half a million dollars, a tremendous sum in that day.

Surprisingly enough, Congress was not sure it wanted the money. "It is beneath our dignity to receive presents from anyone," thundered such opponents as John C. Calhoun. But the eloquence of more farsighted men, including John Quincy Adams, prevailed, and the legacy was accepted. On August 10, 1846, President James K. Polk signed the bill creating the Smithsonian Institution.

Joseph Henry, America's most distinguished scientist at the time, served as Secretary for the Institution's first 32 years. His principles still govern the Smithsonian: "The great object is to facilitate in every way the promotion of science, and especially the fostering of original research, and enlarging the bounds of human thought." He decreed that no branch of knowledge should be excluded from the Smithsonian's attention.

Whatever Smithson's motives may have been, he achieved spectacularly his ambition to preserve his name. The Institution he founded has become one of the world's most influential scientific and cultural centers.*

Researchers Pioneer in Many Fields

The first organization in America to maintain a full-time staff of research workers across the broad field of science, the Smithsonian has played a major role in the surge of American scientific progress of the past century. It has assisted at the birth of such sciences as meteorology, aeronautics, and rocketry; of such Federal agencies as the Weather Bureau; of such organizations as the American Association for the Advancement of Science and the National Geographic Society.

Since Smithson's death, an estimated 2,000 expeditions have carried his name to every part of the earth (map, page 828). Some ten thousand scholarly books and monographs bear the Smithsonian imprint. The Institution's scientific observatories girdle the globe. Scientists and scholars in increasing numbers use its laboratories, its vast study collections,

*For an earlier picture, see "The Smithsonian Institution," by Thomas R. Henry, NATIONAL GEOGRAPHIC, September, 1948.

A Triumph of Taxidermy, the Giant of Elephants Strides in Majesty

Footprints more than two feet long led J. J. Fénykövi, Madrid industrialist and big-game hunter, to this bull in the Angola jungle. Largest land animal in modern records, the 12-ton monster towered more than 13 feet at the shoulder; his hide weighed two tons. He dropped under the impact of 16 heavy-caliber bullets. A carefully modeled papier-mâché form supports the hide in the rotunda of the Natural History Building.

its library of more than a million titles, many of them on deposit in the Library of Congress.

For the public, the Smithsonian maintains a zoo, three museums, and three art galleries. Together they constitute the largest museum complex in the world. More than 11 million people annually view its exhibitions. What they see represents but the choicest fraction of the 52 million catalogued treasures—worth well over a billion dollars—which the Smithsonian preserves.

As I look out of my office windows these spring days, I sometimes feel as though a Pied Piper were playing his tunes near by. Youngsters come in droves, like the children of Hamelin. They spill out of long lines of tour buses along the Mall (we've counted as many as 110 buses at a time) and troop excitedly through our doors. Their plumed souvenir hats bob gaily through the halls.

Thrills Lure the Youngsters

With eager anticipation they rush to ogle the Vanguard and Jupiter-C rockets; to marvel at the dinosaurs and the mightiest of all elephants; to tingle with horror at a scalp once prized by an Indian warrior and at the shrunken trophies of a Jivaro head-hunter.

Their elders follow more slowly, chuckling at the early automobiles and airplanes, and the costumes of bygone days. Their hearts lift at the first glimpse of the Star-Spangled Banner, and other relics that tell the story of our rise to national greatness.

There's something for everyone at the Smithsonian. You would only get intellectual indigestion if you tried to take it all in at once. If you spent one minute looking at each exhibited object, you would be a steady visitor for at least two and a half years.

Come with me for a little while, and savor a few of the Smithsonian's highlights. And let me take you behind the scenes, to show you how the Smithsonian goes about increasing and diffusing knowledge among men.

If James Smithson could come along, I suspect he would choose to start in the Hall of Gems and Minerals, for mineralogy was one of his lifelong interests. Indeed, he discovered a new mineral—zinc carbonate—now called smithsonite in his honor (page 819).

Smithson would be amazed, I think, at the tremendous size and quality of our mineral collection—the world's finest. And I'm sure he would exclaim with delight at how superbly our exhibits specialists, headed by scientist-artist John Anglim, have arranged and lighted choice specimens for a vivid display of nat-

ural beauty (page 818). Many a visitor, gazing in disbelief at our natural crystal clusters, says to the guard: "Are these real? Surely you must have done something to them!"

Children with shining eyes peer into a rock garden flooded by black light. Under invisible ultraviolet radiation, fluorescent minerals glow in unearthly pinks, greens, yellows, and purples. At intervals black light gives way to ordinary illumination; the colors die and the "flowers" turn again, Cinderella-like, into drab and lifeless rocks.

Near by, visitors listen to the crackle of a Geiger counter as a piece of uranium ore from the Belgian Congo orbits past.

Like all our new displays, the Hall of Gems and Minerals teaches as well as entertains. Specimens are grouped and labeled according to chemical make-up. Special exhibits tell how minerals form in the earth's crust; others explain the mysteries of crystals.

School children by the thousands use our museums as a living textbook. Led by trained docents — lecture guides — Washington-area students tour the modernized exhibits in small groups. This year 36 public-spirited members of the Junior League of Washington are giving a day a week to serve without compensation as docents.

Surveys indicate that museums are a major influence in firing the imaginations of young people and leading them into scientific endeavor. Who knows what future Edison or Bell or Steinmetz may date his career from his first visit to our halls?

Enormous Jewels Blaze With Color

Spectacular as are the minerals, they do not dim the magnificence of the walnut-paneled gem room. Here the Hope Diamond dominates the finest and most extensive collection of gems on display in the United States. Ruby, emerald, sapphire, amethyst, jade, topaz—virtually every variety of precious stone joins in a dazzling phantasmagoria that would stir the envy of a maharaja.

Skillful lighting brings out the rays in the 316-carat Star of Artaban, a huge star sapphire. The world's biggest alexandrite, a 66-carat specimen from Ceylon, turns alternately red under artificial light and green under simulated daylight.

The stories behind our exhibits are as fascinating as the specimens themselves.

Here, for instance, lies a bit of gold no larger or thicker than a child's fingernail. Its value as gold bullion can be measured in



ESDACHRUMER BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CONYER © N.G.S.

Evening campfire in a buffalo hunters' tepee calls to mind life on the Great Plains a century ago. Fifty-year-old plaster mannequins of an Arapaho family create a striking illusion of reality. Sixteen poles support the 100-pound tent of 14 buffalo-cow skins. Until recently the 17-foot tepee lay in Smithsonian's study collections; newspapers of 1876 stuffed inside recall that it was exhibited at Philadelphia's Centennial Exposition of that year.



Like Phantoms in a Tunnel of Horrors, Spirit Masks Peer From the Gloom

pennies. Yet this fragment holds tremendous significance in the saga of the West. It is Sutter's gold. Every schoolboy knows how this very nugget in 1848 sparked the California gold rush and gave tremendous impetus to westward expansion (page 819).

Lions and Pearls for the President

A pearl necklace recalls another morsel of history. In 1839 the Imam of Muscat, in eastern Arabia, sent a magnificent pair of lions to the American consul in Tangier, with instructions to deliver them to President Martin Van Buren. Later the ship *Sultance* from Zanzibar dropped anchor in New York Harbor with further royal gifts: two fine Arab horses, a string of 150 pearls, a carpet, cashmere shawls, and attar of roses.

Then, as now, many official gifts to the President and the United States ended up at the Smithsonian. The Institution did not

Skillful illumination in a dark alcove re-creates the dim firelight of a Northwest Coast Indian dance house, where secret societies used these

get the lions and the horses, but you may see the pearls in our gem room, and the carpet graces an alcove in the First Ladies Hall (page 842).

From the earliest days, the Smithsonian took a keen interest in geology, assisting many a pioneer exploration of the West. The United States bought Alaska from Russia in 1867 largely because of testimony by Spencer F. Baird, later the Smithsonian's second Secretary, about the territory's wealth in minerals, timber, and other resources.

Today, behind the glamorous front of gems and fancy rocks, our geological laboratories quietly hum with important research work.

If you walked into the mineralogist's laboratory, you might find him shooting X rays through thin spindles of powdered minerals. Each mineral thus treated creates a characteristic diffraction pattern on photographic film. Scientists use these patterns to iden-



WOODEN MASKS © NATIONAL GEOGRAPHIC SOCIETY

wooden masks in their winter ceremonial dramas. Faces represent specters, man-eating creatures, and mythical heroes. Blurred mask revolves to

show contrasting visages of Zunok, a two-faced Kwakiutl Indian who gave liberally at feasts but was untrustworthy in his dealings.

tify minerals just as positively as the FBI uses fingerprints to identify criminals.

In other geological laboratories, paleontologists study the chronicle of life through the ages. These are the fossil specialists, who reconstruct the evolution of living things from the most primitive one-celled blobs of two billion years ago to the most complex modern plants and animals. With the evidence of fossils, they help trace the slow-motion forces of erosion, sedimentation, and upheaval that have drastically altered the face of the planet.

Such work may seem unimportant, yet, like much of the Smithsonian's pure research, it often turns out to have great practical significance. Consider, for example, the microscopic shelled animals called foraminifera that first appeared in the warm primeval seas of nearly half a billion years ago.

Smithsonian scientists for years have studied foraminifera from apparently useless sea

mud. The tiny shells of these creatures have proved to be reliable indexes to the geologic age of oil-producing rock layers, and thus help to indicate strata under which oil is likely to be found. As a result, scientists of all large oil companies study the tales told by fossils in their test borings.

How to Clean a Dinosaur

Most fossils are encased in solid rock. Some can be freed by dissolving the limy matrix with acid. Others are dropped in a cleaning bath where 29,000 ultrasonic vibrations a second shake loose encrustations. But to free the bones of large prehistoric animals requires tedious chipping and grinding. Smithsonian technicians employ equipment much like a dentist's.

How long does it require to clean a dinosaur? Well, take the case of the giant diplodocus, a 135,000,000-year-old lizard from Utah.

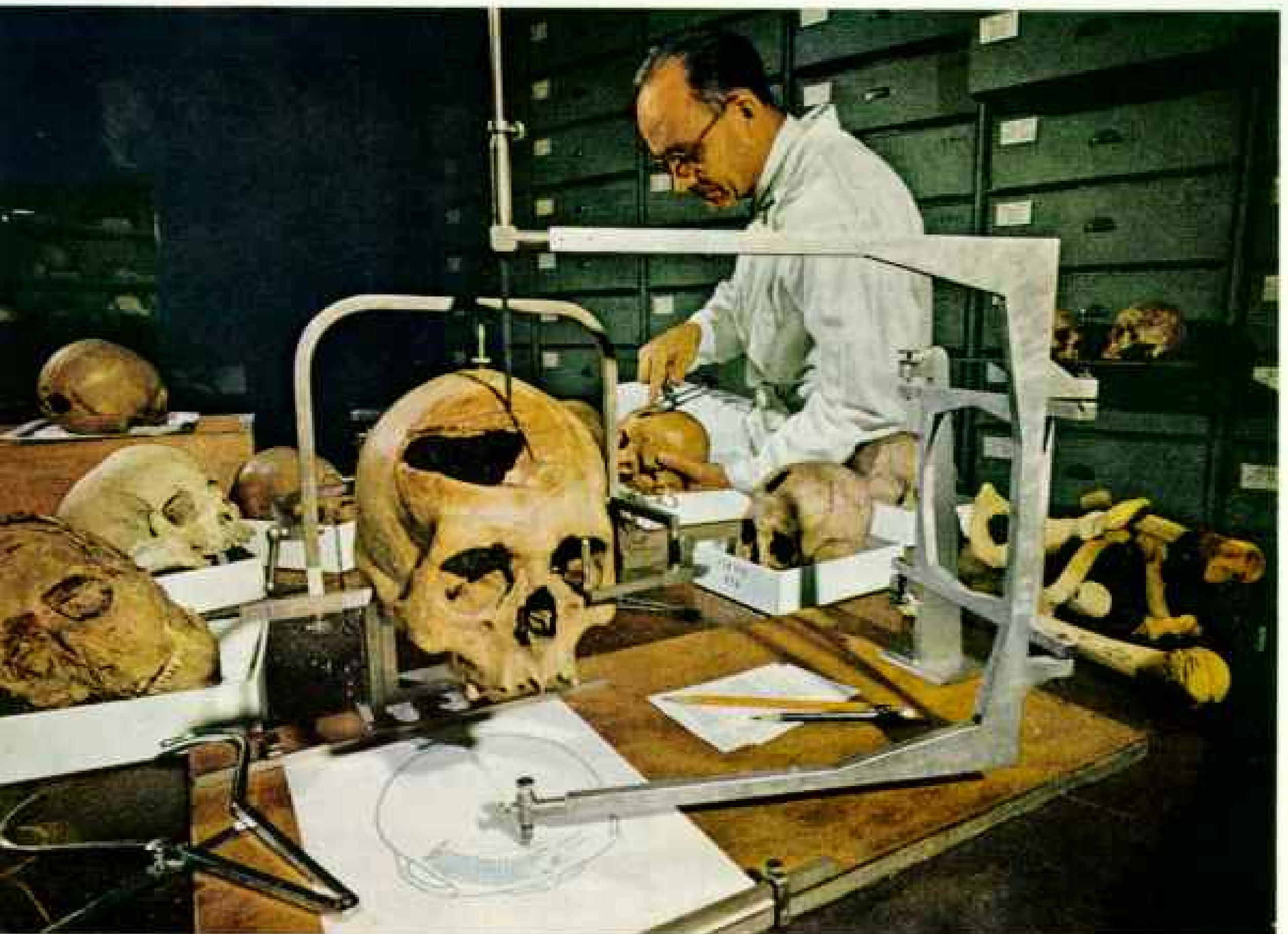


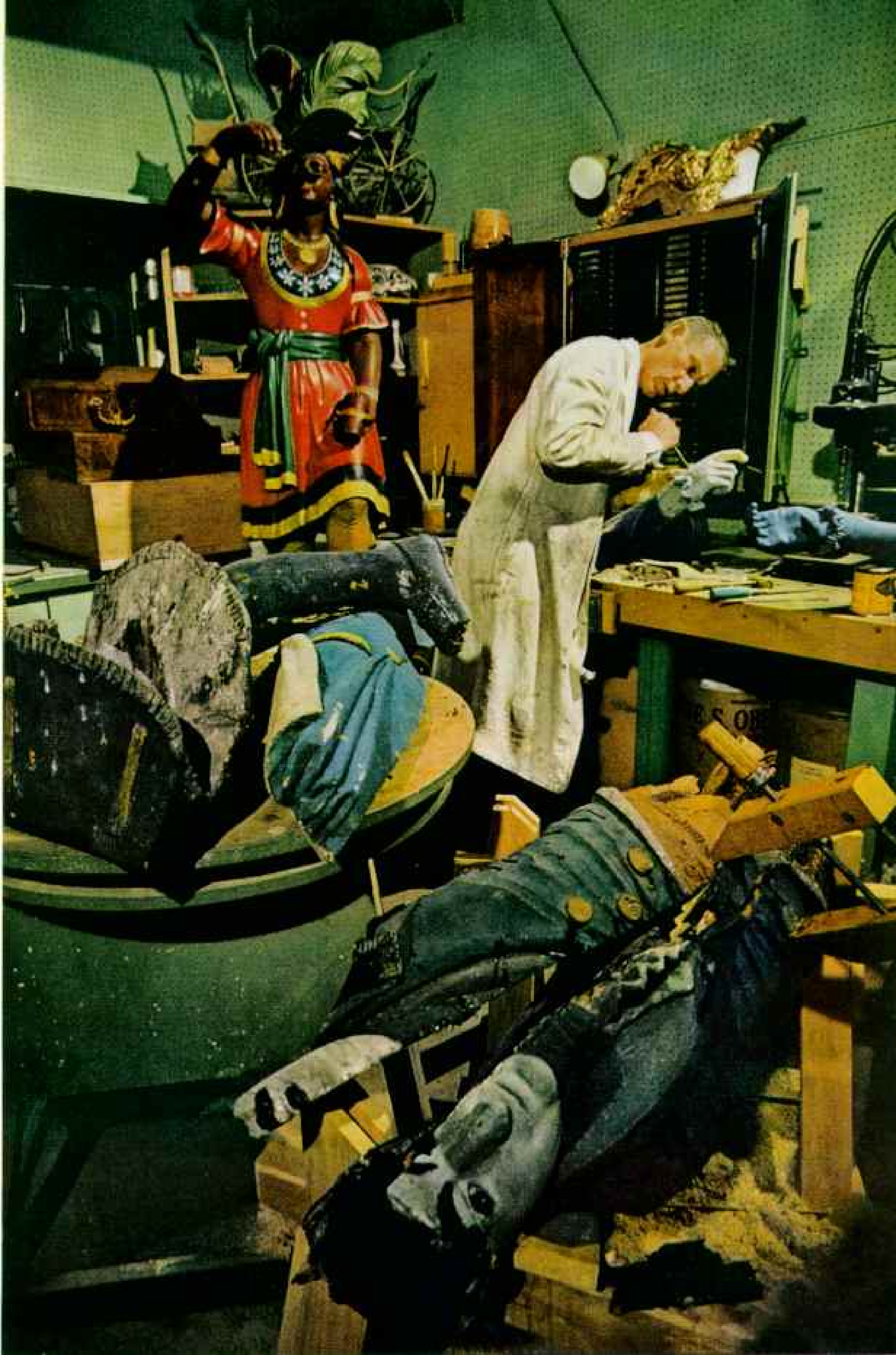
Hideous expressions on Iroquois spirit masks spelled not evil but good; disguised men wore them from house to house, exorcising the demons of sickness. These wooden faces, collected in Ontario's Six Nations Indian Reserve by the Bureau of American Ethnology, wear wigs of horsetails and eye sockets of tin and brass.

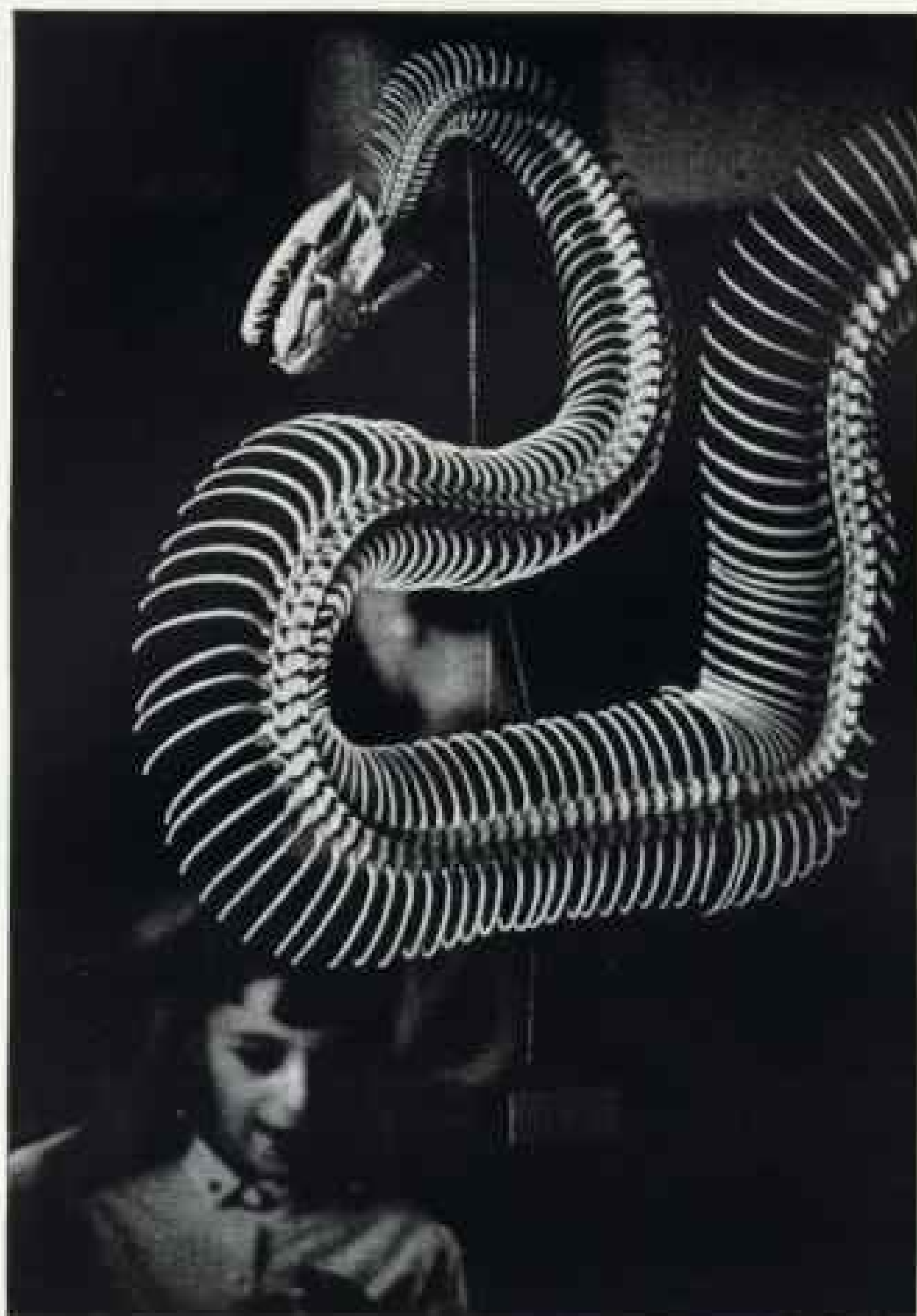
A broken head, a missing hand, a weathered coat of paint—these are routine problems for Gordon Dentry. Descendant of generations of art restorers, Mr. Dentry plies many crafts in his workshop. The damaged statue of England's William Pitt (foreground) belonged to an 18th-century Massachusetts eccentric, "Lord" Timothy Dexter.

Prehistoric surgery, perhaps to let out painful spirits, left a gaping hole in this Peruvian skull. Smithsonian's unsurpassed collection of 20,000 skulls reveals nearly a hundred such examples. Dr. T. Dale Stewart, Curator of Physical Anthropology, carries on an intensive study of primitive trephining.

812







WILLIAM BRADY

Gleaming curves of a python's rib cage turn an object of horror into one of grace and beauty. This 13-foot study of sinuous articulation includes 264 pairs of ribs.

The 70-foot skeleton has long been the delight of visitors in our Dinosaur Hall (page 824). Three men worked seven years chipping away the rock matrix from its bones, mending fractures, shaping missing parts, and assembling the whole.

Our skeletal remains of pteranodon, a hundred-million-year-old flying reptile from Kansas, recall a bit of aeronautical history. With almost paper-thin bones, the airborne dragon likely weighed no more than 25 pounds, but it soared on a 22-foot wingspread, outclassing hawks or eagles in gliding ability.

Pteranodon once served as inspiration to a famed pioneer in aeronautics, Samuel P. Langley, who headed the Smithsonian between 1887 and 1906. When Langley was trying to determine the basic requirements for a heavier-than-air flying machine, he carefully studied the ratio of probable weight to wing

surface in a pteranodon skeleton. This research, along with the study of many birds, shed light on his problem.

Elsewhere in the Smithsonian you may see Langley's steam-powered dragonfly "aerodrome" with 14-foot wing span, which on two occasions in 1896 flew about half a mile. Near by hangs a man-carrying craft which Langley tried to launch from a houseboat in the Potomac in 1903. Twice, flaws in the launching mechanism dumped the aerodrome in the water. Discouraged by these failures and by ridicule from the press, Langley gave up his tests just nine days before the Wright brothers achieved their first flight (page 799).*

Hundred-foot Monster

Huge as were the "terrible lizards" of Mesozoic times, none rivaled the modern blue whale. Dr. A. Remington Kellogg, Assistant Secretary of the Smithsonian and Director of the National Museum (and incidentally the world's ranking authority on whales and whaling), tells me that the blue whale reaches 100 feet in length and 115 tons in weight.

The Smithsonian is now finishing a full-sized 92-foot model of this monster. Supported by a steel skeleton and suspended on the wall of our new Hall of Oceanic Life, it is the biggest one-piece job of reinforced plastic ever undertaken. Its gigantic back arched, the great blue whale plunges eternally toward the depths of an invisible ocean.

Each time I enter our Natural History Building, I expect to hear a shrill trumpeting. There, in the center of the rotunda, a mighty bull elephant—trunk and tail aloft, ears flapping—strides majestically through the echoing room just as he once moved through the African jungle (page 806).

I never tire of watching children as they first catch sight of the behemoth. They break away from their parents and race to the rope to feast their eyes on the biggest

* Aviation's thrilling progress is portrayed in "Fifty Years of Flight" (31 historic photographs), NATIONAL GEOGRAPHIC, December, 1953.



REDAGHIMED © NATIONAL GEOGRAPHIC SOCIETY

Like canned fruits in a farm pantry, preserved reptiles line storage shelves. Dr. Doris Cochran, Curator of Reptiles and Amphibians, cares for 150,000 items in this reference collection.

Scholars by the hundreds come to the Smithsonian to study its millions of insects, mollusks, birds, mammals, and other specimens.

A Cuban boa and a San Esteban Island chuckwalla occupy the large jars at left.

Spineless creatures, like the inhabitants of this Cambrian period diorama, ruled the world half a billion years ago. Few fossils of earlier periods have been found, but a population explosion during the Cambrian filled the seas with shell-bearing animals that left permanent records. Most conspicuous were the flat, articulated spiny trilobites swimming in this ancient seascape. Other denizens are worms, sea cucumbers, jellyfish, and sponges.



elephant ever recorded and the largest land animal of the modern world. Thirteen feet two inches high at the shoulder he stands, a full foot taller than the previous champion. He must have weighed at least twelve tons.

J. J. Fénykővi, a Hungarian-born engineer who now lives in Spain, bagged the elephant and gave him to the Smithsonian. Two Smithsonian taxidermists, William L. Brown and Norman N. Deaton, spent nearly a year and a half preparing the specimen.

A Biological Bureau of Standards

More than a century of gathering has brought together three hundred thousand mammal specimens and ten million mollusks, each the world's record collection. Our fourteen million insects rank second only to the British Museum's collection. Fishes number more than a million and a half; our marine invertebrates about the same.

Birds, eggs, and nests total nearly half a million; reptiles and amphibians, one hundred fifty thousand. And our herbarium boasts nearly three million dried plants mounted on heavy sheets of rag paper.

This tremendous scientific wealth is, of course, a magnet to scholars in many different fields. On an average day some 200 visiting scientists work in our study rooms and laboratories. These men think of the Smith-

sonian as a biological bureau of standards.

A steady stream of scientific papers flows from their studies and from the work of our own professional staff. These papers go to some 1,500 libraries and scientific institutions around the world.

Smithsonian's International Exchange Service, established more than a century ago, now sends out a million packages a year of such materials, as well as publications of numerous other Government agencies. In return, the service receives a great deal of material from abroad, which it relays to America's research centers.

Sometimes industry makes use of the Smithsonian. If a furrier faces a lawsuit over his materials, he may identify them in our fur room. There, in refrigerated splendor, hang rows of magnificent pelts—bear, wolf, wildcat, as well as the costlier skins so prized by lovely ladies.

When Dr. David Johnson, Curator of Mammals, first took me through these thousands of furs, he paused beside a lustrous brown sea otter pelt and asked me to stroke it. I never felt anything softer or more luxurious.

"That's the world's best fur," he said. "The hairs are so fine and thick that the animal can swim for days without getting its skin wet."

(Continued on page 820)





The Fabled Hope Diamond, Cursed by Sinister Legend, Draws Wishful Glances

Largest blue diamond in the world, and perhaps the best known of all, the Hope has been haunted by tragedy ever since it was smuggled out of India in the 1640's. Superstition has associated it with violent deaths and disasters striking a dozen of its owners, including two royal houses.

Given to the Smithsonian by Harry Winston, New York jewel dealer, the Hope serves as nucleus of the finest collection of gems on public display in the United States.

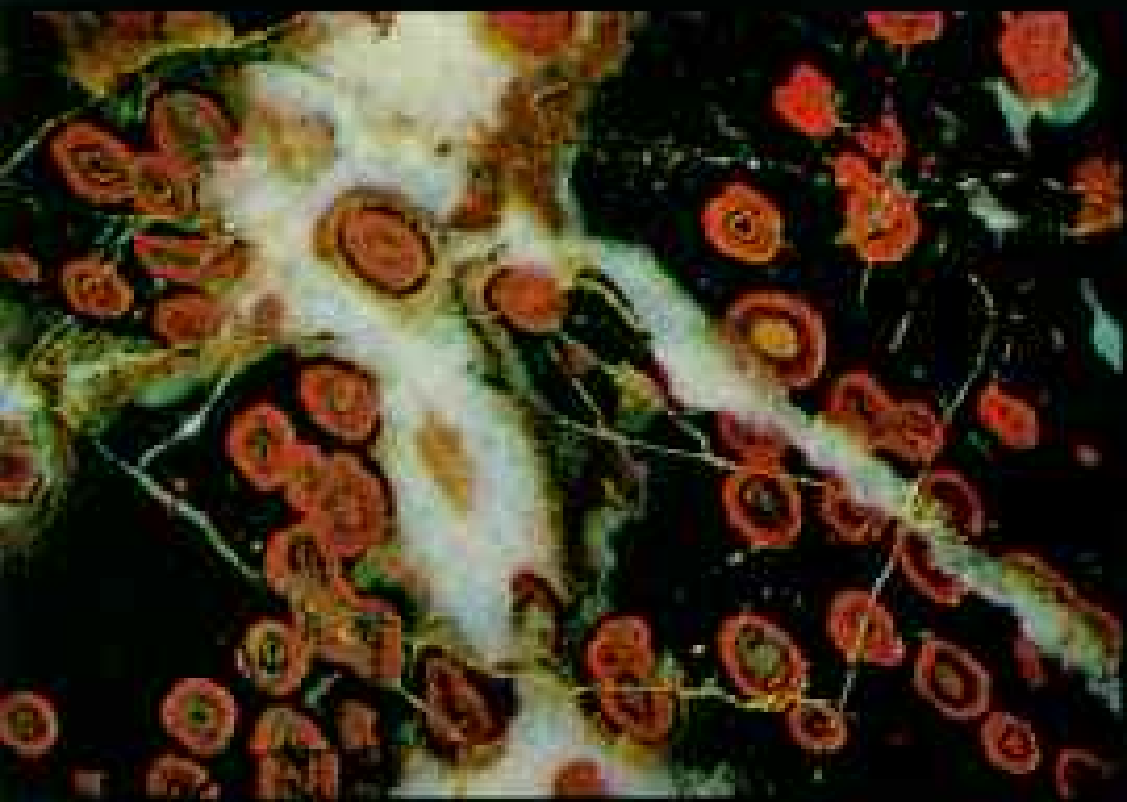
At night a heavy safe door swings shut on the display case. During visiting hours two guards stay close by the 44½-carat blue stone with its circle and chain of 52 white diamonds.

Crystal-gazer's delight, this flawless quartz sphere once figured in a famous customs case. A Chinese merchant attempted to bring the ball into the United States duty-free as a century-old art object. But customs officials discovered that it had been cut in Shanghai in the 1920's.

Mrs. Worcester R. Warner, widow of a telescope maker, bought the ball for \$40,000 and gave it to the Smithsonian as a memorial to her husband.

The sphere weighs 107 pounds and measures 13 inches in diameter. Artisans spent 18 months shaping it from a half-ton block of Burmese crystal.





JASPER FROM CALIFORNIA



PETRIFIED DINOSAUR BONE, COLORADO



AGATE FROM BRAZIL





Smithsonite, a carbonate of zinc, was named in honor of James Smithson, the first scientist to identify it.

VARISCITE FROM UTAH



Sutter's gold, thin flake in the left pan, started the California gold rush in 1848 when it was found at Sutter's sawmill. Large nugget, 82 ounces, suggests a modern sculpture.



Rocks Glow With Unexpected Brilliance in the Hall of Gems and Minerals

Many visitors gasp with disbelief when they come upon this softly lighted hall. Designed by ingenious artists, the room shows the marvels of the mineral world with the dignity befitting crown jewels. It represents the new look rapidly transforming the Smithsonian. Like most of the Institution's modernized exhibits, these are designed to teach as well as to entertain.

The Smithsonian's mineral collection, finest in the world, includes most known varieties. Only the choicest in form and color go on display; 97 percent remain in reference collections, where geologists study their relation to the earth's structure and origin.

Slab of green jade at left, sliced so thin that light shines through, was cut from the boulder beneath it.

Mandarins and tsars once wore sea otter robes, and this coveted fur was the reason Russians settled Alaska. Hunting was finally prohibited after man nearly killed off the species.

As I stepped, shivering, from the frigid air of the fur room, Dr. Johnson remarked about the constant fight against insects. "The 40-degree temperature keeps them inactive here," he said, "but elsewhere we depend on insecticides.

Tiny Beetles Have Big Appetites

"We have to be especially careful about the larder beetle, one of the dermestids. His taste for animal skins would riddle these furs in a hurry."

What an apt example, I thought, of the proverb about one man's meat being another man's poison. For while Dr. Johnson and his colleagues wage warfare on the dermestids, others at the Smithsonian deliberately raise these scavenging insects.

In a small frame building known as the bug room, some 20,000 dermestid beetles work day and night devouring remnants of meat from skulls and other bones. So rapacious is their appetite that within three weeks they can denude an entire bear skeleton. After a soaking in ammonia, the bones are ready for storage and study.

In a year's time the Smithsonian's little gray beetles eat clean more than 2,500 skulls, ranging from bats to rhinoceroses.

One of the beetles' more celebrated meals came from the bones of Swanky Dan, greatest of Ayrshire show-ring bulls. He won 84 grand championships and sired many calves. Oddly enough, Swanky Dan suffered from arthritis, and his skeleton has been of medical interest.

Swanky Dan's bones are not on display. If you have scholarly reasons to see them, a staff member will take you into the storage halls.

Amid an unmistakable moth-ball aroma you tread endlessly through a maze of corridors. Square white storage cases rise to the ceilings. Now and again in these long canyons, scientists lean over open drawers, scanning the tidy inkings of catalogue numbers (page 797).

Here a drawer reveals row upon row of pin-pierced scarab beetles; another yields serried ranks of parrots, their feathered skins a gaudy kaleidoscope; still another holds mammal skeletons so tiny that each occupies its

own glass vial. Indian pottery overflows some of the cases.

In the gaslight era it was the fashion to boast of the sheer size of museum collections by displaying as many items as possible. If you had 200 Zuni pots, you showed them all. By contrast, modern museums display only their choicest items. Today, if you have 200 Zuni pots, you show only those that illustrate superb craftsmanship or tell a story.

Nowhere can you see this principle better illustrated than in the Smithsonian's newest exhibit, the World of Mammals. Endless story possibilities suggest themselves in the titles of a few of the cases: "What Is a Mammal?"; "Destructive Mammals"; "How Mammals Get Their Food"; "Mammals Versus Climate"; "Mammal Parachutists."

For variety we alternate "idea" cases with animals in their natural habitats. I discovered how realistic these displays are one evening when I strolled alone after hours through the deserted and as yet unfinished hall (page 822). As I rounded a dark corner, I stopped abruptly. I was really startled for a moment. There, blocking my path, a huge gray rhinoceros lay on the floor. Evil little eyes glared at me as it struggled to rise.

In a second I realized that this threatening creature with the enormous double horn would never get to its feet. Skillful taxidermy had frozen it in a menacing posture, and the next day workmen would fit it into an African bush scene.

A Voice From the Past

When workmen dismantled our old mammal hall, they found beneath the bison exhibit a rusty, battered metal box. Inside lay a copy of *Cosmopolitan Magazine* with an article on "The Passing of the Buffalo," by William T. Hornaday, the Smithsonian taxidermist who mounted the bison. On the article was a note dated March 7, 1888, from Hornaday himself, addressed to "My Illustrious Successor."

"Enclosed please find a brief and truthful account of the capture of the specimens which compose this group. The Old Bull, the Young Cow and the yearling calf were killed by yours truly.

"When I am dust and ashes I beg you to protect these specimens from deterioration and destruction. . . ."

I find this incident significant, for it was Hornaday's interest in the vanishing bison—

(Continued on page 825)



ROCKEFELLER © NATIONAL GEOGRAPHIC SOCIETY

Brünnhilde, Plastic Maiden From Germany, Teaches a Physiology Lesson

The miracle of life takes on three-dimensional reality in this transparent life-sized model in the Hall of Health. Tiny hidden bulbs light each organ in turn as a recorded voice explains its function. Here a time exposure shows the brain and entire body cavity illuminated. Black light makes the veins glow blue; in their turn, arteries glow red, nerves yellow, and lymphatic system green. The skeleton of cast aluminum faithfully duplicates more than 200 bones. Measurements; 38½, 31½, 38½.



Zebra
Lie Down With the Lions:
a New Mammal Hall Takes Shape

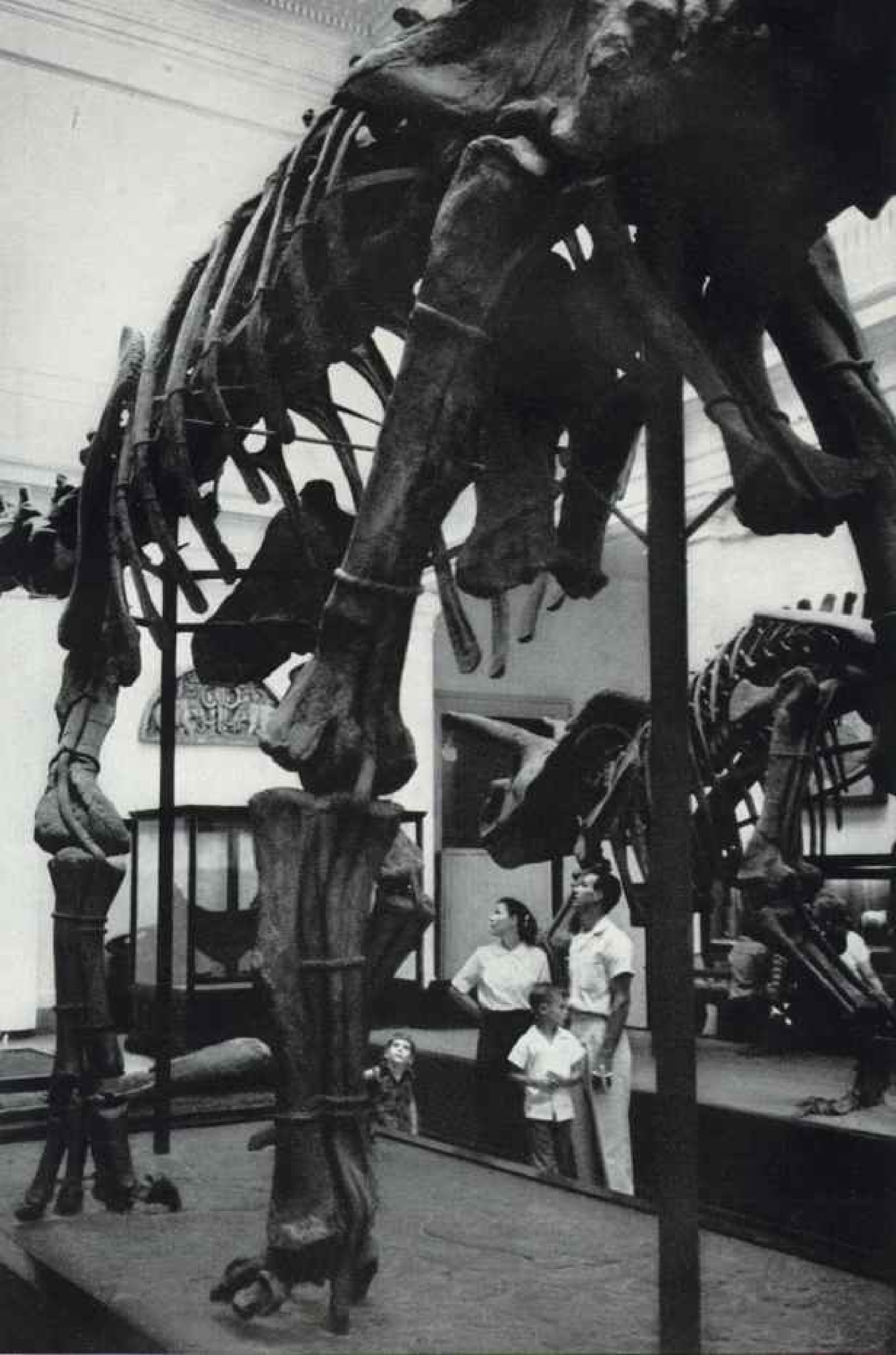
Fresh from the taxidermy shop, a silent menagerie wait patiently for their cozy, lighted niches. When artists finished painting the backgrounds and



BY EXTENSION © NATIONAL GEOGRAPHIC SOCIETY

building the alcoves, the animals took their places, and one of the handsomest of Smithsonian's new halls admitted the public. Today guards are some-

times startled by safaris of small boys, their fingers pointed like guns, who fill the hall with cries of "Pow! Pow! Pow!"





A sculptor's touch chisels rock from the fossil backbone of *Smilodectes*, a lemurlike animal the size of an organ-grinder's monkey. The species lived 50 million years ago in Wyoming and Utah; it has never been found elsewhere. Freed from its matrix with exquisite pains, the skeleton will appear in the Hall of Extinct Mammals.

an interest strongly shared by Secretary Langley—that aroused Congress to create the National Zoological Park in 1889. To Rock Creek, then “a pleasant carriage ride from Washington,” went nearly 200 animals that Hornaday had been keeping in pens behind the Smithsonian castle. They included a group of elk, given by Buffalo Bill Cody, and a herd of bison. The zoo's chief purpose was to preserve fine specimens of North American mammals then on the verge of extinction.

Bony Ghosts of Giant Lizards Walk the Earth as in the Age of Dinosaurs

Diplodocus, for all his terrifying 70-foot length, lived a harmless existence nibbling swamp plants in Utah. Vegetarian triceratops, seen through the 12-foot-high hip bones, defended himself with triple horns. When his order died out, about 80 million years ago, the dinosaurs' long reign came to an abrupt and unexplained end.

Today's National Zoological Park still has one descendant of Hornaday's bison. Along with the park's 2,500 other animals, it watches the passing of more visitors than any other zoo except one in Tokyo.*

Smithsonian's zoo has always been a facility for biological research. Its scientists are especially interested in determining how to preserve the health of animals that ordinarily die in captivity.

Last year, for example, the National Geographic Society financed an expedition to British Guiana by J. Lear Grimmer, the zoo's Associate Director, to observe the hoatzin, a pheasantlike bird. Hoatzins have not flourished in captivity, even in their own habitat. Their young emerge into the world with wing hooks used for climbing. When flight feathers develop, the claws disappear. No other bird in all the world owns such well-developed equipment.

A great deal of biological research also goes on continually in the Smithsonian's Canal Zone Biological Area in the Panama Canal Zone. When Gatun Lake filled up during construction of the canal, it isolated six square miles of ridge now known as Barro Colorado Island. This jungle preserve, set aside for scientific purposes, is the only general tropical biological research center under the United States flag. Hundreds of scientists

have stayed in Barro Colorado's dormitories while investigating the 7,000 species of animals and plants that live undisturbed in the island's primitive forest.

Such field study brings vivid rewards to the National Museum in Washington. In the new Birds of the World Hall, for example, National Geographic members find special interest in a habitat group of the African

* William M. Mann, former Director, tells the zoo story in “The Wild Animals in My Life,” NATIONAL GEOGRAPHIC, April, 1957.

bush country. In the foreground a ratel, or honey badger, tears a bees' nest from the mouth of a cave. Brown birds with yellow shoulder patches watch quietly, waiting a chance to dine on honeycomb and bee grubs.

These are the honey-guides, about which our Head Curator of Zoology, Dr. Herbert Friedmann, has written in the *NATIONAL GEOGRAPHIC* (April, 1954). Dr. Friedmann has won outstanding honors and medals for his honey-guide work. He continues extensive research, trying to link the honey-guide's ability to digest wax with medical efforts to break down the waxy armor of germs causing such diseases as tuberculosis.

The Smithsonian's scientific expeditions bring back hundreds of thousands of objects annually. The National Geographic Society has cooperated in and helped to finance more than 40 of these expeditions.

Society members will recall, among a score of articles in the past decade, accounts of the Russell Cave excavation in Alabama by Carl Miller (March, 1958); Dr. Matthew W. Stirling's many surveys of pre-Columbian life in Panama and Mexico (August, 1953); Dr. Henry B. Collins's pioneer investigations of prehistoric Eskimo cultures (November, 1956); and Frank M. Setzler's expedition to Australia's Arnhem Land (December, 1949).

As Smithsonian's fame grows, more and more private collectors give to the Nation their coins, stamps, beetles, fossils, antiques, minerals, and bits of Americana.

Some private collections are immense. Our own Dr. William Mann, for 31 years Director of the National Zoological Park, donated his unique assemblage of more than 117,000 ants, scientifically catalogued.

And then some gifts are small. I still smile when I remember a letter from one of Gen. Douglas MacArthur's aides. In formal, official Army language it read: "By order of the Supreme Commander for the Allied Powers, I am honored to transmit to you one fly." We were delighted; that fly was a rare one.

Two hundred thousand letters a year ask us about scientific and technical matters. We are glad to say that many of our fellow citizens regard us as an infallible source.

"Can you refer me to a list of automobiles produced in the United States before 1900?" We did.

In our own transportation exhibits, near hundreds of boat models, carriages, and fire engines, we display some of the finest vintage automobiles—a 1900 Locomobile steamer, 1912 Simplex, 1893 Duryea, 1902 Franklin, and the "merry Oldsmobile" of 1903.

"Dear Sir: What Should I Do?"

"I have found what I believe to be the remains of a galleon," wrote another correspondent. "What should I do?" We told him how to preserve iron and wood recovered from sea water.

And then the old stand-by: "I would like information regarding a Stradivarius violin. . . ." That one we get several times a week. "Any violin bearing a Stradivarius label but not accompanied by a historical record must be considered a reproduction," says our printed reply. Even the Smithsonian's large collection of antique and exotic musical instruments includes no violin made by Antonio Stradivari.

Some years ago, to our mystification, Nebraska school children suddenly flooded us with letters asking about Blackbird, an Omaha Indian chief. All these queries, we discov-



ered later, grew out of a grade-school course in the history of Nebraska.

It is natural that anyone should think of the Smithsonian in connection with the American Indian, for the Institution is *the* authority on virtually every scientific facet of Indian life.

From the very beginning, the Smithsonian encouraged investigation of aboriginal life in America. Its first publication was an 1848 monograph on *Ancient Monuments of the Mississippi Valley* (a valued reference, even today). After the Civil War, when national attention turned toward the unknown West, the Smithsonian fostered scientific surveys to regions where Indian tribes could still be found little changed by civilization.

"One-Arm-Off" Explores Grand Canyon

Leader of many of these expeditions was a remarkable Smithsonian explorer and scientist, Maj. John Wesley Powell, who lost his right arm from wounds received at Shiloh. Ka-pu-rats, or "One-Arm-Off," the Utes and Shoshones called him. During one of his intrepid missions he became the first white man to brave the perilous rapids of the Grand Canyon of the Colorado.

In 1879, aware that the red man's culture was rapidly vanishing, the Smithsonian

created its Bureau of American Ethnology to record Indian languages, myths, religion, art, songs, and social practices. For the bureau's first director, it logically picked Major Powell, who simultaneously headed the work of the new Geological Survey. Today's social scientists and historians can thank him and his co-workers for laying the foundations of our knowledge of Indian cultures.

Often, as tribes dwindled, Powell's men snatched from oblivion the words of patriarchs, telling of tribal secrets unknown to a younger generation.

Today the study of Indian culture faces a new threat: The wholesale damming of rivers is drowning countless buried records of Indian settlement. Since 1945 the Bureau of American Ethnology, in close cooperation with the National Park Service, has raced feverishly to find and salvage these archeological treasures. Field teams have dug into hundreds of Indian camps, villages, mounds, and burial grounds in half the States. Floodwaters lapping at their heels, they have sketched the outlines of Indian culture from Folsom Man of 10,000 years ago to frontier posts of the late 19th century.

The remarkable collections of the Bureau of American Ethnology are displayed by Smithsonian's Department of Anthropology,

Bathed, Diapered, Amused, and Fed, Baby Chimpanzee Gets Human Care

When Donnie's mother's milk dried up prematurely, zookeeper Bernard Gallagher volunteered as foster parent. Donnie lived at the National Zoological Park by day, spent his nights for six months with the Gallaghers. Pampered like a family member, he learned to throw tantrums for attention. As a branch of the Smithsonian, the zoo carries on important biological research.



NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN LONER





Life mask made by Frank M. Setzler, Head Curator of Anthropology, helps record a 1948 Smithsonian-National Geographic expedition to Australia's Arnhem Land.

Telescope-with-camera on Maui island daily tracks the satellites man has thrown into space. Twelve such stations belong to Smithsonian's Astrophysical Observatory.



Two thousand expeditions since 1846

which carries on both research and exhibit work. Two magnificent halls show a rich and varied collection of historic Indian materials.

Life-sized plaster figures in family groups depict a vivid panorama of human customs, revealing the ingenuity with which the Indians adjusted to many environments. They range from the southernmost people of the world, the Yaghan fishermen of Tierra del Fuego, who used earthen fireplaces in their canoes, to the world's northernmost people, the seal-hunting Polar Eskimos of Greenland.

Some of our plaster figures were made for the Columbian Exposition in Chicago in 1893. William H. Holmes, who designed them, combined an anthropologist's knowledge of the Indians with superb artistic talent.

So realistic were Holmes's designs and the sculptors' execution that the figures caused a flurry in Congress. "Something must be done," an irate visitor wrote her Represent-



ILLUSTRATION (COVER) BY BARRY BISHOP, REDESIGNED BY MURWELL WALKER (TOP) AND WALTER H. EDWARDS, NATIONAL GEOGRAPHIC STAFF © N. G. S.

have carried the name of James Smithsonian to the farthest reaches of earth

ative, "to stop the Smithsonian from shooting and stuffing all those Indians!"

As you stroll through the halls, a Zuni woman paints pottery with a yucca-fiber brush; a Navajo silversmith pumps his fire with a primitive bellows; a Chilkat woman weaves a blanket of mountain-goat wool; Powhatan Indians trade with Capt. John Smith; Blackfoot hunters drive bison over a cliff; and a Hopi rain maker dances with a rattlesnake in his mouth.

The drama of the buffalo-hunting Plains Indian comes to life in a 17-foot tepee used by an Arapaho family nearly a century ago. It was first shown at Philadelphia's Centennial Exposition in 1876, the very year Arapaho braves joined in the Battle of the Little Bighorn and helped the Sioux kill Custer and all his cavalymen. When we pulled the tepee out of storage recently, we found Philadelphia newspapers of 1876 inside.

Two Indian women could erect such a lodge in an hour; it took our staff most of a day to assemble the 16 foundation poles and the cover of 14 buffalo skins (page 809).

Dead Men Talk Aplenty

The adage that "dead men tell no tales" is abundantly disproved by our Division of Physical Anthropology. The Smithsonian's collection of 20,000 human skulls, many accompanied by full skeletons, speaks volumes about the origins of diseases and medical practices, and the migrations of races across the face of the earth.

Shanidar Man, for example, lived about 45,000 years ago in a cave in Iraq. A Smithsonian archeologist, Dr. Ralph Solecki, found him there in 1957 under more than 15 feet of debris.

We can visualize Shanidar Man's appearance because Dr. T. Dale Stewart, our inter-

nationally recognized Curator of Physical Anthropology (page 812), spent three months in Iraq reassembling the skull fragments. The ancient one possessed a massive jaw and huge brow ridges above the eyes.

What does Shanidar Man tell an expert like Dr. Stewart? Well, his brutish appearance strongly suggests that he was a Neanderthal. This primitive group appeared in the Old World a hundred thousand years ago, but had largely died out before Shanidar Man came along.

Shanidar Man Had Lost an Arm

Evidence of arthritis and other age changes in skeletal joints indicates that Mr. Shanidar was about 40. Most interesting of all, his right arm had been amputated just above the elbow. Dr. Stewart calls it the earliest evidence of human surgery on record.

Front teeth show unusual wear. Obviously this one-armed man found it necessary to hold things with his teeth.

When the FBI wants bones identified, it frequently calls on Dr. Stewart. Once a human hand came into the laboratory from an Oklahoma farm, where it had been picked up on the ground.

"Oh, that's the hand of an Egyptian mummy," said Dr. Stewart. "You can still see traces of the cloth wrappings."

The law men were skeptical.

"What's more," said our anthropologist, "it dates from Ptolemaic-Roman times. Before the Ptolemies, bitumen probably was not used in preserving mummies."

When the story appeared in the newspapers, a reader cleared up the mystery. Her family had stored a collection of antiques on the farm, including a mummy her grandfather had brought from Egypt. A child or an animal had left the hand in the field.

Across the Mall from the Natural History Building, the rich green of ivy washes the soft red sandstone of the main Smithsonian building. Patterned after a 12th-century Norman stronghold, the castle lifts its spires in Romanesque grandeur, a beloved Washington landmark (pages 797 and 805).

The sound of family laughter once echoed in its towers and halls, for in the early days Secretary Henry and his family lived in the

castle. Here President Lincoln came to seek moments of quiet and to ask scientific advice of his friend. On occasion Lincoln even held laboratory apparatus for Professor Henry's experiments.

During the Civil War the townspeople of Washington saw mysterious lights flashing at night from the Smithsonian tower. One day an agitated patriot came to Lincoln with accusations that the Secretary of the Smithsonian was a traitor, that he had been signaling to Secessionists across the Potomac.

Lincoln broke into laughter. He explained that the flashing lights were tests of the Army's new blinker signals. He himself had often accompanied Professor Henry to the tower for the experiments.

In a tomb below the tower rests the body of James Smithson, brought from Genoa, Italy, in 1904 by Alexander Graham Bell, one of the Smithsonian's Board of Regents and the then recently retired President of the National Geographic Society. A bronze plaque proclaims Smithson's noble purpose: "For the increase and diffusion of knowledge among men." These words from the will (page 800) doubtless inspired the explorers and scientists who founded the National Geographic Society "for the increase and diffusion of geographic knowledge."

Leading Citizens Serve as Regents

In the castle the Regents hold their meetings. This board of eminent Americans who govern the Institution includes Chief Justice Earl Warren; Vice President Richard M. Nixon; Senators Clinton P. Anderson, J. William Fulbright, and Leverett Saltonstall; Representatives Frank T. Bow, Overton Brooks, and Clarence Cannon; and John Nicholas Brown, Arthur H. Compton, Robert V. Fleming, Crawford H. Greenewalt, Caryl P. Haskins, and Jerome C. Hunsaker.

Down the Mall, toward the Washington Monument, rises a proud new Museum of History and Technology. In 1962, when this \$36,000,000 structure is finished, it may well be the finest museum building in the world (page 805). In our exhibit shops dozens of artists, cabinetmakers, painters, electricians, and plastics experts are preparing new exhibits that will match the splendor of the build-

Two Misshapen Pearls, Joined by a Goldsmith's Genius, Create a Merman

Sixteenth-century ladies wore pendants like this three-inch Renaissance Triton of gold, rubies, diamonds, and massive baroque pearls. Sometimes ascribed to Cellini, it belongs to the National Collection of Fine Arts. "Portrait of a Youth" (background), from the National Gallery of Art, is by Botticelli, another Renaissance Florentine.





ing. And they are refurbishing the vast miscellany now jamming the old Arts and Industries Building to the rafters.

I say rafters advisedly. When you enter the building you are greeted by history literally hanging from the beams. It is the *Kitty Hawk Flyer*, the frail contraption of muslin, spruce, and wire with which the Wright brothers heralded the dawning of the Air Age. A figure of Orville Wright rides the lower wing, just as he did that cold December morning of 1903 on the sands near Kitty Hawk, North Carolina (page 799).

Directly behind hangs another epoch-making craft: Charles A. Lindbergh's 27-foot-long monoplane, the *Spirit of St. Louis*. Many a visitor remembers well the dramatic 33½-hour hop from New York to Paris in May, 1927, the first nonstop solo flight across the Atlantic.

Late one afternoon a number of years ago Frank Taylor, Director of the Museum of History and Technology, lifted the phone and

found himself talking to Colonel Lindbergh.

"The Secretary says it's all right for me to climb up in my old plane," said the flyer. "When would be a good time?"

"Is there anything we can get for you?" offered Mr. Taylor.

"No, I'd better do it myself. During the flight I scribbled the records of gas consumption on the instrument panel. Now I need the figures for a book I'm writing."

"Fine," said Taylor. "We'll have a scaffolding rolled in place for you."

"No! No!" came the protest. "I'm still active. Just throw a rope over one of the struts and I'll shinny up!" (Of course we didn't let him.)

From airplanes to ladies' gowns may seem a long jump, but in the Arts and Industries Building it's just a few feet. In beautifully furnished period rooms representing portions of the White House, the Smithsonian presents dresses of the First Ladies (page 842).

(Continued on page 837)

Ancient scripture, a 4th- or 5th-century Greek text of the Four Gospels discovered in the 20th century near Egypt's pyramids, brings scholars to the Freer Gallery of Art. Others come to examine Freer's unexcelled Chinese bronzes and Persian miniatures, superb Oriental paintings, and extensive library in Chinese and Japanese.

A Coptic monastery probably used this text, known as the Washington Manuscript I.

Bronze tiger, ritual wine vessel, and masklike lid reveal the superlative development of Chinese culture a millennium before Christ. Rutherford J. Gettens, Freer's famed chemist, analyzes the methods and materials of ancient craftsmen.

833







Young eyes pay no heed to a Picasso painting. The portrait, of the artist's wife, is on loan from the collection of Chester Dale, President of the Board of Trustees of the National Gallery of Art. Like the Louvre, the gallery acquires for the Permanent Collection no paintings by artists who have been dead less than 20 years.

Orchestra's Strains and Fountain's Plash Pervade the Serenity of a Garden Court

The magnificent marble palace of the National Gallery of Art, given to the Nation by Andrew W. Mellon two decades ago, houses one of the choicest collections of Western art. Nearly a thousand old and new masters grace its walls.

One of Washington's most rewarding experiences is a Sunday night visit to the gallery during the concert season. Art lovers may listen to Conductor Richard Bales and his orchestra while relaxing among the fish-tail palms, ferns, and flowering shrubs of this elegant garden court.



This display of fashion since the earliest days of the Republic recalls the hoop skirt and bustle, the sacque and the hobble skirt, the leg-of-mutton sleeve and the Empire style. Here are enough satins and taffetas, brocades, velvets, and laces for a dressmaker's dream.

Martha Washington's voluminous skirt of salmon-pink faille rewards the viewer who studies it closely, for it is hand-painted with dozens of North American wildflowers and insects. At the other end of the hall, Mamie Eisenhower's pink inaugural gown, embroidered with 2,000 pink rhinestones, attracts much attention.

Boys Prefer Machinery That Works

Just as girls love the First Ladies Hall, so do boys take to the Halls of Power and Power Machinery. Those who like moving exhibits and push buttons come into their own here. Press the switch and an old-time steam engine—bright with paint and brass—wheezes and puffs to life; a gasoline engine model, cut away to show piston, valve, and spark plug, runs through its cycles in a flurry of colored lights.

Another exhibit is concerned with electromagnetic induction, discovered almost simultaneously by the Smithsonian's distinguished Professor Henry and by England's Michael Faraday. In the early 1830's Henry improved the electromagnet from a toy to a powerful instrument capable of lifting nearly two tons. He discovered that when it moved close to a wire, a current passed through the wire. From the electromagnetic researches of Henry and of Faraday sprang the dynamo, the electric motor, and the telegraph.

Henry's pioneer contribution is sometimes forgotten because Faraday published his findings first. But in tribute to the originality of the American, the international electrical unit of inductance is called the henry.

The ghosts of America's heroes, as well as her scientists and inventors, walk beside us as we wander these halls. Jim Bowie . . . Davy Crockett . . . Washington, Jefferson, Lincoln . . . Benjamin Franklin . . . Susan B. Anthony. These and many more are the names of those

whose personal belongings and objects associated with their work lie about us in profusion.

As we study the clothing they wore, the weapons they wielded, the possessions they treasured, the scientific instruments they used, the ghosts take on flesh-and-blood reality.

Stand by a small portable writing desk of mahogany and green baize, and you see a thoughtful Thomas Jefferson penning the Declaration of Independence: "When in the Course of human events . . ."

Lift your eyes to the 15 huge stars and tattered stripes of the Star-Spangled Banner (page 840). Through the rocket's red glare you see the symbol of our freedom waving defiantly over Fort McHenry, and Francis Scott Key writing the national anthem.*

A small pine table and two chairs from Appomattox Court House stand empty. Open your mind's eye and you see Grant and Lee signing an end to a tragic conflict.

Snowshoes and ice ax call up scenes of cold and hardship, and with Admiral Peary you triumphantly conquer the North Pole.

And, on an 18-foot model of the U.S.S. *Missouri*, so accurately made that even the thickness of gray paint is in scale, you ride at anchor in Tokyo Bay while an Emperor's representatives sign a surrender.

Two-story House Inside a Museum

Visitors do not need a great deal of imagination when they enter the Hall of Everyday Life in Early America. From an immense collection of rare Americana, entire rooms have been authentically furnished in pre-industrial revolution style. They stand ready as though people in the wings only waited a cue to move in and resume a way of life long past.

Most astounding exhibit is a four-room, two-story farmhouse from the Massachusetts Bay Colony, a gift of Dr. and Mrs. Arthur M. Greenwood of Marlborough, Massachusetts. Originally built late in the 17th century, about the time of the Salem witch trials, it was dismantled with the care nor-

* The history of our flag is told in "New Stars for Old Glory," by Lonelle Aikman, NATIONAL GEOGRAPHIC, July, 1959.

America's Finest Hour in Cabinetry Produced This Mahogany Highboy

Inspired by Thomas Chippendale, colonial Philadelphia's furniture makers developed a skill unsurpassed in the New World. Their genius reached a peak in this chest with its elegant finial, a basket of fruits and flowers. Experts regard the highboy as the choicest object in the Smithsonian's large collection of early Americana.

mally given a fine watch. Each timber, each brick, each leaded casement was numbered to guide reconstruction at the Smithsonian.

On those occasions when I have gone behind the glass panels and stepped into the old farmhouse kitchen and living room, many items have attracted me: dried goldenrod in a Delft drug pot; the rat trap firmly holding its victim; the candlebox filled with new tapers and stubs saved for a thrifty remelting; the bundle of sticks for beating eggs. But nothing has impressed me so much as the rude and painful demonstration that the modern generation has grown too tall for those low-hanging beams. One has only to measure the clothing of colonial days for further evidence of the physical smallness of our forebears three hundred years ago.

Freer Specializes in Oriental Art

Down the Mall, the Freer Gallery of Art offers one of the world's great collections of the arts of China, Japan, Persia, India, and other countries of Asia. Deeded to the Nation in 1906 by Detroit industrialist Charles Lang Freer, this collection constantly grows by purchases with the income from his endowment. The superb scrolls, bronzes, sculptures, and ceramics, with a library including some 19,000 Chinese and 2,000 Japanese titles, form the raw materials for research and writing on the civilizations of Asia by Freer's scholarly staff (pages 832 and 833).

The gallery's American section includes the largest group of works by James McNeill Whistler under one roof.

Along the Mall toward the Capitol, the magnificent marble palace of the National Gallery of Art, gift of Andrew W. Mellon in 1937, shelters what is certainly one of the finest collections of Western art. Old masters by the hundreds cover its walls.*

In the Natural History Building the National Collection of Fine Arts exhibits paintings, sculptures, jewelry, and many other examples of the decorative arts. Here also are shown examples of glass through the centuries, the work of early American and European silversmiths, and important collec-

tions of porcelain and china. And the Smithsonian Traveling Exhibition Service assembles hundreds of excellent art and natural history shows, circulating them both here and abroad.

The Magnet on the Mall will exert even greater attraction with the long-awaited construction of a National Air Museum building. Until then the Smithsonian's unrivaled assortment of famous aircraft is tucked into whatever corners are available. The 1911 *Vin Fiz Flyer*, first plane to cross North America; the *Winnie Mae*, twice flown around the world by Wiley Post in the early '30's; the 1917 Spad XVI flown by Gen. Billy Mitchell at Château Thierry, St. Mihiel, and the Argonne; and the 1947 rocket-propelled Bell X-1, first plane to break the sound barrier—these and a few others are available to visitors. Nearly 200 other historic aircraft are now stored in dark and dusty warehouses.

A few balloon fragments remind us that the Smithsonian was the godfather of the United States Air Force. In 1861, after the Civil War began, Prof. Thaddeus S. C. Lowe begged the Army to use observation balloons. He met cold indifference. But Henry encouraged Lowe in his tests and introduced him to President Lincoln. Lowe spectacularly proved the effectiveness of high-level observation by ballooning up from the Smithsonian grounds and describing the scene to Lincoln over a telegraph wire to the White House.

Aeronaut Spied on Confederate Forces

Through the support of Henry and Lincoln, Lowe became chief of a new Army balloon corps. His hydrogen-filled craft directed artillery bombardments and ferreted out Confederate secrets so successfully that General McClellan shook the pioneer aeronaut's hand and declared, "You are the eyes of the Army."

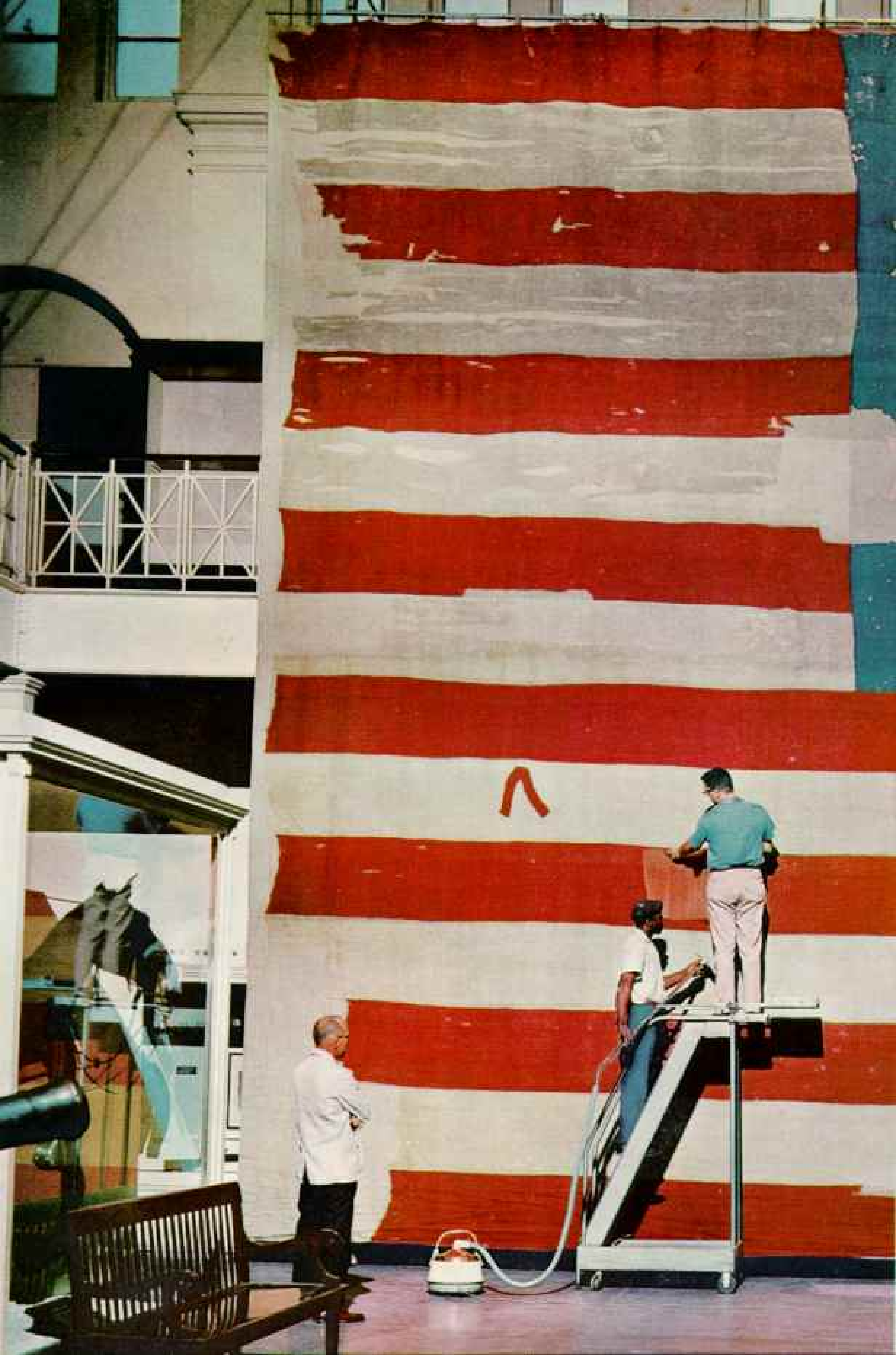
Every time you read of a satellite orbiting earth or a rocket reaching for the moon, you may tip your hat to the Smithsonian and a young experimenter named Robert H. Goddard.

* For an expert's description of the gallery's treasures, see in the NATIONAL GEOGRAPHIC, "The Nation's Newest Old Masters," November, 1956; and "Your National Gallery of Art After 10 Years," January, 1952, both by John Walker, its Director.

"In His . . . Shop a Tortoise Hung, an Alligator . . . and . . . Ill-shap'd Fishes"

Thus did Romeo describe the apothecary shop whose dram of poison ended his life. Shakespeare's hero was speaking of such a place as this German apothecary's laboratory, which in the 17th century compounded popular curatives from strange and loathsome creatures. The reconstructed pharmacy shows a rare collection of Old World drug jars, formularies, materia medica, and laboratory paraphernalia.









First Ladies of the White House from Jackson to Polk stand demurely in a reception room as it might have looked in the 1830's. Varying coiffures give individuality, but the faces copy a sculptured bust of Shakespeare's Cordelia. Emily Donelson (right foreground) wears her inaugural gown and the voluminous puffs of hair fashionable when she served as hostess for her uncle, President Andrew Jackson. Other alcoves reveal changes in women's costume from Martha Washington's day to Mamie Eisenhower's. Carpet was given to President Van Buren by the Imam of Muscat.

◀ Symbol of the Nation's freedom, Francis Scott Key's Star-Spangled Banner unfurls for cleaning. Stitched to linen, these tattered remnants represent about three-quarters of the banner whose gallant streaming over Fort McHenry inspired the words of the national anthem. The curious inverted V at left remains a mystery; no one knows what the appliqué means or how it got there. Few persons have seen the entire flag because a cramped display case requires folding of the lower six stripes. Smithsonian's new Museum of History and Technology will hang the banner full length. Old Glory's 15 stripes were official from 1795 until the 13-stripe design was adopted in 1818.



AN EXTRACT FROM BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DAVID LITTLEMALES

A Massachusetts physics professor, Goddard had been consumed with a passion for rockets ever since he was a boy. Long before Wernher von Braun and others, Goddard foresaw the rocket as a weapon and as a means of exploring the upper atmosphere. Clark University, where he taught, encouraged him, but his early pleas for outside financial aid proved vain until he appealed to the Smithsonian's Secretary, Charles W. Walcott, who received his request with warm sympathy. The Institution granted him \$5,000, and in 1919 published his treatise on which all rocketry is based, *A Method of Reaching Extreme Altitudes*.

Professor Goddard proved that rockets work well in a vacuum, needing no air to push against. Thus, he predicted, it should be possible to send a multiple-stage rocket to the moon and set off a flare visible to telescopes on earth. For this flight of fancy he was labeled "Moony" Goddard and, like Langley, was ridiculed by the press. But the Smithsonian continued to back him.

In 1926, using gasoline and liquid oxygen, Goddard fired the world's first liquid-fueled rocket, direct forerunner of the Thor, the Atlas, the Jupiter. Steadily he improved his ideas for gyroscopic controls. In 1935 he shot his finest rocket a mile and a half above the New Mexico sands at nearly the speed of sound. The next year the Smithsonian published his advanced findings, *Liquid-Propellant Rocket Development*.

Said Dr. Von Braun recently: "American rocketry owes a great debt to his [Goddard's] vision. . . . We can only wonder what might have been if America had realized earlier the implications of his work. I have not the slightest doubt that the United States today would enjoy unchallenged leadership in space exploration had adequate support and recognition been provided to him. It is to the great credit of both institutions that the Guggenheim Foundation and the Smithsonian Institution gave at least part of his continuing effort some financial backing and appropriate professional recognition."

Fifteen years after the inventor's death, the whole world is racing through the door to space that Goddard opened. And in that race, the Smithsonian continues to play a leading role.

On ice island T-3, a volunteer nightly scans the sky for the passage of satellites.

At Edwards Air Force Base, a pilot rises into the stratosphere, scooping up dust that may have come from a planet that exploded billions of years ago.

In a Massachusetts laboratory, a physicist measures the age of meteorites by determining the effect of cosmic rays on them. An astronomer perfects a telescope-in-space to fly via satellite high above the atmosphere.

And at Table Mountain, California, an observer daily measures the intensity of sunlight. His work is in direct descent from the pioneer astrophysical studies of Charles Greeley Abbot, former Secretary of the Smith-



NATIONAL GEOGRAPHIC PHOTOGRAPHERS WILLIE D. WALKER AND DEAN CONNER (LEFT, LOWER)

And these are the visitors, who are as much a part of the Smithsonian as the exhibits or scientists in the laboratories: a piggyback rider; a yawner feeling museum fatigue (it happens in the best of galleries); a photographer listening to an art lecture on a tiny rented radio; and a wonderful child who dances in empathy with a bronze witch doctor.

sonian, who has done so much to advance understanding of the sun and its influence on the weather and on plants.

All these are projects of the Smithsonian's rapidly growing Astrophysical Observatory, headquartered in Cambridge, Massachusetts. All seek to expand the frontiers of man's knowledge about space.

Since the first Sputnik startled the world in October, 1957, Smithsonian teams of volunteer Moonwatchers at nearly 200 spots on the globe and a dozen far-flung Smithsonian camera stations have carried the responsibility for optical tracking of Russian and American satellites (page 828).

Their findings are cabled to a communications center in Cambridge. There other Smithsonian scientists analyze the satellite orbits and glean enormously important new

information about the shape and size of the earth, the measurements of transoceanic distances, the density of the atmosphere, the effects of sunspots and solar flares on communications, and the actions of satellites themselves.

Joseph Henry, in one of his annual reports, wrote: "All knowledge is useful. . . . The discovery of today, which appears unconnected with any useful process, may, in the course of a few years, become the fruitful source of a thousand inventions. . . ."

How right Henry was.

James Smithson used to say, "No ignorance is without loss to man, no error without evil."

If James Smithson came back today and saw the Institution he founded, I think he would feel that his motto had been well served.





First dawn of a new summer silhouettes Stonehenge,

NEW LIGHT ON
AN OLD RIDDLE

Stonehenge

The gaunt ruin on England's Salisbury Plain yields to inquiries of "when" and "how," but stubbornly guards its greatest secret: "why?"

By HAROLD E. EDGERTON

Paintings by BRIAN HOPE-TAYLOR

STARK ON THE WINDY PLAIN of Salisbury stands a huddle of rough-hewed blocks that have defied alike the winds and rains of 4,000 years and the probing questions of historian and archeologist. This mysterious relic of ancient Britain is Stonehenge—place of the "hanging stones."

Nowhere in Western Europe can be found any monument quite like it; it stands alone. We can reckon when it was built and how; we can make learned guesses about its architects; but of its purpose and use through the dark centuries we may remain forever uncertain. Stonehenge, in the words of the novelist Henry James, "stands as lonely in history as it does on the great plain."

My first glimpse of these strange ruins was



STONEHENGE BY THOMAS J. ARBENZBURG, NATIONAL GEOGRAPHIC STAFF © W. S. S.

where Stone Age Britons celebrated mysteries now lost in the haze of centuries

from a vantage point that would have seemed even stranger to the original builders. I lay prone on the floor of an A-20 bomber, gazing down through the rear-gunner's escape hatch. My wartime assignment was to train airmen in night reconnaissance photography, and a favorite target in England was Stonehenge.

Later I had a chance to see the monument from the ground. With artillery officers studying the vulnerability of low-flying photographic planes, I visited Stonehenge to check what happened when the aircraft roared overhead and fired electronic strobe lights or flash bombs. Scrambling over a barbed-wire fence, we stumbled about among the great gray stones and made our observations as best we could in the hazy moonlight.

I propped my camera on a fence post and took some time exposures lighted by the flashes of the approaching planes and by the flares we set off to guide them; but these pictures by no means satisfied my curiosity. I vowed to return someday, preferably at the mid-
(Continued on page 830)

Dr. Harold E. Edgerton, Professor of Electrical Measurements at the Massachusetts Institute of Technology, is the inventor of high-speed flash equipment, for which he won the National Geographic Society's Franklin L. Burr Prize in 1952. He has contributed frequently to the *Geographic*.

Brian Hope-Taylor, Fellow of the Society of Antiquaries of London, is distinguished both as an archeologist and as an artist.—*The Editor.*



HOPPE-TAYLOR

Skin-clad workmen heave 50-ton slabs onto cradles of logs for shaping.

STONEHENGE architects chose to build with gray sandstone slabs called sarsens, which they quarried on the Marlborough Downs (map, page 851). This stone, harder than granite, quickly blunts even steel-alloy chisels.

848 Basing his paintings on modern research, artist

Brian Hope-Taylor depicts the probable means by which primitive men worked without metal tools. Here on the Marlborough Downs about 1500 B.C., toilers lever an embedded sarsen from the earth (upper center). Their fellows, risking crushed arms or legs, thrust timbers under the



PAINTING IN SOURCE BY BRIAN WIFE-TAYLOR © NATIONAL GEOGRAPHIC SOCIETY

fire, water, and repeated blows from stone balls shear off the rough edges.

stone. With the slab clear of the ground, workmen begin to shape it by heating the line of an intended cut with firebrands. Others then douse the stone with cold water to inflict internal stress. Finally, men batter the sarsen by simultaneously dropping 50-pound stone mauls (above). Four

maul hurlers, standing on animal skins to save feet from blistering, await their foreman's shout. With arm raised, he delays until an assistant marks the target line, which still steams from its fire-and-water bath. A boy holds a skin water bag. Earlier cuts trimmed the stone's near side.

summer solstice, and get a real look around.

I chose the solstice—June 22—because many archeologists believe that Stonehenge was deliberately and precisely oriented toward that point on the horizon at which the mid-summer sun rose in those far-distant prehistoric dawns. Not until many years later did I get my opportunity.

From London my son Bob and I set out in a rented automobile for Stonehenge. Knowing English weather, I allowed several days' grace before the 22d. Clouds would not be our only photographic hazard. Over Salisbury Plain, even when the night sky is clear, a dense ground fog often forms.

But we were lucky. The heavens were



bare, and as we drove, we felt on our faces a north wind strong enough to dispel any mist. We made Salisbury about midnight and continued onward another ten miles until, caught in the car's headlights, the famous Heel Stone loomed from the darkness. Beyond rose the huge monoliths, dimly outlined against the sky. Here we would wait out the night

in order to see and photograph the ruins at sunrise.

From my earlier visits and from reading in the vast literature that has grown up around Stonehenge, I knew—even though by flashlight I could only faintly see—the monument's basic design. To the northeast lies the long grassy Avenue, more easily discerned from the



PAINTING BY BRIAN HOPE-TAYLOR. © NATIONAL GEOGRAPHIC SOCIETY

Far fields yielded massive stones. Marlborough Downs sarsens lay 24 miles from Stonehenge. Smaller Welsh blue-stones, some weighing four tons, moved 250 miles by land and sea from Pembrokeshire.



© N.G.S.

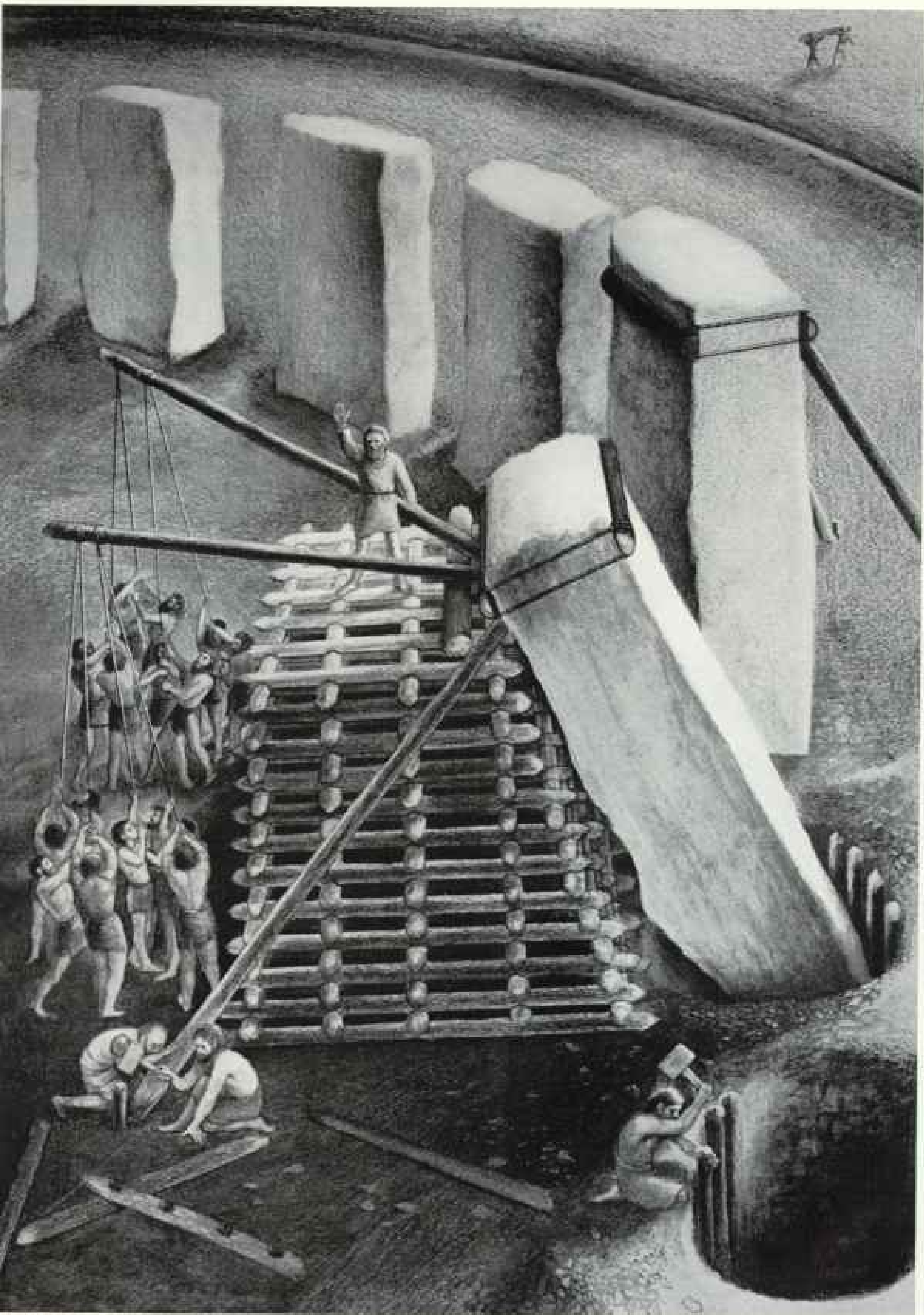
Backs Strain, Bare Feet Claw the Ground: a Sarsen Moves to Stonehenge on Rollers

Antiquarians believe that as many as 1,500 men could have labored for ten years transporting all the immense stones across Wiltshire.

Mr. Hope-Taylor's painting recaptures the slow advance of a 40-ton sarsen on an afternoon 3,400 years ago. Two files of panting haulers bend against the slope of Redhorn Hill, the halfway mark. As the ponderous slab creaks across oak rollers, shuttle teams speed the traversed logs to the front, providing an unending track.

Riding the sarsen, a foreman shouts his orders, and a bearded assistant relays a message to the overseer (right), who holds a ceremonial spear, his badge of office. Ahead of the stone, men with staves align the rollers to prevent dangerous drifting. Gangs at rear man steering lines to prevent the stone from skidding off the logs.

This feat of transport is not so difficult as it may seem: Groups of schoolboys have used the method to move large concrete blocks.



air than from the ground, which extends for $1\frac{3}{4}$ miles to the bank of the Avon River.

Near the southwestward terminus of this Avenue stands the Heel Stone, a slanting, crudely formed boulder which derives its name from a large nick near the base. According to legend, the devil, enraged at a certain friar, threw this great rock at him and struck him on the heel. So indestructible was the virtuous monk, apparently, that it was the stone which suffered.

About 75 feet from the Heel Stone, at the Avenue causeway, begins the ditch and earthwork that encircles Stonehenge in a ring 320 feet in diameter. Just inside occurs a concentric ring of 56 pits called, after their 17th-century discoverer, the Aubrey Holes.

Doubtless they served some ritual purpose.

Next come two more pit circles, the Y and Z Holes, whose purpose is not clear. Then arises the first of the gigantic stone colonnades—the Sarsen Circle.

Sarsens Weigh More Than 40 Tons

Sarsen stones are a form of sandstone found on the Marlborough Downs, 24 miles away. The name apparently stems from "Saracen," a term given in the post-crusading days to almost anything heathenish, foreign, and vaguely satanic. Stonehenge has two settings of sarsens, a $97\frac{1}{3}$ -foot-diameter circle that once held 30 columns, overlaid with a continuous lintel, and an inner horseshoe of

(Continued on page 856)

Muscle Power Inches a Massive Slab Erect in the Sarsen Circle

Of 30 stones that once formed a ring $97\frac{1}{3}$ feet across, 17 stand today, 10 capped by lintels.

The painting captures a tense moment in raising the sarsens. Earlier, workers advanced a finished stone on rollers until the leading third hung above a pit dug to receive it. Next, a concerted thrust dropped the toe of the stone into the hole, barking the protective stakes. Carpenters then built a crib beneath the leaning slab. Now a foreman with arm held high prepares to signal crews to pry the stone toward the vertical.

Mallet wielder at lower right drives stakes into another pit for the next stone.

Beyond the uprights lies the outer earthwork, a circular bank and ditch three centuries older than the stones.

A 60-ton crane gently sets a lintel atop a restored trilithon during limited reconstruction in 1958. Even with modern machines, workers found the stones difficult to adjust.





1400 B.C.: Stonehenge Stands Complete;
Robed Worshipers Hail Summer's Solstice

Archeologists speak of "three Stonehenges," to describe phases of construction lasting some 400 years. Using deer-antler picks, a Late Stone Age people set the uncut Heel Stone (lower right), shaped the outer earthen circle, and, just inside it, dug 56 ritual pits, some of which have yielded



PAINTING BY BRIAN HOPE-TAYLOR © NATIONAL GEOGRAPHIC SOCIETY

cremated bones. Two centuries later newcomers trenched the Heel Stone and Avenue entrance, in which they mounted two smaller stones. About 1500 B.C. their descendants began to erect the Sarsen Circle and the inner horseshoe of trilithons, and embedded the four Station Stones near

the outer earthwork. Outside the Sarsen Circle they dug two rings of holes for the Welsh bluestones, then abandoned the pits and mounted the bluestones within the sarsens. One of the twin pillars at the Avenue entrance causeway survives as the Slaughter Stone (next page).

even grander blocks, some 20 feet tall and weighing more than 40 tons apiece.

Among these sarsen formations stand a secondary circle and horseshoe of bluestones—dolerites and rhyolites imported from the Prescelly Mountains of southwestern Wales. Smaller than the sarsens, they may well have been part of some earlier temple, so valued as to be worth the grim labor of lugging them some 250 miles over land and water.

From this same area in Pembrokeshire—probably Milford Haven—comes the Altar Stone, a great slab that now lies picturesquely within the bluestone horseshoe but that may once have stood upright. From this so-

called Altar Stone sun-worship theorists usually take their bearings, sighting northeastward along an axis between the main pillars of the Sarsen Circle entrance.

How Huge Stones Crossed the Downs

No one can look up at these ponderous blocks without wondering how a primitive people with scant engineering knowledge could have brought them to this lonely spot and erected them. Yet this mystery should not be exaggerated, for the job did not require miraculous powers or any startling ingenuity.

In fact, it could have been done by an army of sturdy schoolboys, as my son Bob



and I saw in a film at a London television studio. The film showed youngsters pulling a heavy concrete column over rough ground with ropes and rollers. We also saw the same weight ferried upriver on three dugouts lashed together.

The sarsens would have offered no insurmountable problems. Between the Marlborough Downs and the monument the haulers would have encountered some gentle hills, a few marshy valleys, several stretches of thicket. But the distance is only 24 miles, and it is doubtful if the builders were pressed for time (page 850).

While the bluestones had to come a much

longer way from Pembrokeshire, they were also a good deal smaller, averaging about one and a half tons. Many routes might have been followed: an all-land trek across the Welsh mountains, the Cotswold Hills, and south into Wiltshire, or a long sea passage around Land's End and up the Avon, for example. More likely now seems to be a mixed journey, by boat from Milford Haven to the Avon at Bristol, up that stream beyond Bath, and eventually, after a number of portages, to Stonehenge (map, page 851).

Admittedly, tugging these stones over broken or marshy terrain would have been no picnic. The wooden rollers would have been constantly bumping into rocks and stumps, snapping, or being ground into the earth; once pitched off into a bog, a boulder would have been a sore trial to extricate.

Even so, more perplexing questions occur to me. What about the fashioning of Stonehenge's colonnades? How did men who never knew steel shape this tough, dense sandstone?

And shape it they did. For the tall sarsens of the outer peristyle are not only cut into

PHOTOGRAPH BY W. E. BOYNER © N.S.S.



Like a Mammoth's Assembled Bones, the Stones Bask on Salisbury Plain

A processional path once led across Wiltshire's rolling chalk downs, starting at the Avon River 13¼ miles away. Time all but erased the ancient lane (far left), but aerial cameras helped disclose it.

Here, say historians, William the Conqueror summoned major landholders in 1086 and exacted from them the famous Salisbury Oath. The vow strengthened first allegiance of the landowners to the fierce old Norman king.

Ancient priests may have sighted summer's first sunrise approximately over the Heel Stone (beside highway). Scholars conclude that rituals performed here saluted earth's source of light and warmth.

The Slaughter Stone, which lies toppled between the Heel Stone and the monument proper, reflects unfounded stories of human sacrifice. The earthen mound beside the highway is believed to entomb a warrior chief who knew Stonehenge in its glory. Arc of white dots marks chalk fill in the ritual pits.

Beyond the distant groves lie Amesbury (right) and Durrington (extreme left).



HIGH SPEED SYNCHRONIZED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER EDNALE J. BRECHOWSKIE © N.G.S.

regular oblong columns, but are capped by lintels joined to the uprights by tenons and mortises; and the heavy lintels themselves are joined by a crude tongue-and-groove bond. No one could mistake the workmanship of Stonehenge for that of the Parthenon; yet it has its own massive distinction.

Dressing Stones Took Long Years

Like everything else about Stonehenge, it took time. Quite probably, the sarsens were hewed by fire. After excavating a likely-looking boulder, the cutters would light a brisk fire upon it and, when the stone was hot, drench it with water, then pound it with maul stones. If they were lucky, the boulder would split along the water mark (page 848).

But this would still yield only a fairly clumsy block. To dress it, they would simply have to beat it into shape, blow by blow. It might be one man pounding away, hour after hour, with a round sarsen maul in his fist. Or it might be two men swinging between them a rope-cradled maul about the size of a football, lifting it in unison and smashing it down on the sandstone.

I hope they knew some good Neolithic work-gang chanties, for it must have been a dull chore, with progress measured in dusty millimeters. One archeologist has estimated that it took about fifty masons three years to thump the sarsens into their eventual form.

Once hauled to the site and dressed, the stones were simply slid, end first, into slant-



Rising sun escapes clouds and mist that often blur Wiltshire's chill dawns. This rare view last June 22 followed five years of cloud-frustrated trips to Stonehenge by National Geographic photographers. As the sun rises close by the Heel Stone, its promise of summer warmth cheers modern-day pilgrims as it did the ancients.

Lantern lights the vigil of a couple awaiting sunrise. In day's transient lights, the hues of Stonehenge vary; by night the stones loom large in inky shadow.

Youths fill the somber dark of solstice eve with frolic. Last year some 2,000 romped and danced to Dixieland music.

ing holes dug to receive them. Then, erecting a timber crib, the builders eased them upright and hastily packed debris of all sorts around the socket (page 852).

The stones were now standing firmly erect. But how were the lintels to be hoisted atop them, without cranes or other modern tackle? Probably we shall never know, but the task is not so formidable as it seems. The great stone slabs could have been hauled or slid on rollers up timber ramps, which were later removed. But an even simpler method has been suggested: a supporting crib of timbers built *under* each stone as it was levered upward by inches, one end at a time, to the summit.

Another question struck me as I stared at the gaunt ruins of today's Stonehenge: Was it ever roofed? We tend to think of it simply as a pattern of peristyle and architrave, open to the skies. But could not these columns and lintels have supported rafters and thatch, forming a circular temple or council chamber? The odd, indeed unique, use of mortise and tenon, tongue and groove on these huge stones suggests that the builders were more familiar with the techniques of carpentry than of





Greek architect's hallmark? Dagger carving on a sarsen invites speculation that an immigrant from Aegean lands or a Briton who had traveled there designed Stonehenge. Like Greek columns, some pillars bulge to overcome the illusion of concavity. Carvings to right and below the dagger resemble bronze axheads of Ireland. Roman letters date from modern times.



HAROLD E. EDGEMOND

Possible model for the dagger comes from ruins of Mycenae, where warriors carried similar weapons about 1500 B.C. Mycenaeans in those times were razing palaces, while Britons were dragging slabs to Stonehenge.

masonry. What more natural for them than to crown their pillars with a timber ceiling? The weather of 40 centuries ago was probably quite as English as it is today!

About 2 a.m., as the wind came whistling through the archways, Bob and I could certainly appreciate the need for shelter. In fact, I retreated finally to our car and its heater, leaving Bob huddled on the Altar Stone in the lee of two large fallen columns. A pajama top wound around his head served as a turban and the pants as a scarf. He had brought his recorder, and I could hear occasionally, rising above the gray ruins, the thin, flutelike notes of a folk song.

Left to myself, I was free to speculate upon the old questions of who had built Stonehenge, and when—questions which are, of course, inseparable. Perhaps the most celebrated guess to come along was that of the astronomer Sir Norman Lockyer, in 1901. Assuming that Stonehenge had been deliberately laid out so that its axis pointed toward the sun on the horizon at the summer solstice, and knowing that the sun's position at this point varies

from year to year, Lockyer's calculations indicated that the last time the solstice sun would have come up at just that spot was 1840 B.C., give or take some 200 years.

This was, admittedly, little more than an educated hunch, for the ancients who laid out Stonehenge relied on the naked eye, not precise surveying instruments. Their line of sight could have deviated enough from Lockyer's to create an error of hundreds of years in his calculations. Further, we do not know which moment the builders regarded as sunrise; a wrong guess here could throw the estimate off by several millennia.

Nevertheless, Lockyer's date gained startling support half a century later when Prof. Stuart Piggott, Prof. R. J. C. Atkinson, and Dr. J. F. S. Stone dug up some charcoal from one of the Aubrey Holes and submitted it to carbon analysis. Measuring the radioactivity that still resided in its carbon-14 molecules, Dr. W. F. Libby of the University of Chicago was able to give the lump a remarkably coinciding date of 1848 B.C., plus or minus 275 years.

A few years later came still more, and most unexpected, support. This same Atkinson, eager to photograph some initials carved by a 17th-century visitor on one of the monoliths, was gazing through the finder of his camera when suddenly he discerned the shadowy outline of a dagger and a single-bladed ax engraved in the stone. Moving his eye from the camera, he stared directly at the weathered surface. There they were, unmistakable.

At once he called Dr. Stone. One look, and Dr. Stone bit his pipe so hard he broke a tooth!

The ax looked familiar enough. Irish weapons like it had been found in the Wessex funerary barrows near by. But the dagger . . . well, the dagger had a large knobbed pommel and a long, tapering straight-edged blade (opposite).

To both Atkinson and Stone, the significance of this design struck home. Nowhere in Western Europe were such daggers to be found, but similar ones had been unearthed, they knew, in Mycenae of Greece, legendary stamping ground of the Homeric heroes and an outpost of the ancient Aegean culture. If the dagger is Mycenaean, it could date Stonehenge back to this 3,500-year-old civilization, and it raises the exciting possibility that the monument's final architect was himself a Mycenaean.

As Professor Piggott puts it: "Stonehenge is unique, the individual creation of an architect whose capabilities in design and proportion were far beyond those of barbarian northwest Europe at the time, and if we look for likely origins, it is to the Aegean we would naturally turn."

Actually, the building of Stonehenge spanned some four centuries and three distinct phases, in the most recent view held by archeologists. The circular earthwork, the Heel Stone, and

the Aubrey Holes came first, probably between 1800 and 1700 B.C. The following century saw the construction of the Avenue and the original arrangement of the bluestones. These stages may well have been the work of late Neolithic Britons.

In the early Bronze Age, some 500 years after Stonehenge first took shape, the chieftains of Wessex traded with the Mediterranean world. They commanded sufficient labor to have rearranged the bluestones, fashioned the great sarsens, and erected the giant rings and horseshoes. Did they import an

Visitors demonstrate the scale of the Sarsen Circle, whose uprights average 13½ feet and whose crosspieces weigh some seven tons. The monument's builders, carpenters in stone, joined pillar and lintel with a crude mortise and tenon.



NATIONAL GEOGRAPHIC PHOTOGRAPHER KATHLEEN HESS

Rooted Like Dancers Under a Spell, Hoary Pillars Awe Today's Visitors

The monoliths have endured despite ravages of wind and rain, vandal and souvenir hunter. Now protected as a national monument, Stonehenge sets off House of Commons debate whenever advocates of restoration clash with lovers of authentic ruins. Recent restoration work involved five stones that had toppled in the past 200 years.

Here visitors marvel at the engineering feat of early Britons. Short Welsh bluestones flank the plump sarsens like children clinging to their mothers' skirts.

Aegean master to oversee the work? Perhaps.

Someone, at any rate, certainly left his signature all over Stonehenge. The strange thing is that, though tens of thousands of visitors had for centuries pored over these monoliths, examining each bump and crevice, no one had ever discovered on them a dagger or an ax. Yet, as soon as men knew what they were looking for, the symbols began to crop up.

Two days after Atkinson had spotted his carvings on Stone 53, a 10-year-old schoolboy named David Booth found similar axes incised on Stone 4. Since then more ax carvings have been found on these and other stones. As photographers continue to focus on the weatherworn stones in varying lights and from different angles, we can expect still more inscriptions to come to light.

Sun Temple—or Sepulcher?

To what use did men put Stonehenge? Legend and the fancies of antiquarians have supplied many a curious answer. Some believed the early British kings, slain by the invading Saxons, were buried here; unfortunately for this theory, Stonehenge would already have been nearly 2,000 years old. Some say the wizard Merlin arranged for the devil to whisk these rocks from Ireland in a night; this tale may have sprung, a little misshapen, from importation of the bluestones from Wales.

Other notions have it that the Romans built Stonehenge as a temple to the sky god, Coelus; that the Danes erected it as a court royal; that the Druids made it to house their pagan rites. Interesting ideas, all of them. But they break alike upon the awkward antiquity of this ancient edifice.

Was it used as a sepulcher at all? One scholar thunders, "The sepulchral origin of Stonehenge can no longer be questioned."



Another politely demurs: Stonehenge, he declares, is "mainly nonsepulchral."

Was it used for sun worship? Again, one archeologist points out that such a religion was unknown to Britain before the Mithraic Romans arrived, and calls the solstitial orientation of Stonehenge a figment of "undisciplined imagination." Other enthusiasts are just as sure the monument's axis was no accident.

Perhaps the fairest summation is E. Herbert Stone's: Says he: "It may have been a Temple for some form of worship—or a Court of



REDACTED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER KAPHLER BEVIS © N.G.S.C.

Justice—or a Hall for ceremonial meetings of tribal chiefs. All we can say with certainty is: *'We do not know.'*"

Just after 3 o'clock, the sky began to show a bit of dark blue, and in the distance I glimpsed a galaxy of tiny lights wavering down the road. Soon I was able to associate the lights with a squadron of bicycles, and the bicycles with schoolgirls in blue uniforms. Expeditionary forces of the Godolphin School of Salisbury had arrived.

Climbing the fence, a little hesitantly, they joined Bob and me within the Sarsen Circle.

We were happy enough to have company, and even happier when, chattering like magpies, they broke out a dawn picnic and invited us to share it. It had been a long, cold, and hungry night.

The sky grew yet paler. Presently another bicycle platoon appeared—boys, this time, from London. They had brought camping equipment and proceeded to make themselves comfortable. For the rest of us, keeping warm meant jumping up and down.

In its own good time, the sun peeked over the horizon, encountering at once a photo-



Mellow tones of a recorder pipe a folk tune among the monument's venerable slabs. Bob Edgerton, son of the author, blows the plaintive notes while awaiting the solstice dawn. He wears a turban of pajamas for warmth.

Recorders descend from primitive pipes trilled by man since remote antiquity. Largely replaced by side-blown flutes after 1700, they now enjoy a revival. Modern Druids carry a recorder in their solstice rituals.



Hooded Druids salute symbols of fire, air, earth, and sea. Each June these mystics converge on Stonehenge to conduct solstice rites, although no evidence ties their order to the monument's erection. As summer dawns, a bearded devotee (opposite) carries a fresh-budded rose, emblematic of the air, to the Sarsen Circle. White-robed celebrants deck a linen cloth with the flower and other symbols: water for the sea, a pot of embers for fire, bread and salt for earth.

Like Stonehenge itself, the Celtic priesthood of the Druids arose in prehistoric mists that defy precise dating. In the first century B.C. Caesar found both Gaul and Britain ruled by a Druid elite. Roman governors stripped the pagan caste of power, and Christian zeal all but wiped out the order by A.D. 400.



graphic barrage laid down by scores of cameras clicking away from the great Altar Stone. From our vantage point we could see its golden rim framed beneath the main entrance to the Sarsen Circle.

Slowly the bright disk rose. Across its face were silhouetted trees on a distant Wiltshire hill. We had been instructed to watch where the shadow of the Heel Stone fell; presumably, it had some ritualistic significance. But shadows are rather uncommon at dawn (we received more illumination from the sky's scattering light than from the sun itself). In any event, the position of the Heel Stone seems a bit irrelevant. The midsummer sun, as viewed down Stonehenge's axis, has never come up precisely over the Heel, and it will not for more than 1,000 years.

Picks Made of Deer Antlers

Unwilling to wait that long, I suggested to Bob that we get some sleep. We did, at an inn near Amesbury. In the afternoon, however, we rose and rambled through the Salisbury Museum, where many of the objects found at Stonehenge are now on display. With the curator, Hugh Shortt, we examined picks made of deer antlers, stone mauls for dressing the monoliths—even the port bottle left under one fallen sarsen by an excavator in 1801 for the benefit of future archeologists! It was fascinating to see, too, a bronze axhead of Irish origin, very like those found carved on the big columns.

The next night we spent out at the ruins again, this time photographing them in the spectacular light of emergency flares we had picked up from a ship chandlery in London.

At dawn it became apparent that clouds would mask the sunrise, so we retired to Amesbury once more. We wanted to save our energy, in any event, for the early hours of the 22d. We knew that, come fair weather or foul, a goodly contingent of Britons would turn out to honor the solstice.

Nor were we disappointed. By afternoon caravans and buses had already begun to chug up. All during the night more pilgrims trickled in, not merely from other parts of England, but from Europe and even as far away as Ceylon. By the time the stars began to wink out, one by one, nearly 1,000 visitors were on hand.

Most picturesque of the lot, of course, were the "Druids." Exceedingly little is known about the pre-Roman priests of this Celtic

nature cult, but since the days of Dr. William Stukeley, the leading 18th-century antiquarian, romantic Britons have been only too happy to supply details.

For hundreds of years groups of latter-day mystics have gathered annually at Stonehenge to perform rites which they ascribe to the ancient elders. The fact that Stonehenge was a venerable relic long before the first Druid is known to have set foot in it has never dampened their ardor.

In flowing white robes, then, our modern celebrants began before sunrise their processional around the monument's encircling earthwork. From a rock at the west a Druid picked up a bowl of bread and salt; from the north, water.

While a musician played a tune on a recorder, the Druid band marched to the Heel Stone and thence to the Sarsen Circle and the Altar Stone for sundry incantations and observances.

Unfortunately for the ceremony's general effect, the sun rose but refused to shine. It was several hours, in fact, before it managed to emerge from the English morning mist.

By this time the Druids had repaired to their assembly point on a small mound at the monument's southern edge, and a group of morris dancers took over. To the measure of a fiddle, they whirled through time-honored rural figures on the greensward between the Sarsen Circle and the causeway.

A holiday feeling possessed us all. In high spirits we exchanged jokes and lighthearted banter, spread our picnic lunches on the grass, and generally enjoyed ourselves. With or without archeological sanction, we had celebrated the summer solstice in fitting fashion.

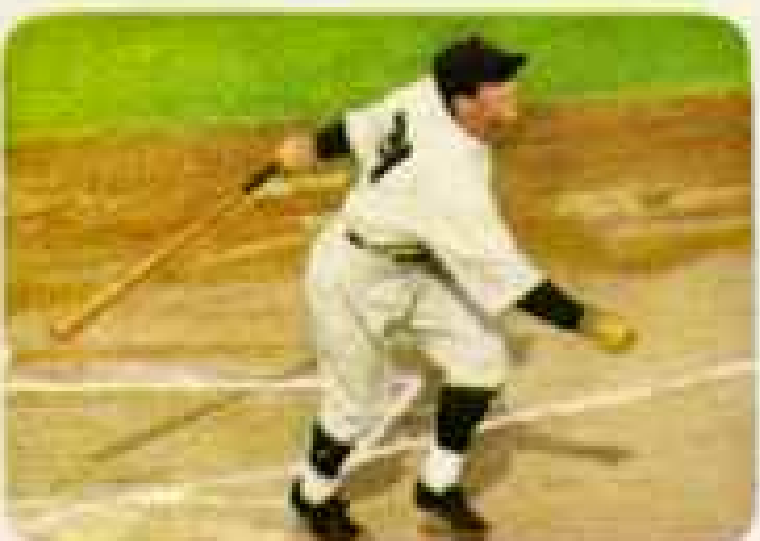
Stonehenge Keeps Its Secret

Behind and above us still reared the enigmatic rocks. Over the years we have unraveled some of the secrets of Stonehenge. Yet a great part of the mystery still eludes us, and perhaps we value and enjoy it the more for that.

There is even an element of sardonic humor implicit in this venerable monument. As the English poet Michael Drayton wryly observed early in the 17th century:

*Ill did those mighty men to trust thee
with their story;
That hast forgot their names who reared
thee for their glory.*

* * *



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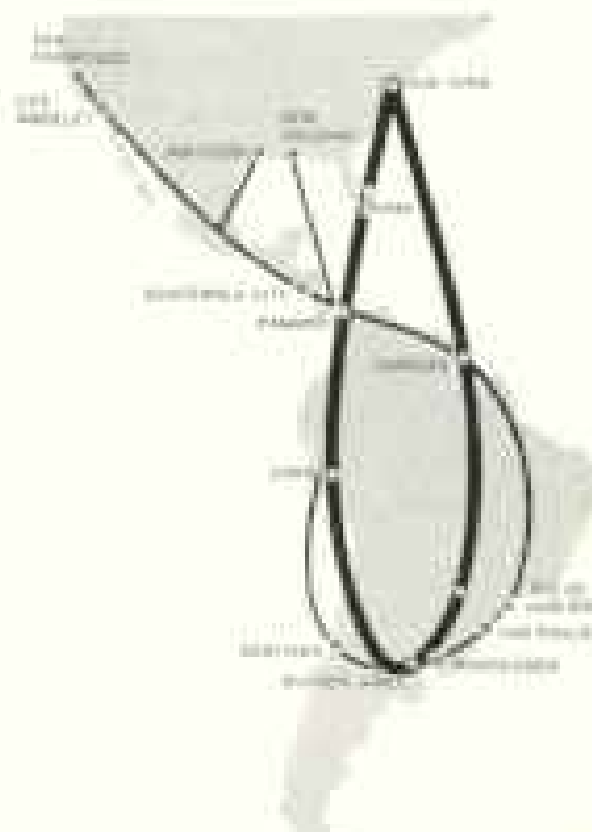


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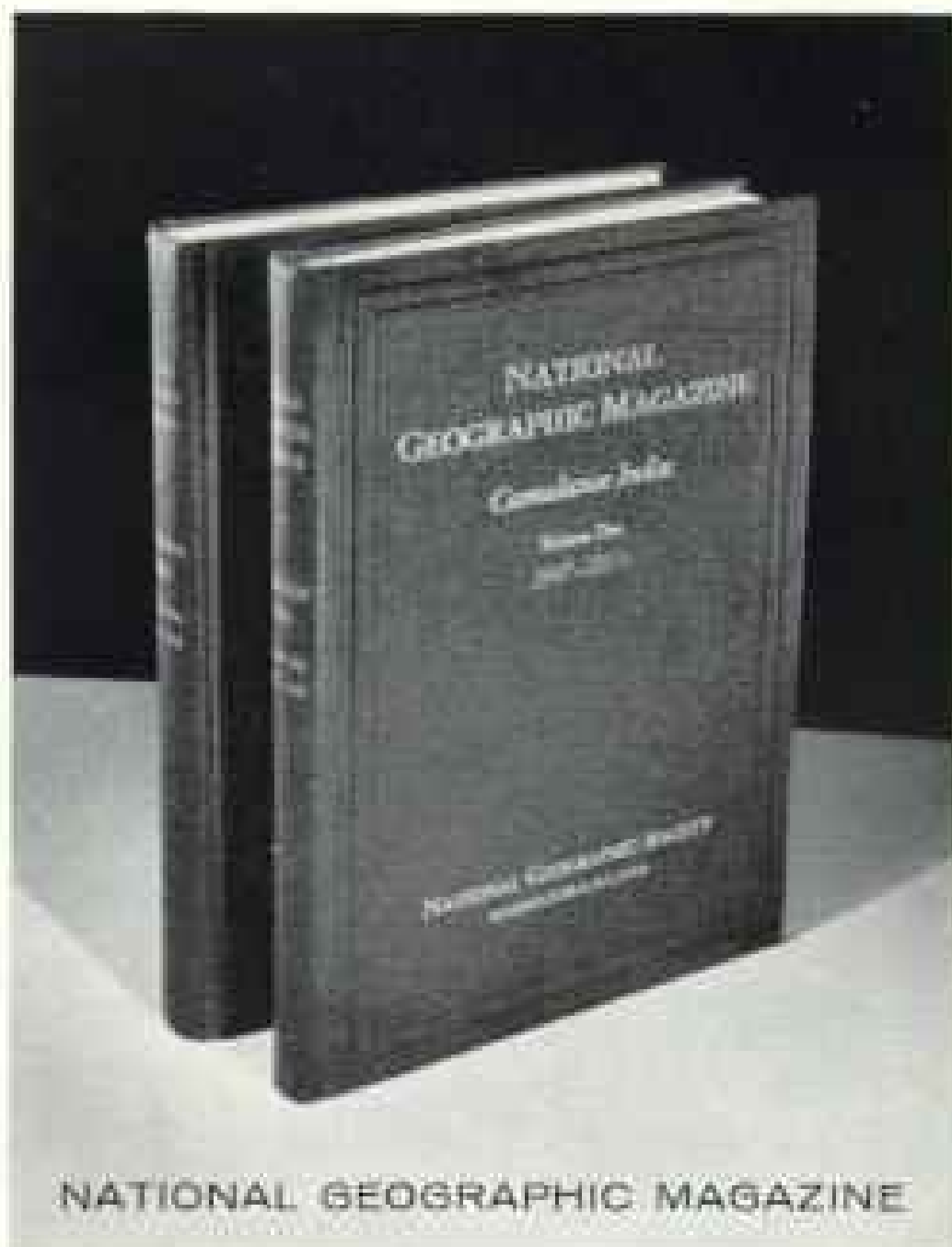
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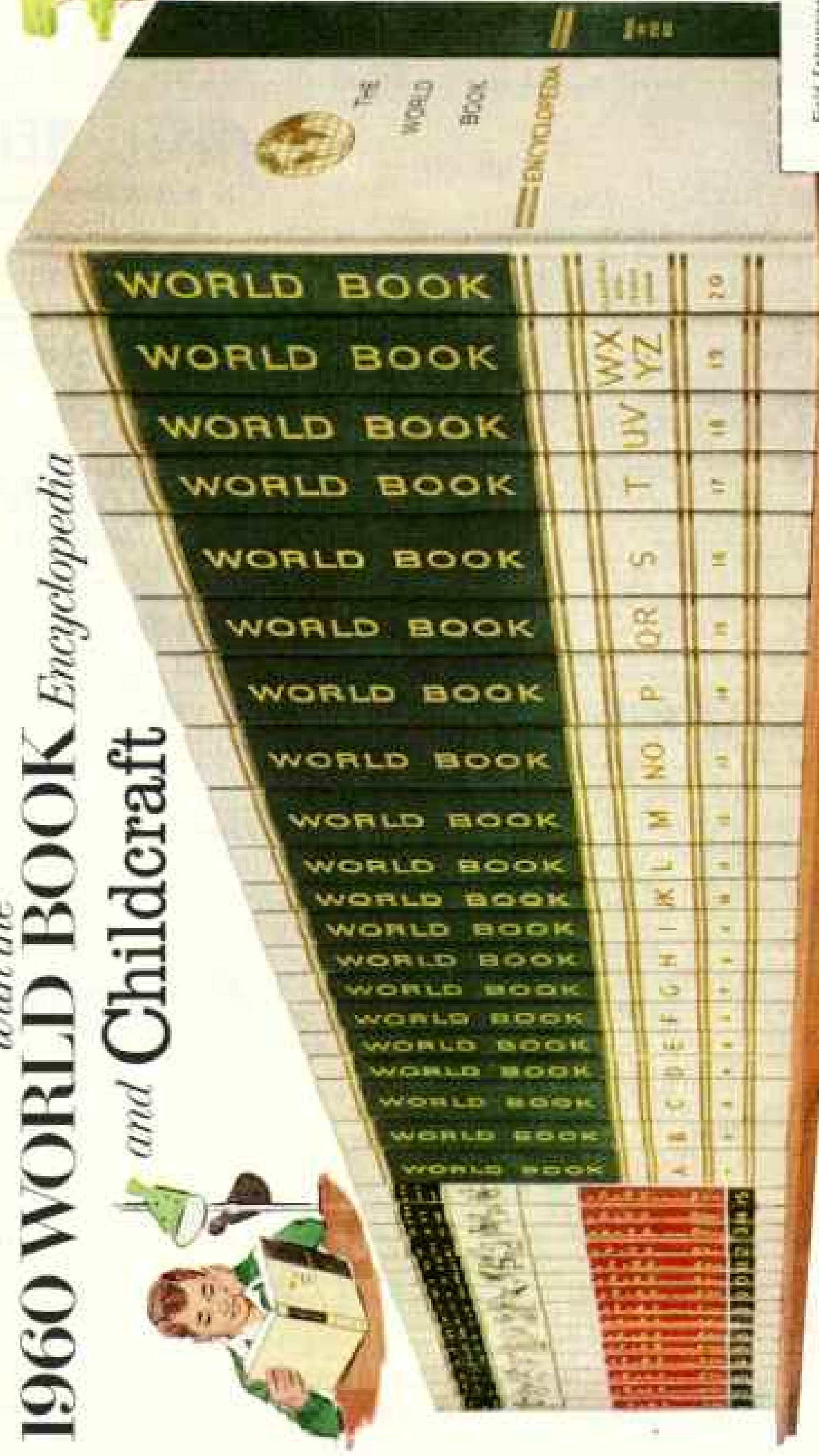
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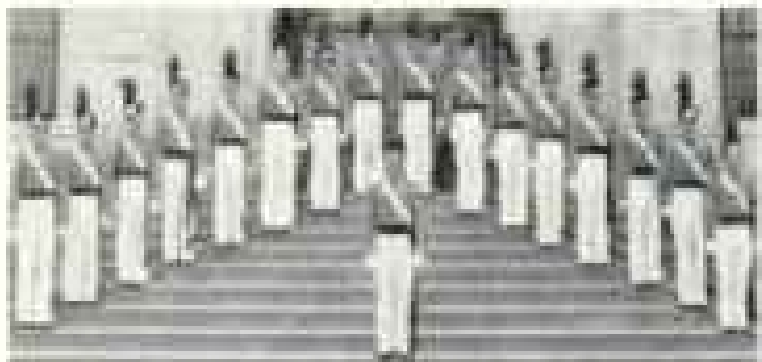
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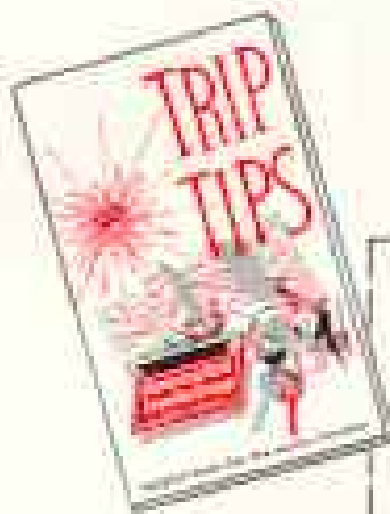
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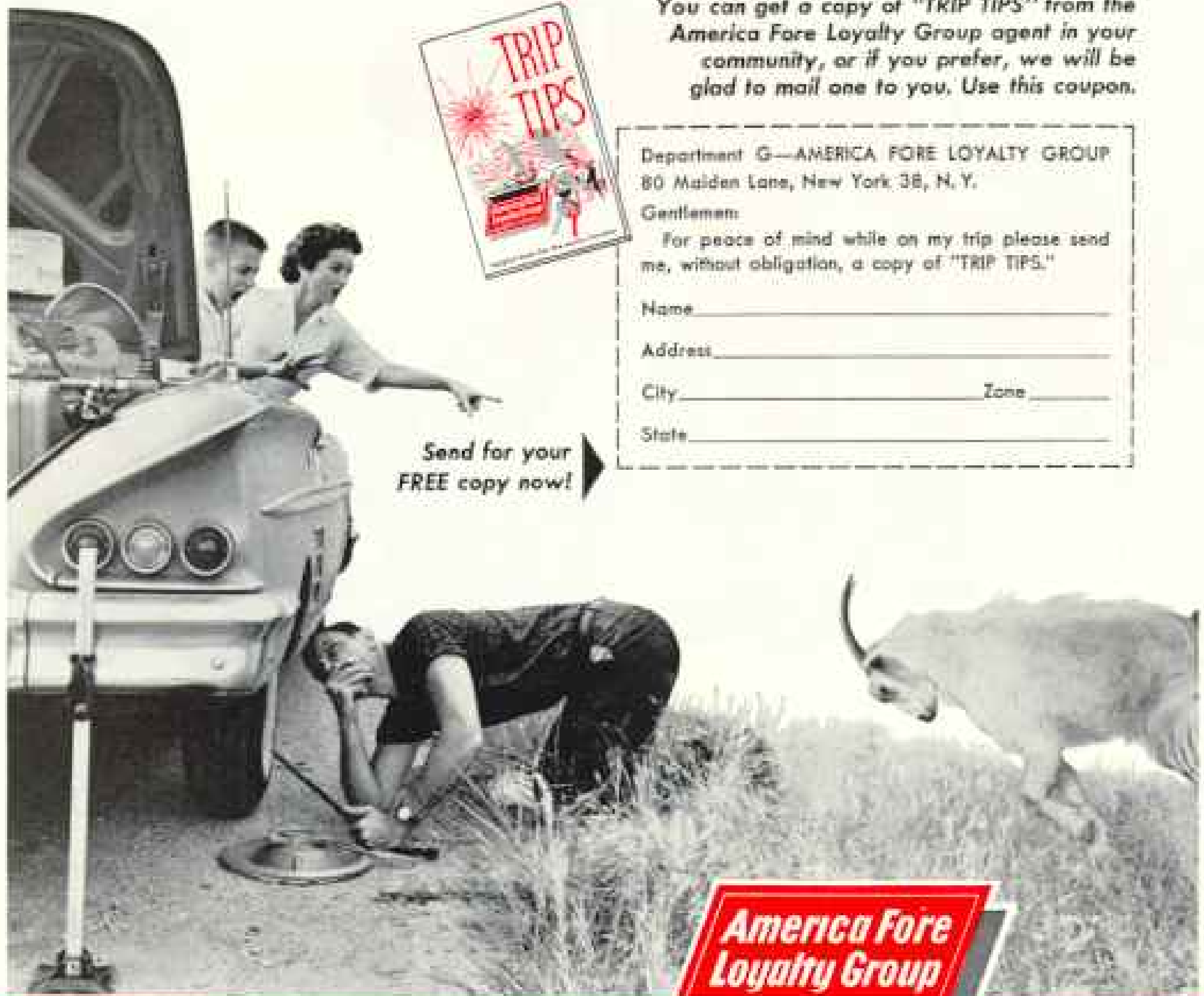
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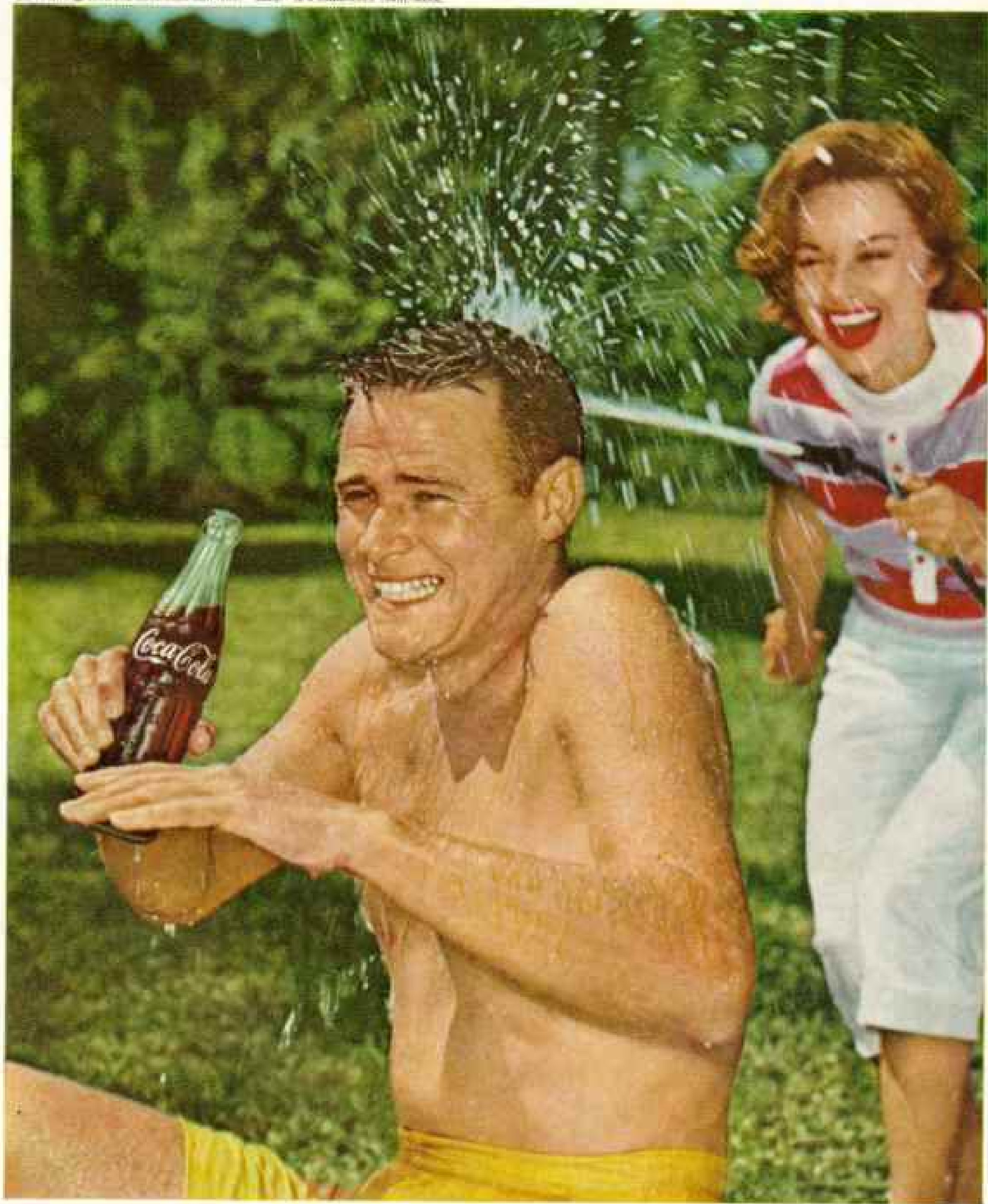
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