

VOLUME CX

NUMBER TWO

THE NATIONAL GEOGRAPHIC MAGAZINE

AUGUST, 1956

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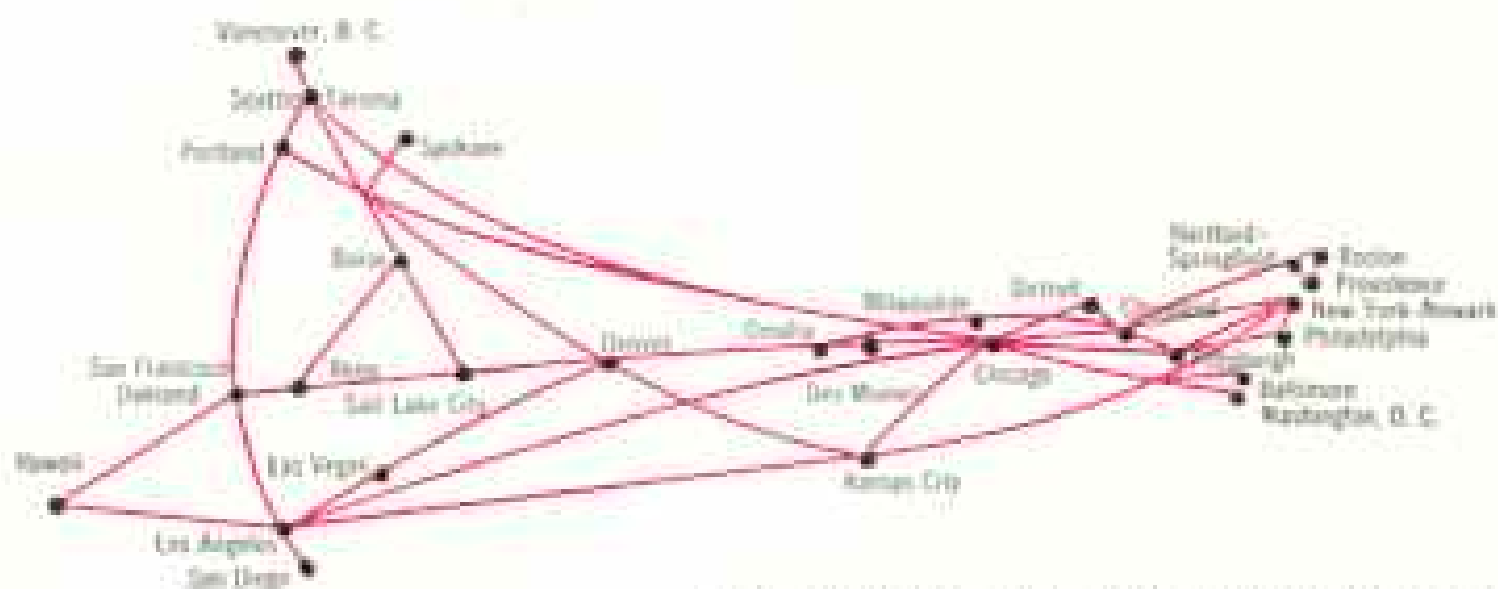
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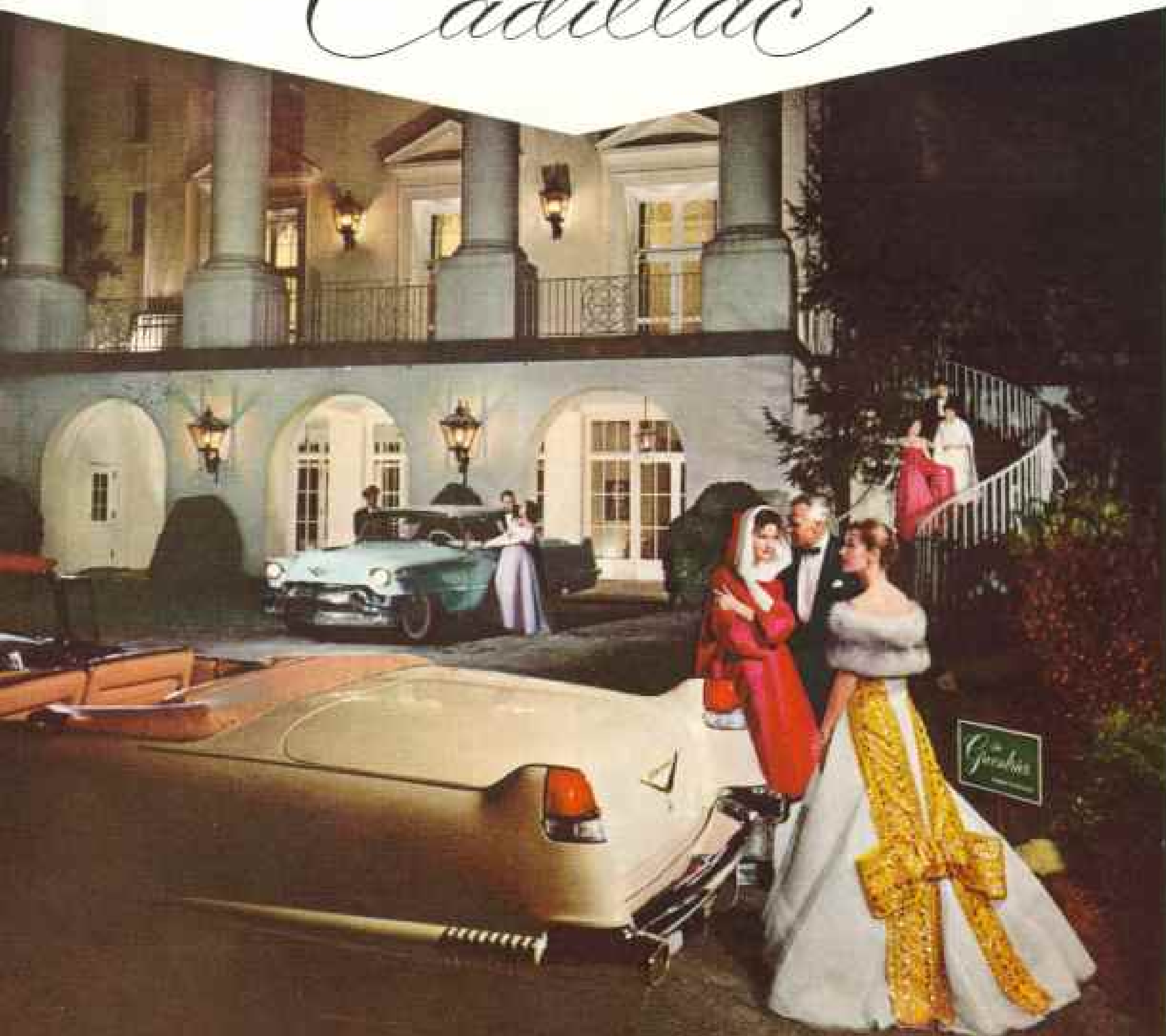
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What is a good breakfast? It should supply 25 to 33 percent of the vital nutrients needed for the day. It should include fruit in some form; bread made from whole-grain or enriched flour; cereal or eggs, meat or fish; and milk either to drink or use on cereal or in a cooked dish.

A breakfast planned around these foods, adding other things you like, provides the "pickup power" you need after having fasted some 12 hours from the meal the night before until breakfast the next day.

Moreover, every item on a wholesome breakfast menu supplies important nutrients. Citrus fruit or fruit juice helps fill your need for vitamin C. Whole-grain or enriched bread and cereals yield energy, B vitamins, iron and other minerals. Milk is important for both its calcium and its proteins, and eggs and meat for their high-grade proteins, vitamins and minerals.

A breakfast that gives you these food elements may help you escape mid-morning fatigue . . . and helps you to avoid overeating at lunch or dinner. This is why overweight people need well-balanced breakfasts.

If you or members of your family seldom feel hungry for breakfast you might get into a good breakfast habit if you try some of the following suggestions:

1. Start the day at least 15 minutes earlier. This will allow more time for the family to eat unhurriedly without risking tardiness at school or lateness at the office.
2. Try to take a bit of light exercise before breakfast, preferably in the fresh air.
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Today this American shrine, as part of Colonial National Historical Park, teaches an exciting history lesson. You can wander the streets of a town little changed in 175 years...see the redoubts and battlements authentically reconstructed...learn at first hand how our freedom was won.

At Yorktown, too, you can see the handiwork of one of America's great organizations, the Daughters of the American Revolution. The Customs House, the nation's oldest, has been faithfully restored by the D.A.R.

In Washington, the Society maintains an excellent historical museum and one of the finest genealogical libraries in the world. But the greatest of the D.A.R.'s many contributions to the nation lies in its far-reaching program of patriotic education through which millions of children learn to become better citizens and to appreciate the miracle of America that began at Yorktown almost two centuries ago.

As long as such work continues, that miracle will continue to be a potent force for freedom in the world...

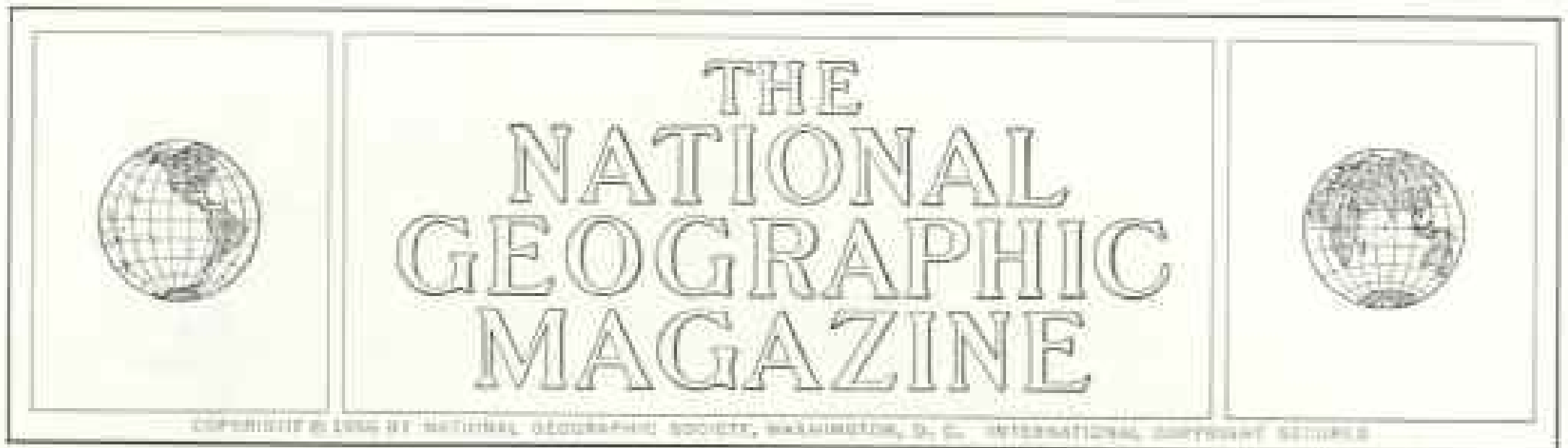
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All-out Assault on Antarctica

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Operation Deepfreeze Carves Out United States Bases for a Concerted International Attack on Secrets of the Frozen Continent

BY REAR ADMIRAL RICHARD E. BYRD, USN (RET.)*

NOT long ago I received a radio message from the southernmost human beings on earth.

"Huts buried to rooftops with drifting snow; temperature plunged to minus 53," reported Little America, 8,761 miles from Washington, D. C., and 812 miles from the South Pole. "Ninety percent personnel talked to loved ones via ham radio. Beautiful aurora observed daily."

Winter at the Bottom of the World

In the heat of a Northern Hemisphere summer it may be hard to realize that down at the other end of the world 166 Americans are living amid blizzards, bone-piercing cold, and a four-months-long night.

These men are the hardy Seabees and Navy specialists we left behind in Antarctica last March to build and man two bases 447 miles apart at McMurdo Sound and Little America V (map, page 147). Around them rages the worst weather in the world; yet in their snug huts in the snow the men enjoy daily movies, innerspring mattresses, hot and cold running water, soft drinks, and steaks to order.

Other countries hold similar beachheads, for this is a great international effort. Eleven nations are joining forces in the biggest assault ever made on the secrets of the white continent, nearly twice the size of the United States, that covers the bottom of our planet.

This major campaign is being waged in behalf of science, but it is using many of war's tools—ships, planes, and ponderous tracked vehicles. Its "troops" are as highly

trained as any that a fighting war demands.

To a man who has devoted thirty years of his life to exploring the polar regions and preaching the importance of Antarctica, it is an enormous satisfaction to see this job at last get the tools that it demands. It is my privilege to have a part in it as Officer in Charge of United States Antarctic Programs, now and during the International Geophysical Year.†

When I sailed on my first expedition to Antarctica in 1928, my flagship was the wooden bark *City of New York*, 502 tons displacement and 200 horsepower. On my fifth and most recent trip, the 1955-56 phase of U. S. Operation Deepfreeze, the ship that took me to the south polar continent was the Navy's newest icebreaker, *Glacier*, 8,625 tons displacement and 21,000 horsepower.

Quite a difference—and it's typical of the big advantage we have today.

* For three decades the National Geographic Society has been privileged to cooperate in the history-making polar explorations of Richard Evelyn Byrd, first man to fly over the North and South Poles and, since 1953, a Trustee of The Society. Admiral Byrd's five previous personal narratives in the NATIONAL GEOGRAPHIC MAGAZINE are immortal chapters in the annals of arctic and antarctic exploration: "Flying Over the Arctic," November, 1925; "First Flight to the North Pole," September, 1926; "Conquest of Antarctica by Air," August, 1930; "Exploring the Ice Age in Antarctica," October, 1935; and "Our Navy Explores Antarctica," October, 1947.

† See "The International Geophysical Year: Man's Most Ambitious Study of His Environment," by Dr. Hugh L. Dryden, Director of the National Advisory Committee for Aeronautics, Home Secretary of the National Academy of Sciences, and Trustee of the National Geographic Society, in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1956.



Berthed in Ice, U.S.S. *Glacier* Brings Rear Admiral Richard E. Byrd Back to Antarctica

The Navy's newest icebreaker crunched to this majestic landing at Ross Island on December 18, 1955. Helicopters from the sturdy ship scouted for bases for Operation Deepfreeze, which marked Admiral Byrd's fifth trip south.



Mount Erebus, Landmark for Explorers, Backdrops Sailors Playing Tag with Penguins

The dozing volcano climbs 13,200 feet from bay ice to clouds above McMurdo Sound; a faint plume of steam rises from its crater. The Scott and Shackleton expeditions early in this century based within sight of the peak.

My first flight to the South Pole, on November 28-29, 1929, was made in a Ford trimotor. It had 975 horsepower and cruised at 105 miles an hour. To get over the Queen Maud Range, we had to throw out 300 pounds of food.

On my latest flight to the South Pole, on January 8, 1956, I rode in a four-engine Sky-master (the Navy's R5D). It weighed more than six times as much as our Ford trimotor of 1929 and flew twice as fast. Far from having to jettison food, we had a hot lunch of pork chops, French fried potatoes, and peas above the world's most forbidding terrain.

Why Back for the Fifth Time?

Late last year Operation Deepfreeze sailed to Antarctica with 1,800 men. This November another big task force goes south to complete and staff the scientific stations, carry on the expedition's work, and relieve the wintering-over parties.

By Christmas of 1957 the *year-round* population of Antarctica will be many hundreds. If all goes well, 15 of this number will be Americans living and working at the geographic South Pole. Think of it! That is no longer a dream but a serious scientific objective.

People ask me why I keep going back to Antarctica again and again. Well, I like it there. I like the endless reaches of wind-rippled snow, the stark peaks, the awesome glaciers.

I like the clatter of tractor trains, the whir of helicopters, and shouts of men wrestling with vehicles and gear. Yes, and the howling of the huskies too; they're still needed for rescue work. I like the symbols of life's triumph in a lifeless land: the squawking skua gulls, the comical penguins, seals wheezing at their blowholes, the arching backs of whales.

Most of all, I guess, I like the challenge of it, for Antarctica still plays for keeps. And I believe, as the scientists do, that the things we can learn there will have a profound effect upon the lives of us all.*

Thus it was with the old sense of excitement that I stood on the bridge of the brand-new icebreaker *Glacier*, on December 15, 1955, as she entered the south polar pack, the ring of floating ice that guards the Antarctic Continent. We were scouting far ahead of the rest of the task force—two other icebreakers, three cargo ships, and a tanker. Rear Adm. George J. Dufek, operations commander, rode the freighter *Arneb*.

I want to make it clear at the outset that the credit goes to Admiral Dufek and those under his command for the direction of the ships, planes, and men. George Dufek, who was with me on two previous antarctic expeditions, commanded Task Force 43, which had for its mission the establishment of our antarctic bases (page 150).

With two of my staff I had joined *Glacier* in New Zealand after flying there from the United States and conferring on polar matters and the IGY program with Prime Minister S. G. Holland and other high officials of his Government. My companions were Dr. Paul Siple, now my deputy, whom many remember, I'm sure, as the Eagle Scout who was picked from the entire country to go with me in 1928 on my first antarctic expedition, and Maj. Murray Wiener of the Air Force.

As I explained to our New Zealand hosts, we planned the establishment of two main bases. One, to be erected on the Ross Ice Shelf in the Little America region, was to be the chief U. S. scientific station.

An Air Operating Facility, to be built on land far back in McMurdo Sound, would be the staging base for a daring airlift at the end of 1956. From it, Air Force planes would carry to the South Pole itself 500 tons of materials, as well as construction and wintering-

*As the Government's senior representative for antarctic affairs, Admiral Byrd is in charge of United States expeditions in the southernmost continent. Supervising multiple aspects of U. S. south polar programs, he coordinates the efforts of all Government departments concerned with the Antarctic. His unmatched knowledge and experience are called upon to keep the public accurately informed on antarctic matters and to foster harmonious relations in common scientific and operational goals with other countries taking part in the International Geophysical Year. Admiral Byrd also is charged with setting up a permanent unit for administration of U. S. antarctic undertakings.

"Whirlybird" Thrashes Skyward to Scout → a Safe Course Through the Ross Ice Pack

Last December Operation Deepfreeze sent seven ships and 1,800 men to the bottom of the world. Laden with prefabricated buildings and a staggering variety of supplies, the expedition prepared for United States scientific studies in Antarctica during the International Geophysical Year, 1957-58.

Here *Glacier* carves a channel through a 400-mile band of pack ice guarding the approaches to Antarctica. Steaming south in convoy, *Greenville Victory*, *Nespelem* (half hidden), *Wyandot*, and *Arneb* gingerly follow in her wake.





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Old Antarctic Hands Plant a Flag Atop Little America II

"I am mayor of this place," jokes Admiral Byrd (left). The tip of a 70-foot radio mast in the background marks his 1928-30 base, buried by snows of three decades. Little America II, built in 1934 above the first camp on the Ross Ice Shelf, lies 40 feet below the surface.

Dr. Paul A. Siple (laughing), Admiral Byrd's deputy, has accompanied the explorer on all five of his antarctic trips. He went on the first as a 19-year-old Eagle Scout. Other polar veterans (left to right): Maj. Murray Wiener, Air Force adviser to the Admiral, on his third trip with Byrd; Lt. Richard E. Byrd, Jr., on his second; and Edward E. Goodale, an IGY representative, also on his second.

over personnel, for Pole Station, an IGY-assigned U. S. scientific outpost.

The International Geophysical Year, from July, 1957, through December, 1958, is perhaps the most important cooperative effort of scientists in the history of man. From it we are going to learn a great deal about this old world we've crawled around on for so long.

In the single field of weather, for instance, the antarctic IGY stations will greatly enlarge our understanding of the basic circulation of the atmosphere, and thus improve long-range forecasting. Estimates of the money value of

this knowledge to workers in construction, forestry, and, especially, agriculture run into the billions.

An increase of good will among peoples will be an almost inevitable byproduct of some 40 nations working together in world-wide collaboration. Typical of this spirit was the heart-warming reception that was given us in New Zealand.

Six days after we sailed from Lyttelton we were crunching through the 400-mile-wide pack with helicopters scouting ahead. *Glacier's* skipper, Comdr. Eugene ("Pat") Maher, smiled approvingly as his burly ship slashed through four-foot-thick ice.

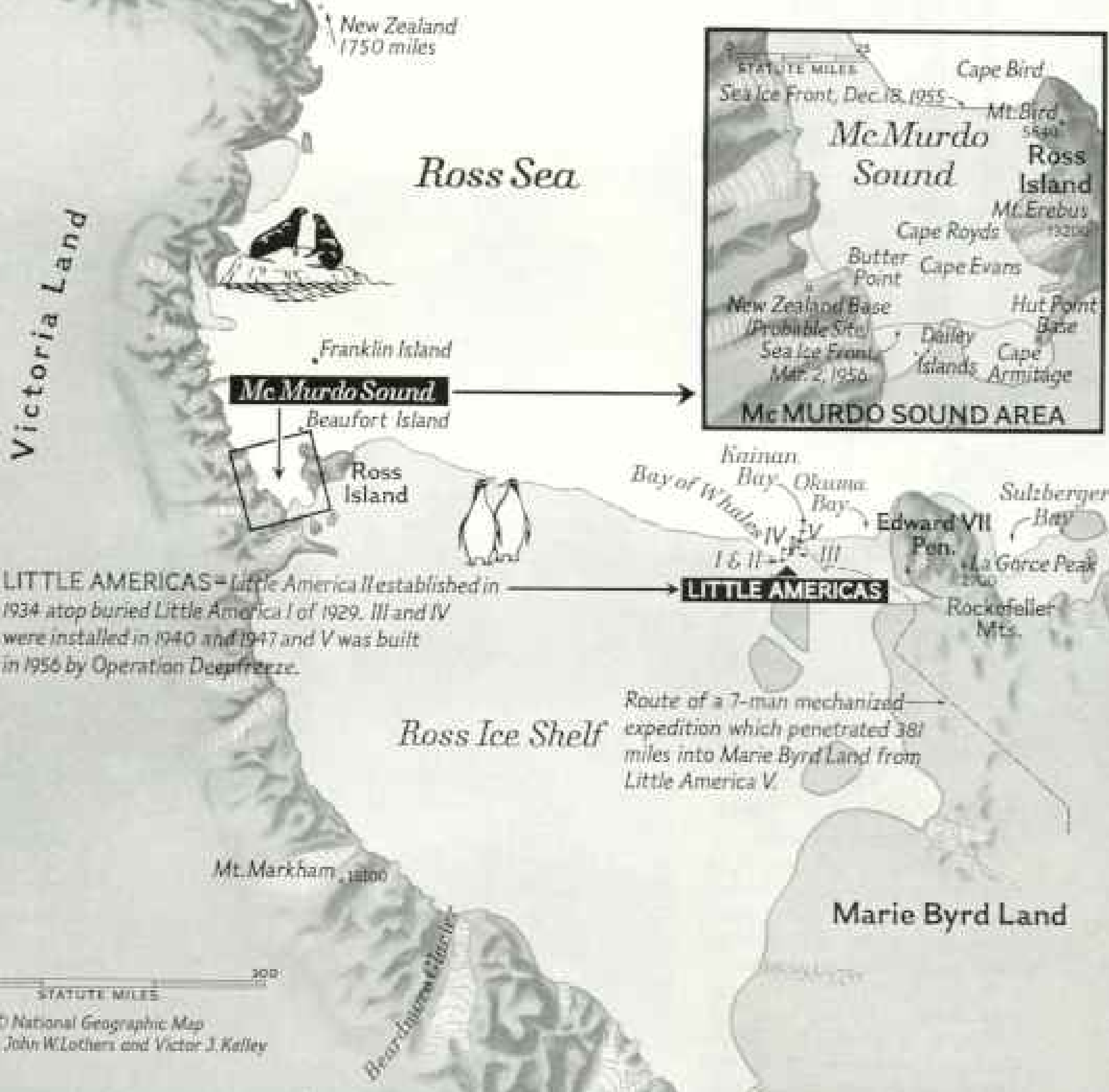
We had reached the world of 24-hour daylight. Often we stayed up all night because there was no night. The sun was a giant lamp swinging in a circle around a blue ceiling.

Seals dotted the ice: a few fat, lazy Weddells, many slimmer, more agile crabeaters, and the occasional voracious sea leopard and rare Ross seal. Adélie penguins, Antarctica's perennial welcoming committee, tobogganed on their stomachs across the ice to escape the onrushing ship (page 158).

On December 17 we shook free of the pack and raced on across the open southern Ross Sea.

Late that evening, through frost haze and wind-torn clouds, we had our first sight of Antarctica—the furrowed cone of Mount Erebus, puffing a plume of steam and smoke (page 143).

Very early the next day *Glacier* rested her scarred gray chin on the hard ice of McMurdo Sound. As the ship's engines fell silent, crew and passengers lined the rails, spellbound by the gleaming peak of Erebus and the blue-gray icefalls cascading off Mount Bird.



LITTLE AMERICAS - Little America II established in 1934 atop buried Little America I of 1929. III and IV were installed in 1940 and 1947 and V was built in 1956 by Operation Deepfreeze.

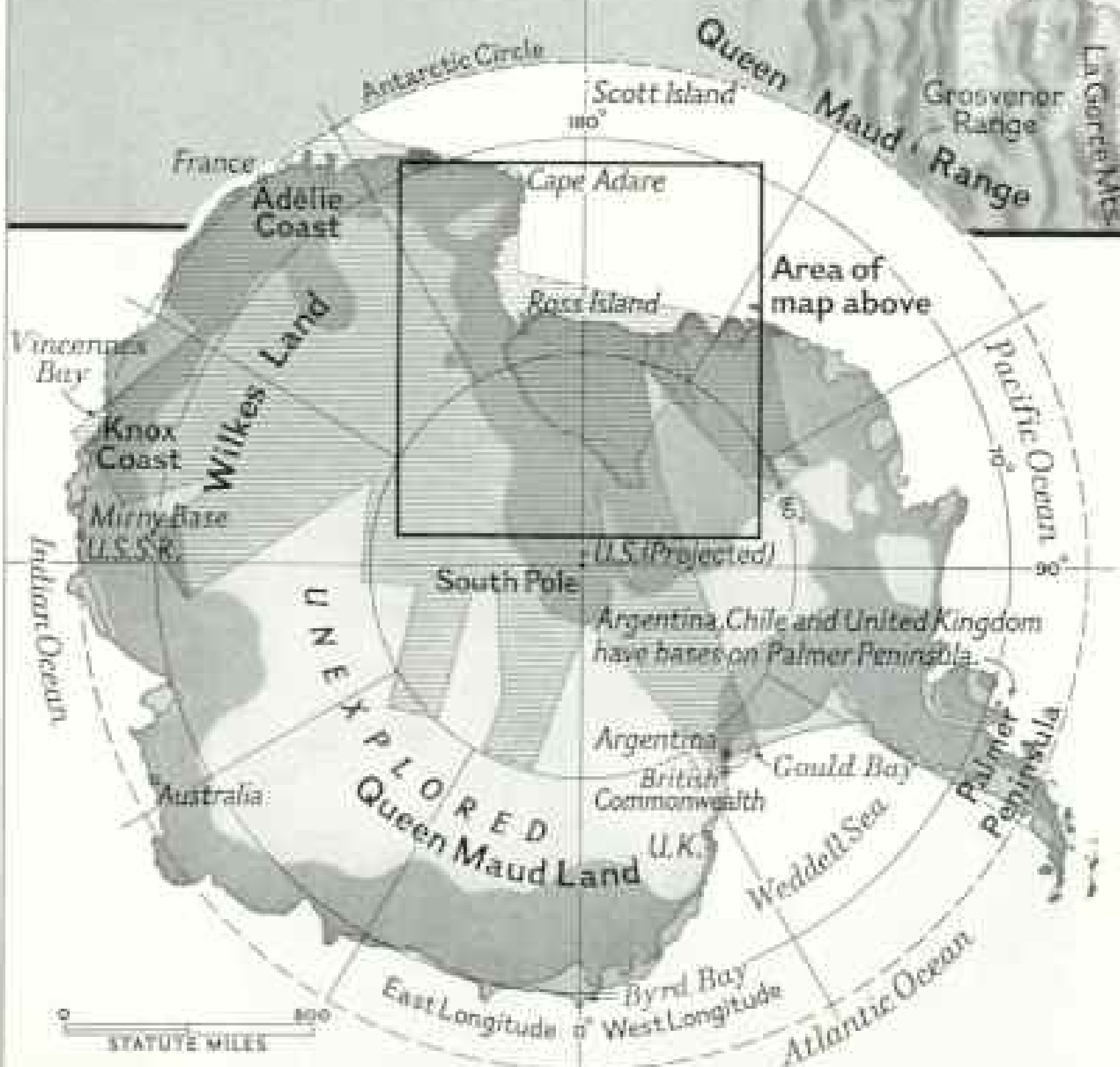
OPERATION DEEPFREEZE
PHASE I, 1955-1956
U.S. participation in the International Geophysical Year antarctic programs, July 1957 to Dec. 1958

1956 Flights Unveil Nearly a Sixth of Antarctica

During the next four years 11 nations will man bases around the frozen continent, sending scientists to make intensive earth observations in an area nearly twice that of the United States.

"I am hopeful that Antarctica, in its symbolic robe of white, will shine forth as a continent of peace as nations working together there in the cause of science set an example of international cooperation," says Admiral Byrd.

- Established IGY Stations
- Area explored by Operation Deepfreeze aircraft.
- Previous exploration





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↑ "Mr. Antarctica" Visits Hut Point Airbase

Admiral Byrd (left) has lived and led the 20th-century evolution of antarctic exploration from dog teams and wooden ships to far-ranging aircraft.

In yellow Byrd Cloth parka and trousers, he has come by helicopter to inspect the Deep-freeze air camp on McMurdo Sound and to visit Robert Falcon Scott's 1902-4 base camp, still standing on Ross Island's Hut Point (page 155).

Here Admiral Byrd talks with Air Force Master Sergeant Hendrik Dolleman, veteran dog-team driver of the U. S. Antarctic Expedition of 1939-41. → Page 149, above: Dolleman's huskies curl happily near a snow-drifted sled. Though planes now blaze polar trails, rescuing dogs can still mean life or death to downed flyers.

Glacier Skirts a → Mighty Wall of Ice

Four times Manhattan's size, this giant island berg measures nearly 100 square miles. Experts estimated its average height as 125 feet and its depth below water as 750 feet.

The monstrous mesa split off from the Ross Ice Shelf and cruised for 200-300 miles before grounding between Ross and Beaufort Islands.

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Rear Adm. George J. Dufek (Left) Plots the Course South for Task Force 43

Three icebreakers, three cargo ships, and a tanker made up the support fleet for Operation Deepfreeze. Here the Admiral confers with *Edisto's* captain, Comdr. Roger W. Luther (center), and the Deepfreeze base operations chief, Capt. Richard B. Black. The National Geographic map helped mark ship and plane positions on the 2,400-mile course from New Zealand.

We had returned to reawaken the echoes in the region where Scott and Shackleton made antarctic history early in this century.

Getting to Know the Natives

Glacier quickly shed her deckload of over-snow vehicles and one of the expedition's four single-engine Canadian-built de Havilland Otter planes (page 165).

Off-duty shifts played softball on the ice or hiked three miles to the bare, black slopes of Cape Bird to visit a penguin rookery. There 30,000 family-minded Adélies were busy hatching eggs and tending the trembling mouse-gray blobs of fluff that were their

young. Rapacious skua gulls perched and hovered near by, ready to pounce on unguarded eggs and young (pages 158, 159).

Marching penguins made heavy two-way traffic on the crushed-lava slope from ice edge to rookery.

"While one bird tends the eggs, the mate heads for seal holes or the open sea," explained Dr. Oliver L. Austin, Jr., U. S. Air Force observer and ornithologist who was banding penguins and skuas for the U. S. Fish and Wildlife Service. "Here it's a round-trip walk of about five miles.

"Birds come back from salt water full of shrimp. After some affectionate billing and

squawking, the penguins switch places on the pebble nests and the hungry shift takes off for the sea. Both parents feed the hatched young by regurgitation."

The *Glacier* had pushed quickly ahead to McMurdo Sound to reconnoiter an ice airstrip that could receive the eight multi-engine aircraft assigned to Task Force 43. These planes were waiting in New Zealand for the go-ahead on the hazardous 2,400-mile over-water hop.

Airstrip Laid Out on Bay Ice

During Operation Highjump, in 1947, I took part in the successful 800-mile flight of six twin-engine R4D's (Douglas DC-3's) from the aircraft carrier *Philippine Sea* to Little America, a flight led by Comdr. William M. ("Trigger") Hawkes, who flew to Antarctica on Deepfreeze, too, as Aviation Transit Officer.

This new air movement, however, would span a three times greater mileage and would be the first fly-in of big planes to Antarctica from a land jump-off point.

To locate the required airstrip, a team took off from *Glacier* by helicopter. Heading it was Comdr. Gordon K. Ebbe, commanding officer of the air squadron that would put aloft the long-range aircraft.

Thirty-five miles to the south, near Hut Point, site of Scott's first expedition cabin, they red-flagged an 8,000-foot snow strip that could easily handle the biggest airplanes (page 152).

A helicopter flew three of the correspondents to see the newly marked runway, landed them, and took off again. At the snowy strip, hours later, they stamped feet and rubbed nipped cheeks, waiting for a helicopter to pick them up. It was cold and very lonely on windswept McMurdo Sound.

"Well," said one, "we surely ought to make it back to the *Glacier* before dark."

The others nodded agreement—then jerked to attention, realizing it wouldn't be fully dark here for several months.

First New Zealand-Antarctica Flights

News of the airstrip was radioed to Admiral Dufek aboard *Arneb* and to the plane crews waiting in New Zealand. Then the south-bound task force ships steamed to their ocean stations for picket duty at intervals along the flight route. As soon as weather permitted, the historic air hop would be ordered.

Glacier left McMurdo on December 20, heading for her plane-guard station 200 miles north. Half a dozen emperor penguins—three-foot-tall patriarchs weighing 60 to 90 pounds—wagged flippers at us as if in au revoir.

Soon word came that all eight aircraft so vital to fulfillment of our exploration plans were airborne from New Zealand.

The four larger planes, two Neptunes (P2V's) and two Skymasters (R5D's), landed safely at McMurdo Sound that evening. The R5D's were the first four-engine aircraft ever to fly in Antarctica, and the first to land there on wheels alone.

"It's the most miserable flight I ever made," said the pilot of the first plane in, Lt. Comdr. Joseph W. Entrikin. "Oh, it was smooth all right, and we had very little icing up. But it seemed so long, not knowing what to expect, wondering if the weather would hold, and with no place to land but just one spot in the whole continent where there were people on the lookout for us."

What magnificent achievement lay ahead for these airplanes and their crews!

Earlier, to our regret, the four smaller aircraft, ski-wheel DC-3's and Grumman Albatross triphibians, had been forced to return to New Zealand because of adverse winds. Time forbade holding the ships on station for another fly-in attempt.

Plane Crashes Near McMurdo Sound

Soon *Glacier* plowed north to rendezvous at Scott Island with the three cargo carriers and the tanker. Gathering them in convoy column behind her, she led them southward through the loosening pack ice (page 145).

The days just before Christmas were clouded by news of the crash on December 22 of the Otter aircraft unloaded four days before from *Glacier*. But by Christmas Eve all hands got the good news that none aboard had been killed, though one officer was seriously injured and one enlisted man suffered a painful, but soon-mended, back injury.

The small plane, jam-packed with passengers and supplies for Hut Point, had cracked up immediately after take-off from the northern edge of the McMurdo Sound ice.

A weasel snow vehicle at the crash site transmitted an SOS to Hut Point. One of the Neptunes flew to the ice edge and took the injured men to the tent camp.

The base doctor gave first aid. But as yet



← First Flight to Antarctica from Land Touches Down on McMurdo Sound

Ski wheels reach for a flag-marked runway on snow-carpeted bay ice as a twin-engine Navy P2V Neptune completes a historic flight from New Zealand.

Four planes successfully made the 2,400-mile non-stop hop on December 20, 1955, after *Glacier* had raced ahead to pick a landing site. Two of them—Navy R5D Skymasters—were the first four-engine planes ever used on the south polar continent.

he had neither instruments nor shelter adequate for treatment of his patients.

One of the task force ships had to be summoned. But the camp radio at Hut Point failed to contact the ships at sea.

Commander Ebbe checked his big planes. One Skymaster had about an hour and a half's gas left. (Until a tanker arrived, it was impossible to refuel the planes.)

Radiogram Goes Long Way Round

"Get up there," Commander Ebbe ordered its crew, "and try to contact an icebreaker."

No luck. So the pilot climbed to 10,000 feet, his gasoline rapidly dwindling, and raised a commercial radio station 2,800 miles away in Auckland, New Zealand. When he landed, his plane's tanks held only 30 minutes of fuel.

The Auckland station alerted the ships. *Edisto*, outbound from McMurdo, "did a one-eighty," turned up flank speed, and raced to the crash scene.

When *Edisto* reached the ice on Christmas Eve, 50-knot winds canceled out the take-off of the rescue helicopter. Thirty-three hours ticked away with exasperating slowness before the pilots, Lt. Comdr. Charles Costanza and Lt. (jg.) John Bacon, whirred up to Hut Point and picked up the crash victims.

In the air again, the "choppers" plunged into whiteout conditions, the dread of polar flyers, when ground, sky, and horizon all are lost in a milky haze.

"I felt like a fly trapped inside a ping-pong ball," said Jack Bacon.

But the helpless passengers were safely delivered to *Edisto's* warm sick bay.

Christmas at sea was a day of worship and feasting. I was invited to eat Christmas dinner with the crew and enjoyed talking with these fine Navy men.

To *Glacier* from *Arneb* came a message by blinker light: "Radar contact friendly sleigh drawn by eight reindeer led by Rudolph piloted by Kris bearing zero zero zero and flashing continuously 'Merry Christmas.'"

Bound now for Little America, *Glacier* cruised along the face of the fabulous Ross Ice Shelf, or Barrier. This fortresslike white cliff is the seaward edge of a sheet of glacial ice as big as California (page 148).

The Shelf is an amazing feature, a striking example of Antarctica's "living Ice Age." Fed by glaciers pouring into Ross Sea from the continental uplands, it also grows by the deposit of fresh snow on its surface.

Recent dramatic changes in the ice front became evident when we compared the *Glacier's* carefully plotted positions with the Barrier face as charted in 1947. Between Little America and a point in longitude 178° E, a chunk of ice about 200 miles long and 10 miles wide had broken off, a piece as big as Delaware.

I asked Dr. Siple, an expert on puzzles of the Barrier, his opinion on how this happened.

"Probably at quite long intervals—perhaps decades," he explained, "the right combination of tides, storms, and waves, prolonged snowfalls, or perhaps even a cataclysm like an earthquake, must cause multiple breaks along the whole Barrier edge."

Back to Little America

Very early on the clear, cold morning of December 28 we raised the Bay of Whales. Soon, through binoculars, appeared the tips of radio towers and poles of Little America, deserted since 1947.

At 4 a.m. a helicopter lifted me off *Glacier's* flight deck for a look at the few square miles of ice that have such special meaning for me.

As we fluttered comfortably along, my mind flew back to a scene of sweat and strain that was acted out in this very setting 28 years ago. Vividly I saw in memory the grunting, heaving line of men and dogs that hauled our Ford trimotor plane, its wings removed, five uphill miles across the ice to our first Little America camp.

We buzzed Little America III and IV, where radio poles and tents protruded from the snow, and then alighted at Little America

← A Batter Aims at Lofty Mount Erebus

Softball on McMurdo ice makes home seem not so far away on New Year's Day. Under the antarctic summer sun, temperatures sometimes rose higher than on the same days in New York City.





Blizzard-beaten Camps of Antarctic Pioneers See Life Again

Three half-century-old huts cling to the black lava shores of Ross Island as monuments to men who dared break the way to the South Pole.

◀ Britain's Capt. Robert Scott built this camp on Cape Evans in January, 1911. Racing Roald Amundsen for the Pole, he set out southward November 1, never to return (page 175).

Deepfreeze work teams sampled some of the food supplies left by Scott and by Shackleton's Ross Sea party in 1915-16. They tasted English cocoa and curried rabbit, still perfectly preserved.

National Geographic photographer Jack Fletcher (right) looks upslope toward Scott's main supply dump and the South Pole 850 miles beyond.

◀ Page 154, below: From this hut on Cape Royds, Sir Ernest Shackleton's 1907-9 expedition climbed Mount Erebus and pioneered a route to within 97 miles of the Pole.

Whistling winds, sun, and rocky terrain keep this spot clear of snow.

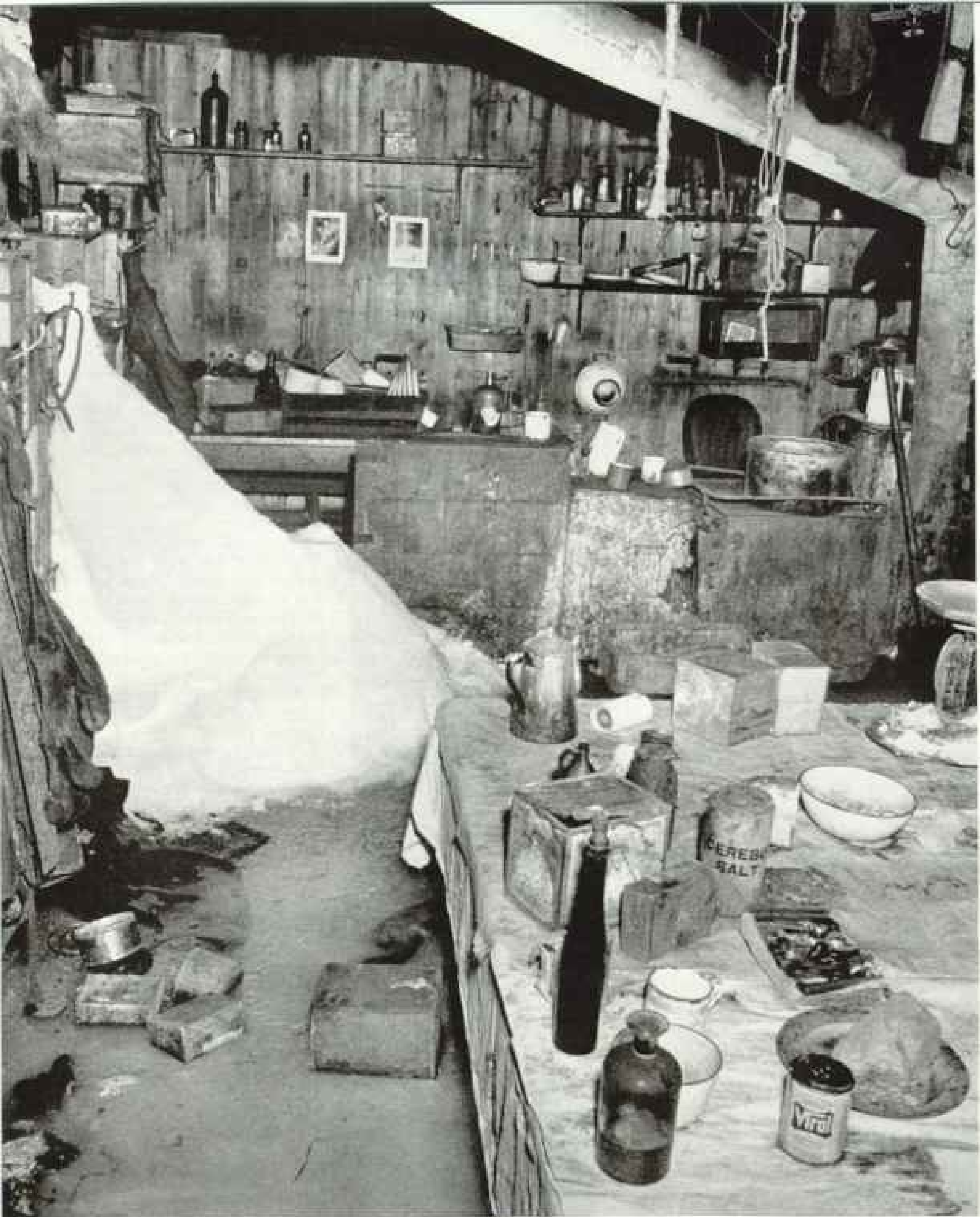
▼ On Hut Point, at Scott's 1902 base, Admiral Byrd (left) inspects a pickaxe found lying outside the snow-filled building.

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Ghostly Cabin Filled with Frozen History Waits for Explorers to Finish a Last Meal

Capt. Robert Scott built the hut on Cape Evans in 1911. Last men to occupy it were seven survivors of Sir Ernest Shackleton's Ross Sea party. Shackleton came to their rescue in January, 1917, with the ship *Aurora*. Sailing home, he wrote, "I had the hut put in order and locked up." Thirty-nine years later shore parties from Operation Deepfreeze were forbidden to enter, but photographer Fletcher aimed camera and flash into the gloom through a broken windowpane and shot a series of pictures. This dramatic view developed, showing the table's wine, bread, and cheese perfectly preserved by Antarctica's natural icebox. A pot stands on the stove ready for cooking. King George V and Queen Mary appear on the wall in precoronation portraits. Snow, choking all but this room, drifts through a chink. This year's visitors sealed the cabin as a memorial to Scott and Shackleton,

I and II. There, above the surface, still project three wooden antenna poles and the tops of two steel radio towers, about 10 feet of one and 8 of the other.

Old friends from former expeditions had flown in, too. We raised the American flag and I reminisced a bit (page 146).

"It's great to get back here, with about 10 buildings of my first two camps right under my feet. They're likely to be there for a long time to come, locked away tighter than a mummy in a pyramid, but their contents still well preserved and available if needed. . . .

"You know, these radio towers were 70 feet tall when we put 'em up in 1929. When we came back in 1934, the first base was completely buried. We just put the second one down right on top of it."

A knife-edge wind sliced in from the south across 400 miles of unbroken ice. The temperature was four or five below zero. White snakes of ground drift hissed across the snow. And this was midsummer!

Towers and poles only accented the abandoned feel of the place. The men, wandering about in their bright parkas, seemed like bewildered visitors from another world.

In relays we hopped back to the ship, hungry both for warmth and for breakfast.

Old Site Ruled Out

It seemed doubtful whether it was worth while to try to establish our new base in the Bay of Whales. Sometime between 1948 and 1954 the ice cap enclosing the once bottle-shaped bay had broken out. In most places sheer white cliffs precluded putting ships' cargo on top of the Barrier. I felt certain we would find better locations to the eastward.

In Kainan Bay, 30 miles northeast, Paul Siple found the right combination: bay ice for unloading, gently sloping snow ramp to the Barrier summit, and a ridge of Shelf ice to support the buildings and give their tenants a view over Kainan Bay and the Ross Sea (page 166).

Glacier broke out an ice harbor 1,000 yards wide and 1,200 long. The supply ships *Arneb* and *Greenville Victory* tied up and began discharging cargo. From *Greenville Victory* Capt. Stevan Mandarich, USN, came aboard *Glacier* to join me as my chief of staff.

Probing showed up many ice cracks and crevasses along the five-mile route between open water and base site. Most were drifted over with snow, but one crevasse was a gap-

ing turquoise slit 60 feet deep and 25 to 30 feet across.

Under Army Warrant Officer Sikas Bowling, with years of experience bridging crevasses on the Greenland Icecap, Seabee teams spanned bay ice cracks with aluminum bridges that could support 70 tons. They dynamited crevasses in the Barrier fringe. Drivers brought up 35-ton D-8 tractors rigged with bulldozer blades and shoved hundreds of tons of snow into the beautiful but treacherous mantraps there and farther inland (page 180).

Within ten days of the first landing, tractor trains already had delivered hundreds of tons of construction materials to the base site and to a temporary dump on the bay ice.

Shore Parties Greet 1956

The ships celebrated New Year's Eve with gala shore parties. Colored flares flamed wanly in full daylight. Men wearing tissue-paper hats and false noses chanted, with monotonous logic, "We're here because we're here, because we're here because we're here!"

On January 4, 1956, I joined Admiral Dufek in the formal dedication of Little America V. Here would arise 17 bright orange buildings, chief structures of the 73-man base (pages 166 and 168).

On the way to the flag-raising ceremony, my Sno-Cat broke down and Amory ("Bud") Waite, Army Signal Corps representative, picked me up in one of his weasels. Bud was one of three men who saved my life in 1934, rescuing me from my solo vigil 123 miles by trail inland from Little America after I had been badly poisoned by carbon monoxide fumes.

During Deepfreeze I, Bud Waite made valuable studies of radio wave propagation in snow and ice. He confirmed that snow, unlike water, won't short-circuit a copper antenna wire laid across its surface.

In the snow, Waite and his men dug two pits 20 feet deep and a mile apart. Even with very low-power equipment, they were able to talk easily by radio through the intervening barrier of hard-packed snow.

In his "cosmic ray shack" on *Arneb*, Rochus E. Vogt, of the Enrico Fermi Institute for Nuclear Studies of the University of Chicago, kept busy mapping the force of the earth's magnetic field and taking fixes on the geomagnetic equator in outer space. He did this by interpreting the influence of the earth's magnetic field on cosmic rays.



Adélie Penguins Leap from Beneath the Ice Like Porpoises in Boiled Shirts

Clown princes of their frozen kingdom, Adélies rollick at ice edge like boisterous children. Inordinately curious, they scolded Deepfreeze ships, craned necks at man's odd labors, and waddled into sailors' softball games. A skua gull perches on the ice; his kind regularly steal penguin eggs and newly hatched young.

Vogt's dozen cosmic ray counters, embedded in paraffin and separated by massive lead blocks, received the cosmic radiation produced by high-energy particles. *Arneb's* route in antarctic waters, and bound to and from them, allowed Vogt to make tangent readings that accurately located the geomagnetic equator. Knowledge of the geomagnetic field in outer space, among other values, is useful for precise aiming of ballistic missiles.

Other scientists pursued their researches in many fields. Ornithologist Austin banded thousands of penguins, and one of the hydrographers dredged up a sea worm 30 feet long.

"Heat Wave" Brings Crisis

After *Glacier* left to return to McMurdo Sound early in January, there arose at Little America V a major emergency. Later I heard the story from Comdr. V. L. Pendergraft, Task Force Air Operations Officer.

"To speed off-loading, we took a chance on setting up that big supply dump you saw growing on the Kainan Bay ice close to the Barrier," he said. "As fast as equipment came out of *Arneb* and *Greenville Victory*, tractor trains hauled it to the halfway dump. Seabees piled up the stuff by the hundreds and hundreds of tons, despite the calculated risk involved in trusting it to the bay ice.

"Then an antarctic 'heat wave' moved in. Temperatures rose to the freezing point.

"On January 7 surveyor Frank Biba, sighting through his theodolite, saw the ice edge heaving up and down. What if everything we'd off-loaded—supplies, tractors, Sno-Cats, aircraft—were lost to Davy Jones?"

"Admiral Dufek, against the advice of some, at once ordered every box, crate, drum, and bundle in the supply dump moved to the base site on the Barrier within 48 hours. By now the ice the surveyor had seen quaking was nothing but a jumble of tossing ice cakes."

All hands turned to, many spurred by the danger of losing the means of their survival over the long antarctic winter to come. A day and a half of fierce exertion—and every stick of equipment was safely relocated on the Shelf ice.

In a howling storm of blowing snow, vehicles and loose equipment near the ice edge were hauled back aboard ship (page 164).

Within hours after the move, wind and seas licked Kainan Bay clean of the last bay ice. The natural float that had supported the supply dump was entirely gone.

McMurdo Ice Claims a Life

The ships moved in and tied up to the face of the Barrier at a low point almost at deck level (page 162). Officers and men, the crisis weathered, were wiser for their experience. Moral: Young bay ice is fickle stuff, never to be trusted.

Hardly had *Glacier* returned to McMurdo Sound when a man died almost within sight of our decks: Seabee Construction Driver 3d Class Richard T. Williams, of Ilion, New York, had just jockeyed his 28-ton D-8 tractor across a bridged crack in the bay ice opposite Cape Royds and moved on about 20 feet when the ice suddenly split all around it.

The metal monster slid out of sight, and driver Williams with it. The water was 100 fathoms deep. There was nothing anybody could do.

Later the new Navy airbase in McMurdo Sound was named Williams Air Operating Facility in honor of this faithful young Seabee.

In happy contrast to this tragedy was the safe completion of the aerial exploration program. In 10 spectacular flights from the McMurdo Sound ice, between January 3 and January 14, U. S. Navy long-range planes of Air Development Squadron Six observed approximately 800,000 square miles of Antarctica previously unseen by human eyes. That means more than a fourth as much territory as there is in all the United States.

A series of short, preliminary flight-familiarization hops was called by the pilots "fright-familiarization."

The air tracks of the two Skymasters and two Neptunes fanned out across the heartland of the continent. Four of the flights crossed the South Pole.

Jack Fletcher, National Geographic photographer, had the distinction of taking part in a flight that found the highest area yet discovered on the white glacial dome of Ant-

arctica's hinterland. An area near latitude 82° S. and longitude 55° E. humped up to about 14,000 feet (map, page 147).

I had expected to find this high land because of the furious and continuous south winds that ships and land parties have bowed before on the Adélie Coast of Wilkes Land. Nevertheless, this discovery was a most worth-while geographic find.

The Australian, Sir Douglas Mawson, a great scientist and my good friend, as long ago as 1912 reported 90-mile winds blowing there for days, with gusts hitting 200 miles per hour. Other explorers confirmed these gales, which revealed a sharp contrast with the situation at Little America. There 14 mph was the average for the windiest month, and 75 mph was the strongest recorded wind.

Ice Dome Helps Solve Wind Mystery

From the observations of the various plane crews Siple deduced that a shallow trough lies between the tall mountains of Victoria Land, some of which reach up to 15,000 feet, and the high dome found by our planes in central "East Antarctica."

Sloping down evenly from near the South Pole toward the Adélie Coast, this wind chute spills out cold air from the ice plateau. Gaining speed from the pull of gravity as it pours downhill, the air reaches the sea as a screaming antarctic gale.

Saul Pett, Associated Press correspondent, became the first newspaperman to fly over the South Pole. Pett won local fame for his lively sense of humor. Once, sharing with other cor-

An Antarctic Ambassador Erupts from the Depths

Black-and-white Adelles pop comically from water to ice with the suddenness of watermelon seeds squeezed from fingers, yet maintain an erect stance worthy of a diplomat in full dress. They size up the ice edge from 20 to 30 feet away, rush at it under water, and shoot up to land feet first on the snow.

John E. Fincher, National Geographic Staff



respondents a temporary drop in morale. Pett suggested, "Let's go out on the ice and build snowwomen."

The summer's first transcontinental sweep was a 3,000-mile flight across Wilkes Land to the Knox Coast and back. The plane swung within distant view of the area where, a few days later, the Russian IGY expedition began setting up its Mirny Base. Other flights crossed areas where the U.S.S.R. plans to build inland bases.

"SOS, SOS, SOS!" brought the air operations room aboard the *Wyandot* to tense alert in the late evening of January 6. The distress call came from Lt. Comdr. Joe Entrikin. His Neptune was 1,200 miles out from McMurdo.

Entrikin reported his starboard engine failing. Power output was wavering as revolutions per minute fluctuated wildly. The crew jettisoned bomb bay fuel tanks and stripped the airplane of everything but essential radio and survival gear.

What a relief when radar spotted the cripple 100 miles away, staggering in over the 10,000-foot mountains west of McMurdo Sound!

Ten minutes from the airstrip, the starboard engine failed completely. But the pilots made a perfect single-engine landing.

No wonder crews sometimes referred to these hazardous air journeys as "long-range missions"!

The aerial survey program ended with a tremendous transcontinental effort in which "Trigger" Hawkes and his teammates flew a Neptune from the Ross Sea to the Weddell Sea and back. The 3,200-mile trip was the longest flight yet made in Antarctica.

Third Time to the Pole

To me, of course, my own flight to the Pole—my third—stands out with special vividness.

We took off from McMurdo Sound, and our first goal was the so-called "area of inaccessibility," the heart of the United States-size section of "East Antarctica" that, until this year's survey flights, never had been seen by man. I also wanted to go to the South Pole to inspect the surface of the snow and névé there to get an idea of what conditions may be found by the plane, or planes, that will have to land the Pole Station construction personnel this fall.

With me rode Paul Siple, who has been asked to take charge of the U. S. base to be built at the Pole.

During the long flight we kept checking the navigator's headings with the same Bumstead sun compass we used in 1929. This simple but ingenious device was invented by Albert H. Bumstead, first Chief Cartographer of the National Geographic Society.

At a point 20 minutes beyond 85° S. and 90° E. we began to ice up and flew into a thickening whiteout. So we headed for the Pole, the visibility improving en route. Each time I've approached the Pole from a different direction. This time we came in along the 90th meridian, east.

It's quite easy to find the Pole when the sun is visible. Using the periscopic sextant, we took a true south heading. From tables we knew the angle of declination of the sun south of the Equator at the Pole for the day, January 8. When the sextant showed the sun's altitude above the horizon equal to its declination, we would be over the Pole.

Plane Overshoots the Target

The trouble was that broken clouds interfered with our sun fixes, and we overshot the Pole by 17 minutes. But we promptly backtracked and soon hit our almost featureless target, hub of the vast flat snow field of the polar plateau.

Our altimeter reading, plus radar, confirmed the Pole's elevation at about 10,000 feet.

We circled the Pole three times, the first time any of us had made three round-the-world trips in 10 minutes. Naturally we kept crossing the international date line (180° east and west from Greenwich).

"How should we count this on per diem?" quipped Commander Ebbe, squadron CO along for the ride.

We dropped an American flag and a brown paper bag signed by all of us and stuffed into a piece of pipe. The crew chief threw out four pennies.

Pilots of other expedition aircraft had reported the Pole blanketed with snow so soft

(Continued on page 169)

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"Chopper SI" Lowers a Skyhook → for a Ship-to-air Pickup

Six Sikorsky helicopters gave Operation Deepfreeze unprecedented mobility, shuttling staff officers between ship and shore, delivering cargo, and serving icebreakers as lookouts.

This whirlybird hovers above icebreaker *Edisto's* landing platform to hoist canvas cargo bags.

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John E. Fletcher, National Geographic Staff





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↑ Gray Ships Moor to an Ice Wharf Carved in Kainan Bay

Admiral Byrd landed supplies for four previous Little America expeditions at the Bay of Whales, a natural bight in the Ross Ice Shelf, or Ross Barrier. Since 1948 a vast ice section has split away, taking with it a small part of Little America IV and leaving sheer ice ramparts.

For Little America V, icebreakers sought another landing spot with a gentle slope for hauling supplies to the Barrier top. They found it in Kainan Bay, 30 miles northeast of the Bay of Whales. With 21,000 horsepower behind its blunt nickel-steel bows, *Glacier* chopped a harbor in the 6- to 8-foot-thick ice apron.

Here *Arneb* (left) and *Greenville Victory* flank *Glacier*, carrying Little America's share of the 9,200 tons of supplies brought for U. S. antarctic bases. Unloading begins under a bright midnight sun. Sno-Cats and weasels scratch the first curving tracks across wind-streaked snow.

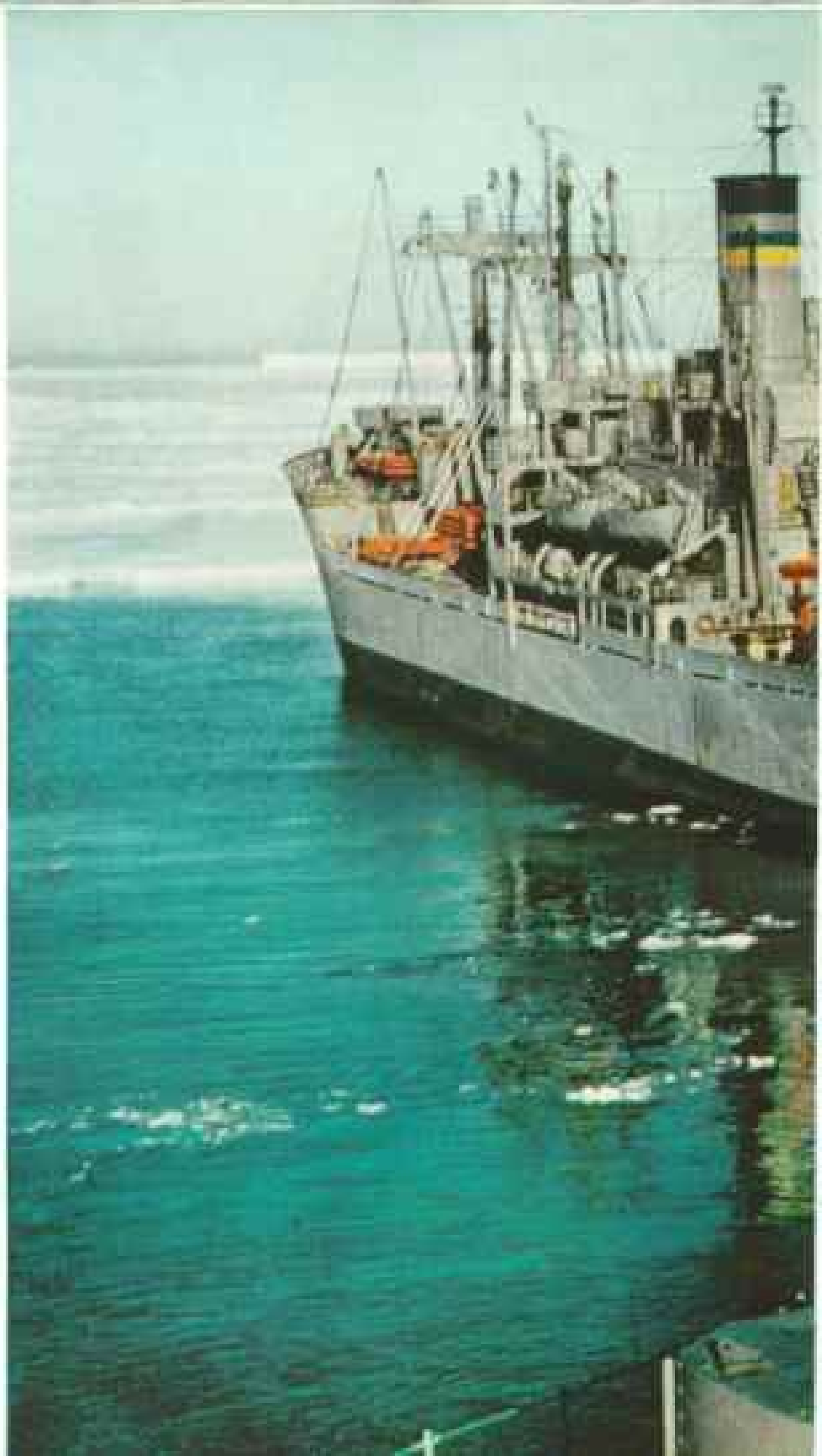
Ice floes drift seaward toward a double horizon formed by low-hanging clouds, their dark undersides reflecting the sea in a polar "water sky." Navigators in pack ice watch for such a sky to spot open water. A cotton-white overcast, or "ice blink," reveals snow-covered ice fields.

Two Miles of Bay Ice Pave the Way → to the Jutting Barrier Cliffs

Little America's first heavy equipment was unloaded with extreme caution, for the relatively thin ice of Kainan Bay floats over more than 1,000 feet of water. Before the work was finished, the ice broke up in a storm (page 164). Ships scurried to the safety of open water, then returned to tie up directly to a deck-high section of the Barrier.

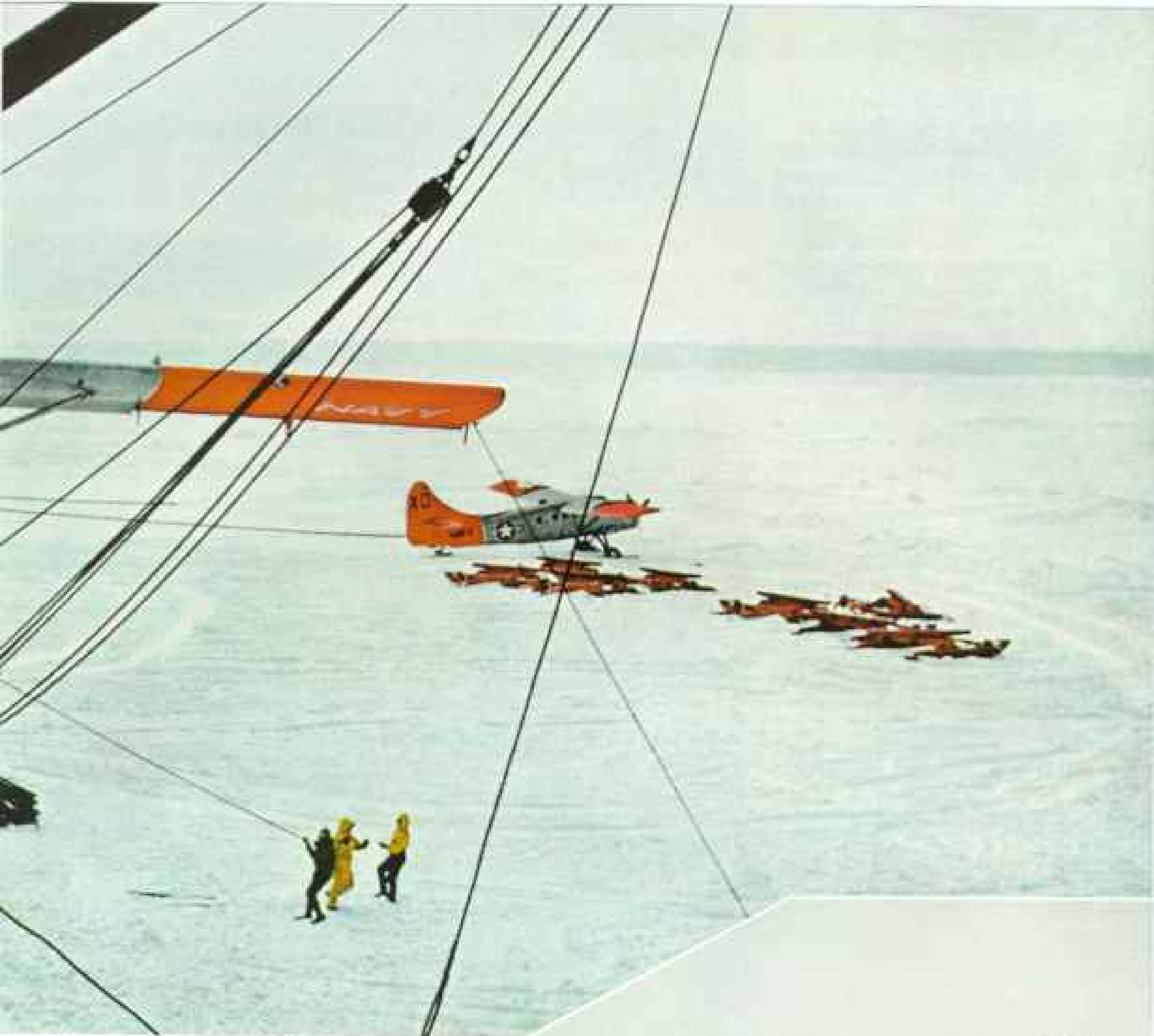
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Illustrations by Andrew H. Brown, National Geographic Staff









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↑ **Cargo Booms Swing Canadian Bush Planes into Antarctica**

Bad luck dogged the de Havilland Otters used in Operation Deepfreeze. One dropped when an unloading rig buckled, and another crashed taking off from McMurdo Sound. A third pancaked in soft snow on Edward VII Peninsula.

← **Lashed by a Snow-filled Gale, Crewmen Battle to Save Supplies**

Page 164: When cracking ice threatened a temporary supply dump on Kainan Bay, thousands of tons of gear were rushed to the Barrier. The last vehicles came back aboard ship just as the blizzard struck. Hours later wind and raging seas had swept the bay clean.

Cury-Lifts were jacks-of-all-work, hoisting heavy loads, stacking cargo, and shoveling snow.

→ Amid blowing snow a work gang struggles to lead out a line to a loaded cargo sled. Spate sled runners stand in the foreground.



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Andrew H. Brown and (lower right) John E. Fletcher,
National Geographic Staff

World's Southernmost Town Takes Shape at Little America V

The main U. S. antarctic base for scientific work in 1957-58 springs from a vast jumble of supplies. Navy Seabees erected bright orange cubicles in hours from prebuilt panels and girders.

For morale of a 73-man party left here to spend the antarctic winter, "L.A." stands on a slight rise overlooking Kainan Bay. Farther inland, only snow and sky meet the eye in every direction. Beyond a row of parked sleds, *Edisto* nudges the distant ice edge.

→Page 167, below: Visitors from *Edisto* stroll L.A.'s "Whitney Lane," named for Seabee Comdr. Herbert W. Whitney.

↓Stars and Stripes go up before construction begins. Side by side, Admiral Byrd (in caribou-skin suit) and Admiral Dufek salute.

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John E. Fletcher, National Geographic Staff, and (lower left) Cmdr. Vernon L. Penberg, USN,

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as to preclude a plane landing either on skis or on wheels. Our findings differed. We flew very low and concluded that the snow surface looked firm enough to land on. This was indicated by the crisscrossing and fan-tailed form of the sastrugi, or snowdrift pattern.

Our homeward flight track shadowed the route by which Captain Scott trekked back from the South Pole in 1912 and perished with his four companions.

What changes two generations had wrought! Where Scott and his ill-fated trail mates man-hauled heavy sleds, we rode past at three and a half miles a minute with the security of four engines and magical new electronic navigating equipment. Tea was served at intervals.

Inland Glaciers Have Shrunk

At the head of the majestic Beardmore Glacier, route of both Scott and Shackleton to the polar plateau, we found the mountains bare over broad areas. And from the upper Beardmore, blue ponds, completely ice-free, winked up at us. Many of the bowl-like mountain cirques were empty of ice.

Paul Siple agreed with me that these features gave evidence of slight glacial withdrawal—or at least snow starvation—in this area. Certainly glaciers here once had greater extent.

At 10:30 on the evening of January 8 we landed smoothly at the Hut Point airstrip. In 11 hours and 10 minutes we had flown 2,310 miles. I had never before made a polar flight under such comfortable conditions.

Apart from two ranges of mountains found west of the Victoria Land peaks, and other ranges discovered inland from the Weddell

Sea, our wide-reaching surveys brought to light no important new land features. What our eyes and aerial cameras mostly viewed was a relatively featureless waste of snow, level or gently tilted over the high heart of the continent, crevassed and splitting into glacial tongues at the margins.

By mid-January the four big aircraft had completed much of the work they came south to do. Furthermore, the frozen runways that had served so well were softening up and cracking. Besides, they lay in the path of unloading operations.

On January 18 the planes flew uneventfully back to New Zealand for further staging homeward to the United States.

Stubbornly the ice clung to McMurdo Sound, impeding week after week the transfer of materials for building the Air Operating Facility at Hut Point. This "Airofac" will be the staging base for installation next season of the South Pole scientific station. It also will support the Pole outpost throughout the IGY program.

But the return of *Glacier* changed the picture. Within two days the rugged ship ground out a 20-mile channel through hard 6-foot ice to within about 10 miles of Hut Point. Captain Maher handled the ship superbly.

Icebreakers as Cargo Ferries

This pathway, unfortunately, was jammed with ice rubble that would quickly put holes in the cargo ships' thin sides. By necessity the icebreakers became cargo ferries. At the edge of open water the freighters off-loaded onto the icebreakers' helicopter flight decks (the helicopters temporarily perching on the ice). *Glacier*, *Edisto*, and *Eastwind* took turns moving up "the slot," soon hacked out to within five miles of Hut Point. They boomed off their loads directly onto giant cargo sleds lined up on the ice.

"The toughest ice operation in polar history," Admiral Dufek called it.

Fortunately, as the summer waned, the bay ice kept breaking out. Once, within three days, McMurdo Sound sent to sea giant ice pans covering 350 square miles, an area as big as New York City.

All of us on board *Glacier* watched with awe as the ship smashed solid, unbroken ice. Against the sides great blue slabs heaved up on edge (page 170).

The undersides of the floes were spread with plankton, brown as peanut butter.

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Seabees Play Polar Dominoes on a Table of Snow and Ice

Deepfreeze huts, designed for 100°-below-zero temperatures and 100-mph winds, are refrigerators in reverse, keeping heat in and cold out. Skylights are the only windows at Little America. Winter blizzards will bury the base to the eaves, but furious winds will sweep flat roofs clear until, years from now, snow engulfs all. Silvery structure is an aluminum test building. Helicopter parks on the snow.

Before March storms struck, outside stores had to be carefully stacked and marked with flags. Eventually all supplies except fuel were placed indoors or in snow caverns branching from burlap-and-wire-walled tunnels connecting the buildings.



↑ **Smashing Through Ice Six Feet Thick, *Glacier* Batters Down Antarctica's Guard**

The 10-engined *Glacier* fulfills a motorist's dream for solving traffic jams: she backs off and charges headlong. Advancing a few yards, she shudders to a halt, retreats, and rams ahead again. In heaviest going, the ship's slanting bow slides up onto the ice, crushing it by the sheer weight of her 8,625 tons. Crewmen compare ice-breaking to riding a runaway bus over a hummocked, corkscrew road.

Here, forced off course by a stubborn stretch, *Glacier* plows a looping furrow up McMurdo Sound toward Hut Point. Thin-skinned cargo ships, moored far behind, could not come up the floe-choked channel. Icebreakers ferried supplies to waiting tractor trains. "The toughest ice operation in polar history," said Admiral Dufek.

→ Water and ice explode beneath *Edisto's* bows as the 6,500-ton breaker slams forward.

"During continuous daylight of the antarctic summer," Eddie Goodale, a polar veteran and an IGY representative on Deep-freeze, explained to the men, "dark-brown plankton, drawn by sunlight, accumulates on the underside of the bay and sea ice.

"The sun's rays easily penetrate the snow and ice. The plankton, absorbing the heat, concentrates warmth on the bottom of the ice. So, except in the warmest weather, ice melts more quickly there than on top. During the sunny period, therefore, ice that seems hard on the surface often is dangerously mushy underneath, ready to break up at the first strong wind."

After the middle of January the Hut Point base grew apace. When I flew up there early in February, I found a cluster of tight and spacious buildings perched proudly on a black

bluff overlooking the cape where Scott's storm-buffed 1902 cabin still stands (page 175).

Someone had put up a sign that read:

There's no place
Any place like this place
Anywhere near this place
So
This must be the place.

To the south rose Observation Hill. I could easily see on the peak the tall cross raised by Scott's expedition mates to commemorate their leader's conquest of the Pole and his tragic death with his trail companions.

In McMurdo Sound I transferred from *Glacier* successively to the cargo ships *Wyandot* and *Arneb*. The captains of these two vessels, respectively Capt. Lindsey Williamson and Capt. Lawrence W. Smythe, not only were the finest of skippers but also were won-

—John H. Flinn, *National Geographic Star*



derfully hospitable and considerate hosts.

From Little America, late in January, antarctic veteran Lt. Comdr. Jack Bursey and a six-man trail-blazing team headed across the inland ice in two Sno-Cats and a weasel. Their hoped-for destination was about 600 miles away at latitude 80° S., 120° W., the chosen site for the U. S. scientific outpost in Marie Byrd Land. But bad crevasses and engine trouble slowed the trail blazers and at last forced them to turn back 381 miles out.

An Otter aircraft had supported Bursey's party by laying down fuel caches. On February 3, while ferrying four members of the trail group back to Little America, the Otter failed to turn up.

Six days later, Lt. Don M. Sullivan, flying another Otter, spotted the smashed plane on a snowy mountainside in the Edward VII Peninsula near La Gorce Peak. But there were no men in sight.

The search plane couldn't land—the snow surface was too rough—so radioed the position and returned to Little America. A helicopter flew out and found tracks leading away from the crash scene. The "chopper" followed them and overtook the seven missing men 45 miles to the northwest.

Crash Victims Unhurt

None of the party had suffered anything worse than shock and scratches. The search Otter made rendezvous with the helicopter; between them the two aircraft evacuated the rescued men to Little America. It was miraculous that no one was hurt.

Their story: "We'd swung north of our course to duck bad weather. Ran into clouds, whiteout, and freezing drizzle. The plane iced up fast. We couldn't hold altitude and mushed, nose up, into the mountainside without ever seeing it till we hit."

They had broken out tents and dug into the snow. With food and fuel they were comfortable enough. On the fourth day they took off on foot toward Little America. They knew their exact position and figured they had enough food at least to reach Okuma Bay, where seals could be killed.

It was on the inland ice also that Antarctica struck one more fatal blow as the bitter autumn settled in. Construction Driver Max R. Kiel of Joseph, Oregon, was using his D-8 tractor to shove snow into an ice chasm to fill it up and thus make a bridge, when his vehicle plunged through another crevasse, hid-

den and unsuspected. So deep was the crevasse that neither the body nor the vehicle could be recovered.

Early in February I left Antarctica, returning to New Zealand on *Arneb* and continuing home by sea and air.

By the end of March all ships had left the Ross Sea area. Behind, 93 men remained at McMurdo Sound and 73 at Little America. These groups would spend the long antarctic winter getting ready to build the South Pole and Marie Byrd Land bases, work that will begin late in 1956, weeks before ships can reach Antarctica.

In March, Admiral Dufek led *Glacier* on a notable survey cruise halfway around the frozen continent. The purpose of the voyage was to find sites for two additional IGY scientific bases on the coast of Antarctica.

Site Found for New Base

Bucking the wretched weather of the antarctic fall, *Glacier's* survey teams picked one base site on the Knox Coast, at the Windmill Islands in Vincennes Bay.

Inland from this shore reaches out the vast expanse of Wilkes Land, named in honor of Charles Wilkes. As a young lieutenant, Wilkes led an American exploring expedition that skirted this coast in 1840. It was Wilkes, in fact, who first recognized that Antarctica probably was a great continent.

Admiral Dufek intended also to locate another base site near Gould Bay in the Weddell Sea. So late in the season this place could not be reached, although a party got ashore at Byrd Bay in Queen Maud Land.

Having fully proved her worth on a difficult maiden voyage, *Glacier* at last departed antarctic waters on March 30.

I hope this brief narrative has made it evident that the field tasks of Operation Deep-freeze were a cooperative effort of 1,800 well-trained men and officers.

On any large-scale expedition, and particularly where the scene of action is so hostile as Antarctica, success depends on efficient day-to-day fulfillment of responsibilities, including many that may at the time seem trivial. The over-all supervisory role which I held freed me from most operational detail.

The attainment of most of the goals set before Task Force 43 reflects great honor on the United States Navy. It is a tribute, too, to all the officers and men who took part in the expedition.



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John E. Fletcher, National Geographic Staff

⤴ **Restless Seas Gnaw the Barrier
at a Continent's Icy Rim**

Wind, wave, and summer storm have swept sea ice from Kainan Bay. A ghostly veil of snow blows from the jagged face of the Ross Ice Shelf. Pushed by antarctic glaciers, the California-sized ice sheet here creeps seaward more than four feet a day.

⤵ **Afloat in Near-freezing Waters,
Swimmers Test Polar Rescue Suits**

Navy volunteers Kenneth S. Meyer (left) and Roland R. Robichaud tread 29° F. water in McMurdo Sound, only 1.5° above sea water's freezing point. Survival suits of rubber and cotton over waffle-weave cotton longies keep the men surprisingly warm.







↑ Snow Tractor Grows Uphill to Hut Point Supply Dump

Williams Air Operating Facility, huddled on Ross Island's southern tip, was named for a Seabee lost when his tractor broke through ice into 600 feet of water.

McMurdo Sound's thick ice (background) will provide runways for the heaviest planes.

Atop Observation Hill (left) stands a wooden cross in memory of Captain Scott and four companions who died in March, 1912, while returning from the Pole. Carved on its staff are the oft-quoted words from Tennyson's *Ulysses*: "To strive, to seek, to find, and not to yield."

← Giant melter, heated by diesel exhaust, hot antifreeze, and hot air, turns snow to water at 100 gallons an hour.

→ Windows are usable in prefab buildings at wind-swept Hut Point. Four-inch-thick panels are plywood and aluminum sandwiches filled with Fiberglas.

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Photographs by Andrew H. Dunn,
National Geographic Staff





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↑ Pilots Chart a Flight Beyond the Pole

On 10 survey sweeps by Deepfreeze planes, men saw for the first time some 800,000 square miles of unknown territory—a sixth of Antarctica. Comdr. Henry P. Jorda (left), pilot of the Navy R5D, confers with squadron leader Comdr. Gordon K. Ebbe on a 2,545-mile flight over the "area of inaccessibility," Antarctica's remotest region.

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John E. Fitcher, National Geographic Staff





↑ **Take-off Rockets
Spew an Icy Plume
Across McMurdo Sound.**

JATO boosters, hurling a Neptune skyward beneath Mount Erebus, leave a mile-long trail of frozen vapor, smoke, and snow. An engine faltered on the return of this flight over Wilkes Land toward the Knox Coast. Jettisoning loose gear, the Neptune barely limped over the high mountains west of McMurdo and glided home to a single-engine landing.

Foreground plane awaits refueling from a near-by tanker tied up to the bay ice.

↔ The flight into the area of inaccessibility, to the right of the South Pole viewed from the Ross Sea, crosses jagged peaks knifing through a flowing sea of snow and ice. Beyond, the bleak polar plateau rises gently toward its highest level yet discovered, roughly 14,000 feet.

Iron oxides tint the mountain flanks reddish brown. Layered strata slashing across the nearest slope are sedimentary deposits, probably sandstones.

John K. Fletcher and (above)
Andrew H. Brown, National
Geographic Staff





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↑ **Decks Rimed with Ice,
Glacier Noses Against the Barrier**

In a cold, cutting February wind the icebreaker returns to Little America's frozen waterfront. Crewmen on the forecastle chop away a thick sheath of frozen sleet and spray on exposed lines and fittings. A mooring team linked by a safety line goes out on the ice. Flags stuck in the snow mark crevasses.

← A line-handling gang walks out the heavy wire mooring cable to a "deadman" of stout timber which has been frozen solid into the ice. In an emergency the mooring line can be freed quickly by knocking loose a wooden toggle.

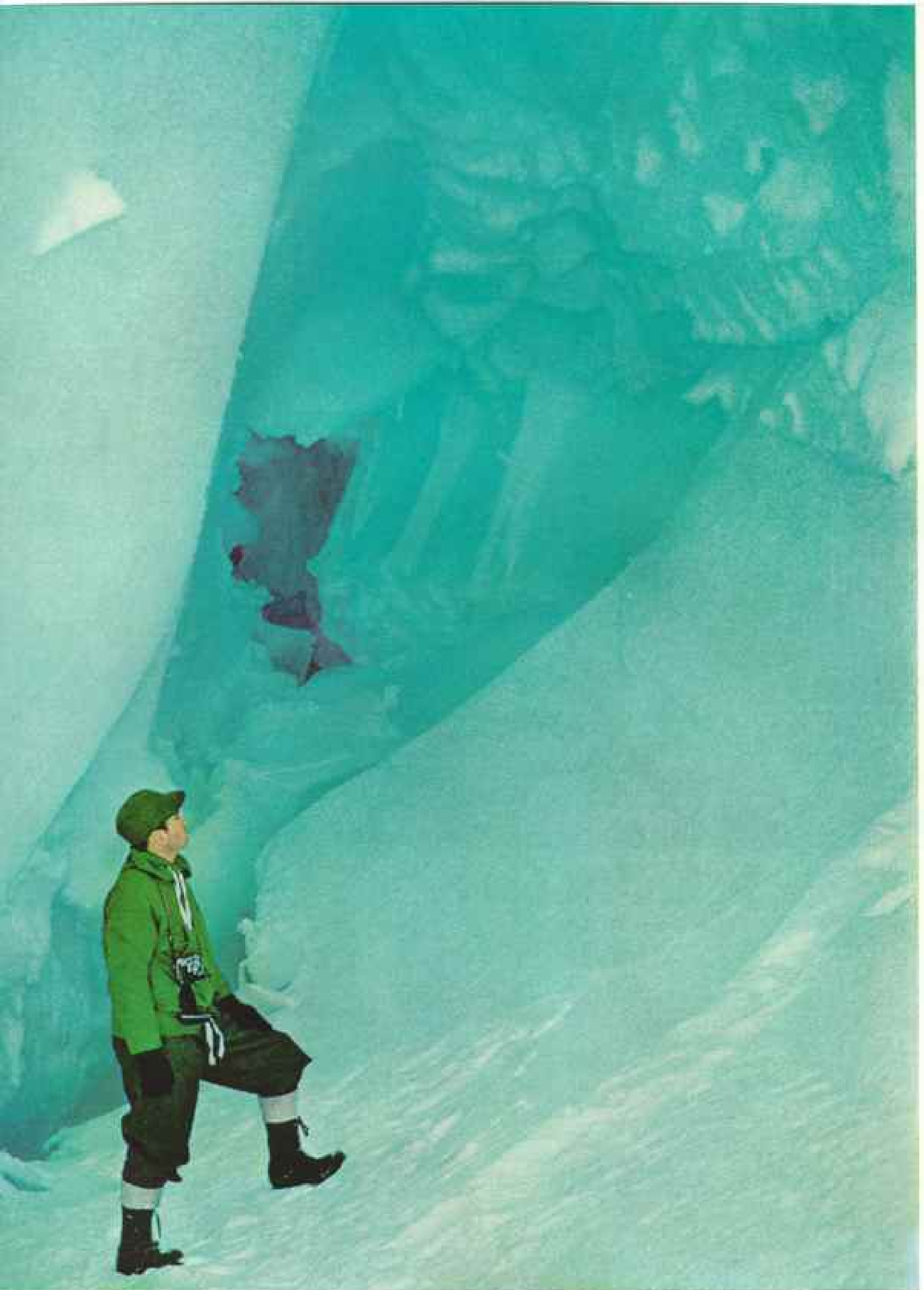
After gun turrets straddling *Glacier's* flight deck are pointed forward to prevent guns from fouling helicopters. The ship's five-inch guns fired star shells to signal the fleet's rendezvous point when murky weather dimmed visibility and icebergs cluttered radarscopes.

→ Bundled in cold-weather gear, a sailor swings a wooden mallet to knock a six-inch crust of ice from the anchor chain.

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Andrew H. Brown and (right) John E. Fletcher,
National Geographic Staff





Icy Jaws of a Snow-bridged Crevasse Could Swallow Man or Tractor Train

Between sea edge and Little America V lay a fissured dip in the Barrier surface dubbed "Crevasse Valley." Treacherous snow bridges had to be dynamited and the gorges bulldozed full of snow.

A Rising Tide of People and Prosperity Has Changed Many Things in the City by the Golden Gate, but Not Its Love of Life

BY FRANC SHOR

Assistant Editor, National Geographic Magazine

With Illustrations by National Geographic Staff Photographer David S. Boyer

WHEN I was a young newspaperman in San Francisco, I thought it was the most wonderful city in the world.

Then World War II took me away, and during the next 15 years I traveled from Peiping to Paris, from Buenos Aires to Bern, from Isfahan to storied Kandahar and Kabul. I returned with a new basis of comparison—and found that to me San Francisco is still the most wonderful city in the world.

Why? Partly it's a matter of vitality. You feel it in the very air, in the salty breeze from the Pacific; you feel it in the fog, too, and the long call of the foghorns, and the ships groping in beneath the great bridges. There's a lift to the spirit in the sight of the soaring spans themselves; surely no metropolis ever rose in more spectacular fashion to surmount the challenge of a tremendous water hazard.

Like Rome, Enthroned on Hills

This happy marriage of geography and people welcomes comparison and thrives on it. The lusty dance-hall personality of gold rush days has become, Pygmalion-like, a cultured, sparkling beauty. Serene and proud on her fabled hills, San Francisco today casts her queenly charm over natives and newcomers alike.

I was, I hasten to make clear, only an adopted San Franciscan. But so are the city's mayor, the president of its biggest bank, its leading criminal lawyer, and the two most famous columnists. Native sons regard being born elsewhere as simply bad luck, and choice of their city for a residence as proof of good judgment.

My wife Jean had never seen the city, so I chose our entry carefully. The first view of a city is important. We drove into San Francisco at twilight, the disappearing sun silhouetting the hills and skyscrapers in clear relief as we crossed the Bay Bridge from Oakland. Lights blinked on as we threaded the city's busy traffic (map, page 191).

I headed for the winding road up Twin

Peaks. Lookout Point was the perfect place to introduce Jean to my favorite city. There we watched the hills turn blue, then smoky gray, then black. The lights of Market Street traced a golden arrow to the Ferry Building at the harbor's edge.

The beauty of the city by the Golden Gate lay before us. There also was to be seen the reason for its existence. For San Francisco was born not only of the gold rush but also of the sea. When gold was gone, the harbor remained. On its commerce the Argonauts built their fortunes, their skyscrapers, and their future. Now we looked out across the easy spread of the Bay, at the brightly lighted vessels dotting its 18 miles of berthing space, and at Oakland and Berkeley on the far shore.

Toward us, up Market Street, came a solid stream of headlights. Up the approaches to the Bay Bridge and the Bayshore Freeway unrolled another golden ribbon of commuters, hurrying home to the East Bay and to San Mateo County.

As darkness fell, the tide of moving lights ebbed. Multicolored neon signs flashed rainbow invitations.

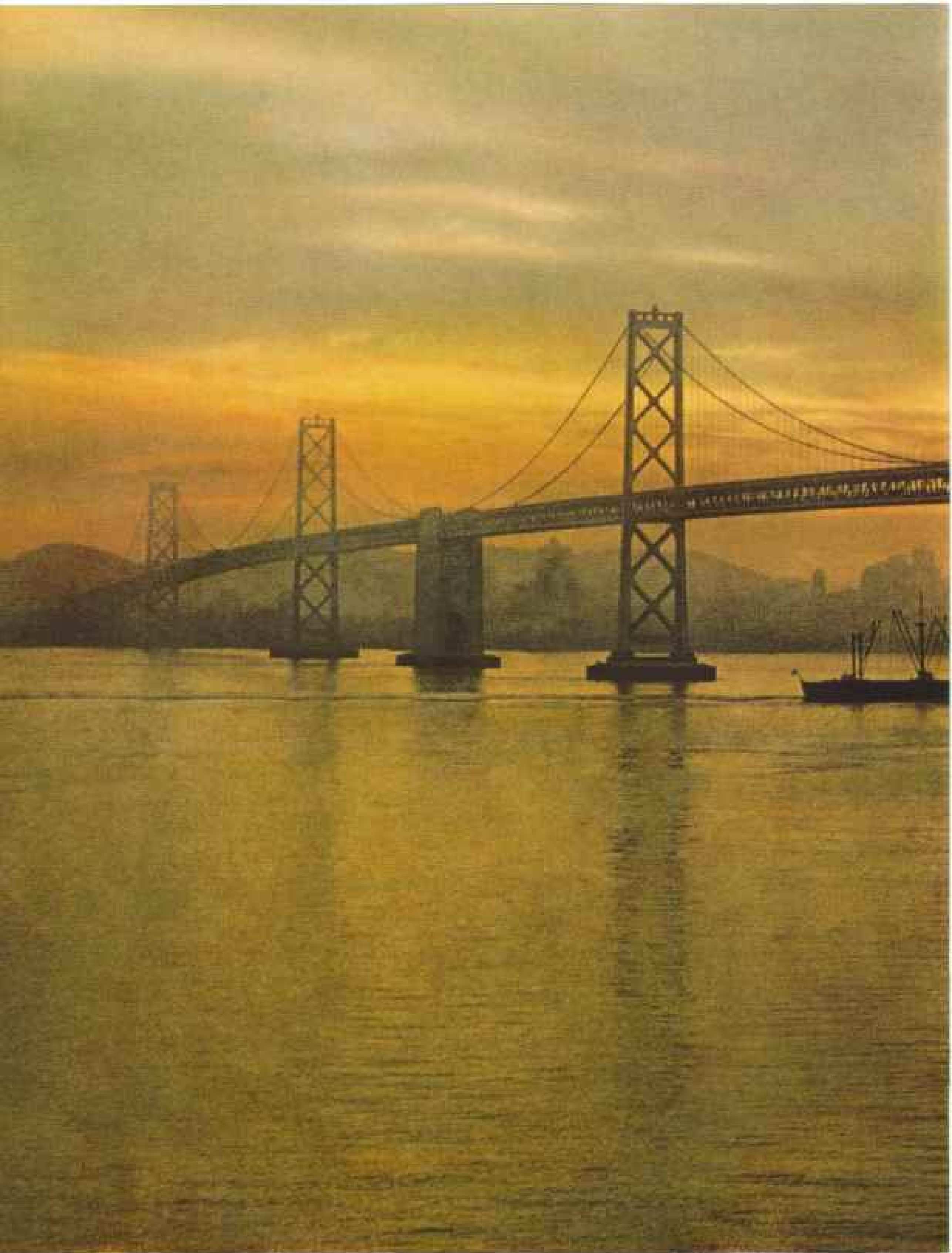
"Look!" cried Jean suddenly. "The headlights are going the other way now."

They were. The residents of the bedroom areas were driving into the city for dinner in its famous restaurants and an evening in theaters and night clubs.

City Reaches Out for Living Space

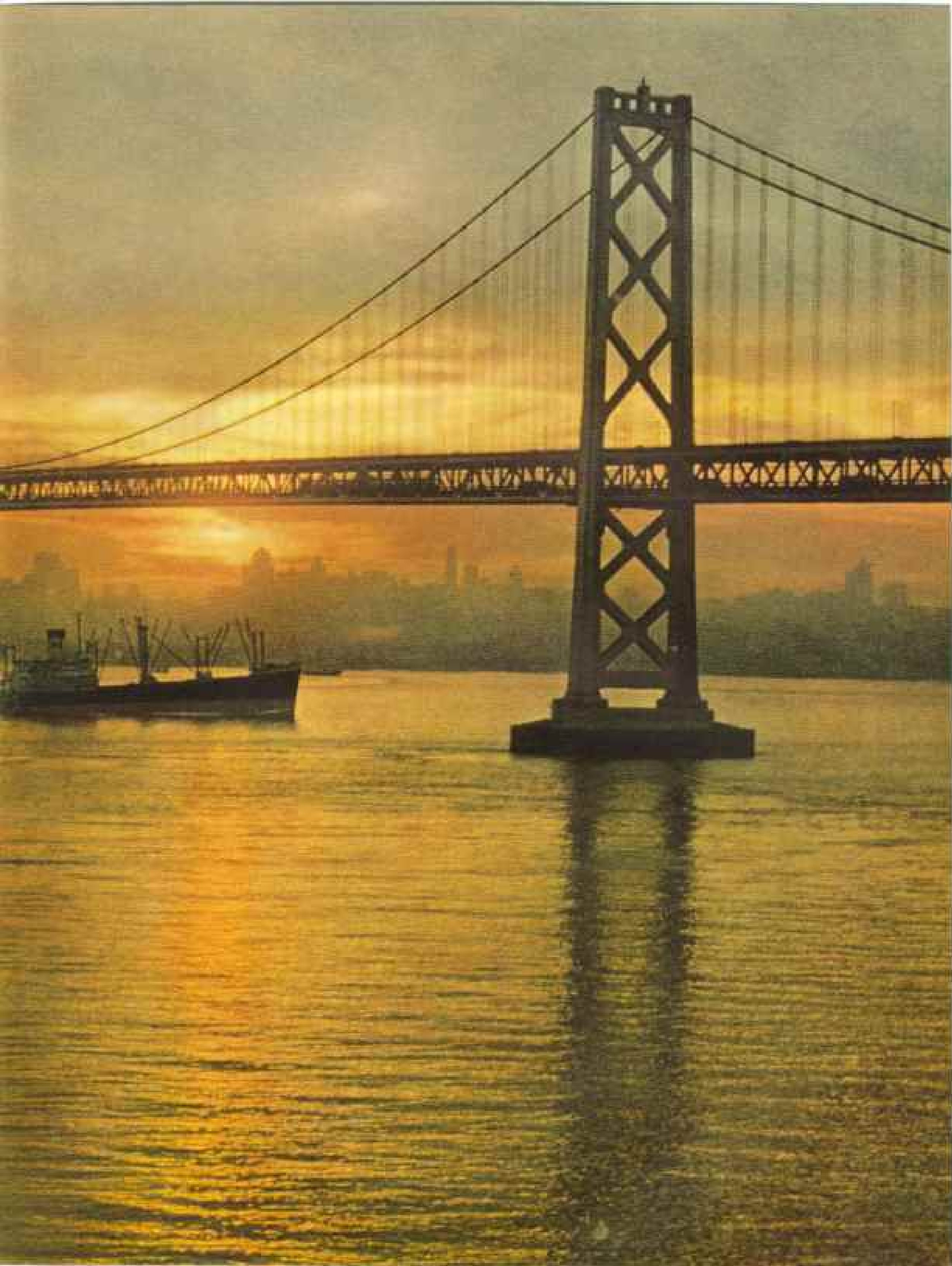
The two directions those headlights traveled told part of the story of present-day San Francisco. Balked in its expansion by the sea, which washes it on three sides, the city has turned to its surrounding counties for living room. There its workers build ranch houses with sun-swept patios. And the city, in return, provides office space and busy stores and a world financial center, plus a focus of entertainment.

This happy exchange has resulted in a boom that has altered many things about San Fran-



Shrouded in Golden Mist, San Francisco Appears as Beautiful and Remote as a Dream

Fifty years ago the metropolis lay in ruins, gasping for life after less than a minute of earthquake and three days of holocaust. Today the "City That Was" ranks as a major port and financial center of the western United States; it is home to some 800,000 and hub to more than 2,200,000 others within the Bay Area. A potpourri of nationalities, a playground of countless moods, hospitable San Francisco is aptly called "Baghdad by the Bay."



Eight Miles of Steel Leap the Inland Sea Known as San Francisco Bay

One of the seven wonders of American engineering, the San Francisco-Oakland Bay Bridge carries six lanes of automobile traffic on its upper deck, three lanes of trucks and buses and two train tracks below. An average of 91,000 vehicles cross it daily. Ships arrive and depart the landlocked harbor at the rate of one an hour. The city offers 18 miles of berthing, some deep enough for the largest vessels afloat. This freighter heads seaward.

cisco, but not its beauty or its character. Neither boom nor bust nor earthquake nor fire, and San Francisco has known them all, has been able to do that.*

Suddenly, from out upon the Bay, came the sonorous notes of a foghorn. Then another, and another. From over the hills behind us drifted the wispy fingers of white, reaching out to envelop the city. We hurried on to our Huntington Hotel apartment on Nob Hill. Outside our windows the blanket spread, the lights seemed to dim, and San Francisco took on the other-worldly aspect in which I love it best. This was my city as I had hoped to introduce it to my wife.

For weeks Jean and I toured the city, renewing old acquaintances for me, making new ones for her. Mostly we went on foot, for a good pair of legs will buy more entertainment in San Francisco than money can pay for in many cities. Here it is almost literally true that the best things in life are free.

We had only to step outside our door to see the Gothic spire of Grace Cathedral, first cathedral seat of the Protestant Episcopal Church in the United States. And across from us stood the massive brownstone home of the Pacific-Union Club, once the \$1,500,000 residence of James C. Flood, who made his millions in the fabulous Nevada Comstock Lode.

A Grassy Oasis in Mid-city

To visit Union Square, we walked down hills so steep that steps are cut into the sidewalk. In the small park fat pigeons begged for handouts, and office workers from near-by skyscrapers ate lunch on the welcoming grass (page 194). We sauntered through the busy streets adjoining the square, where the city's most fashionable shops are congregated, admiring their brilliant window displays and the smartly dressed women who passed through their doors.

I took Jean into Gump's, just off the square (page 197). Courtly Joseph Wheeler, who has been with the firm for nearly 50 of its 90 years, led us upstairs to the Jade Room. Spread before us was a collection of that precious mineral reputed to be one of the finest in the world.

Beautifully fashioned jade bowls, figurines, and carvings appeared in a bewildering multitude of colors. We might have been in Gump's yet if Jean had not casually asked the price of a pair of brilliant green urns which stood in a corner niche.

"Those bear the Imperial seal, Mrs. Shor," said Mr. Wheeler. "The price is \$11,000. That, of course, is for the pair."

"Of course," gulped Jean, and we went to lunch.

"Wall Street of the West"

Our way took us past Montgomery Street, a canyon stretched between skyscrapers which house one of the chief financial centers of the West. As we looked up its busy length, teeming with smartly dressed secretaries and brief-case-carrying brokers and lawyers, it was hard to credit the note made by Gen. William Tecumseh Sherman about its state in 1850:

"Montgomery Street had been filled up with brush and clay and I always dreaded to ride on horseback along it. . . . The rider was likely to be thrown and drowned in the mud."

For a special first-day treat we lunched in the sumptuous Garden Court of the Palace Hotel. (It is called the Sheraton-Palace today, but San Franciscans find it difficult to change.) It was pleasant to see old friends lunching at the same tables they occupied when last I ate there 15 years before. One, Lawrence Davies, the San Francisco correspondent of the *New York Times*, joined us.

Larry had been a newcomer to the city when I left, and I asked if he had grown fond of it.

"It didn't take me fifteen years to do that," he laughed. "It happened the first week I was here. I like the informality of the place."

"I represented the *Times* in Philadelphia for fifteen years. My headquarters were in a newspaper office there. The day I left, I went in to say goodbye to the editor. He looked

* See "New Rush to Golden California," by George W. Long, NATIONAL GEOGRAPHIC MAGAZINE, JUNE, 1934.

Chinese Maids Flash Smiles of Welcome → Beneath Their City's Towered Symbol

The Ferry Building, completed in 1896, was for many years the traveler's introduction to San Francisco. Before bridges spanned the Bay, as many as a million passengers a week streamed off and on the ferries docking here.

Today the building provides office and display space for the Bay Area's World Trade Center, where foreign and domestic importers and exporters meet to buy and sell.

Majorettes of the St. Mary's Catholic Chinese Mission's Girls Drum Corps lend international flavor to civic parades and celebrations.





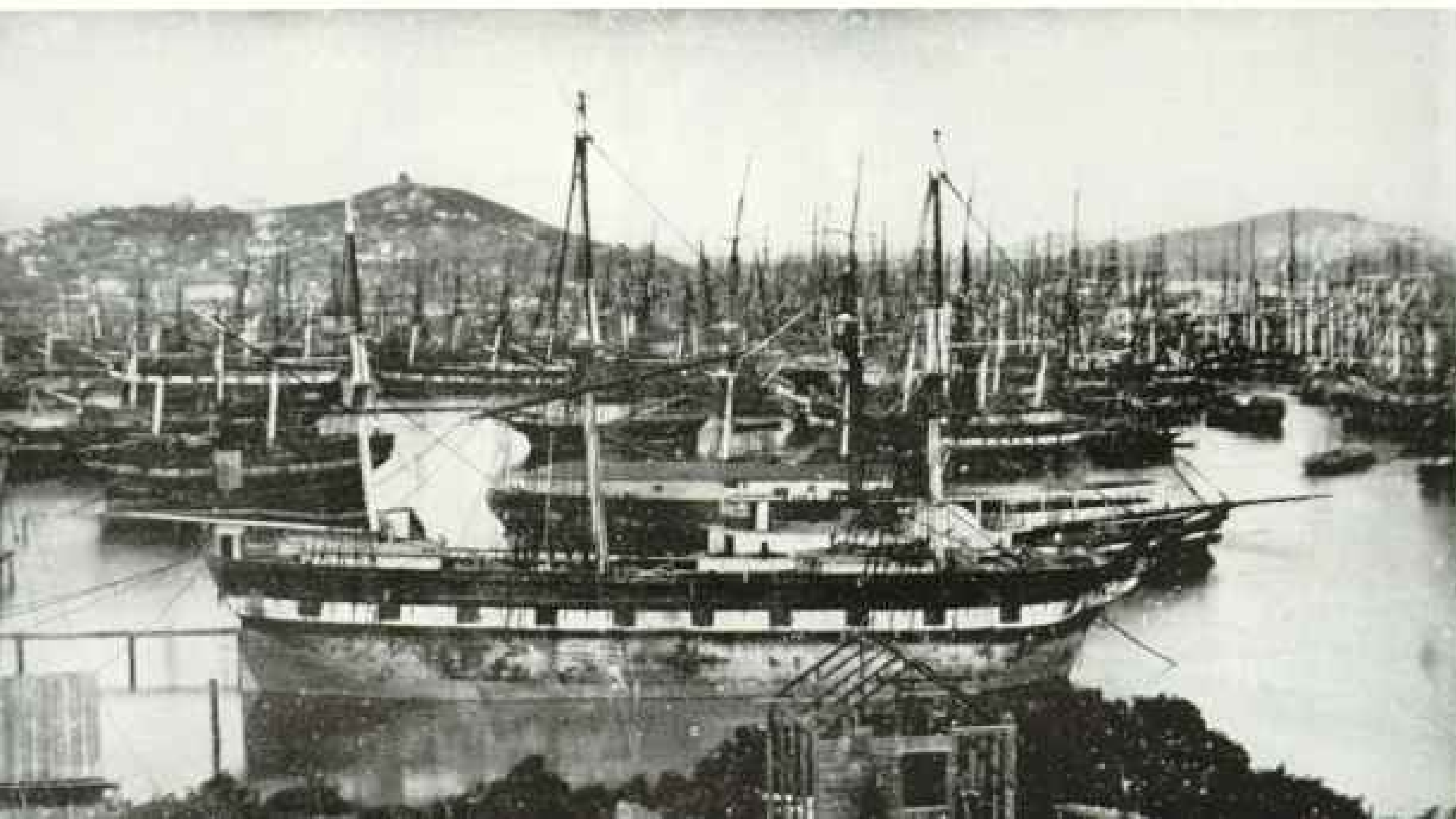
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Matt Southern, San Francisco Examiner

↑ From a Natural Grandstand, San Francisco Watches the Breeze-spanked Hearst Regatta

↓ With the discovery of gold in 1848, thousands set sail for San Francisco. These rotting ships, their masts like a fire-swept forest, were abandoned by passengers and crews alike in the frantic search for wealth. Part of the phantom fleet now lies beneath sand fill and rock used to extend the city's waterfront (map, page 191).

Metropolitan Institution





up and said, 'Goodbye, Mr. Davies, it's been nice to know you.'

"When I arrived here, I moved into the office of the *Chronicle*. Next day the editor came to my desk. 'Let me know if there's anything we can do for you, Larry,' he said."

The original Palace, opened in 1875, was built by William C. Ralston, an Ohioan who had made a fortune in mining stocks and banking. His hotel, he decided, should be the best the world had seen, and he poured some \$5,000,000 into it. It was, a writer has observed, "at least four times too large for its period and place, but the town had never had a sense of proportion, and no one was disturbed."

A San Francisco columnist, bored with the advance hallyhoo, wryly reported that "there are thirty-four elevators in all—four for passengers, ten for baggage, and twenty for mixed drinks. Each elevator contains a piano and a bowling alley."

Ralston died, \$4,000,000 in debt, before the hotel opened. His associate, Senator William Sharon, saw it to completion. For

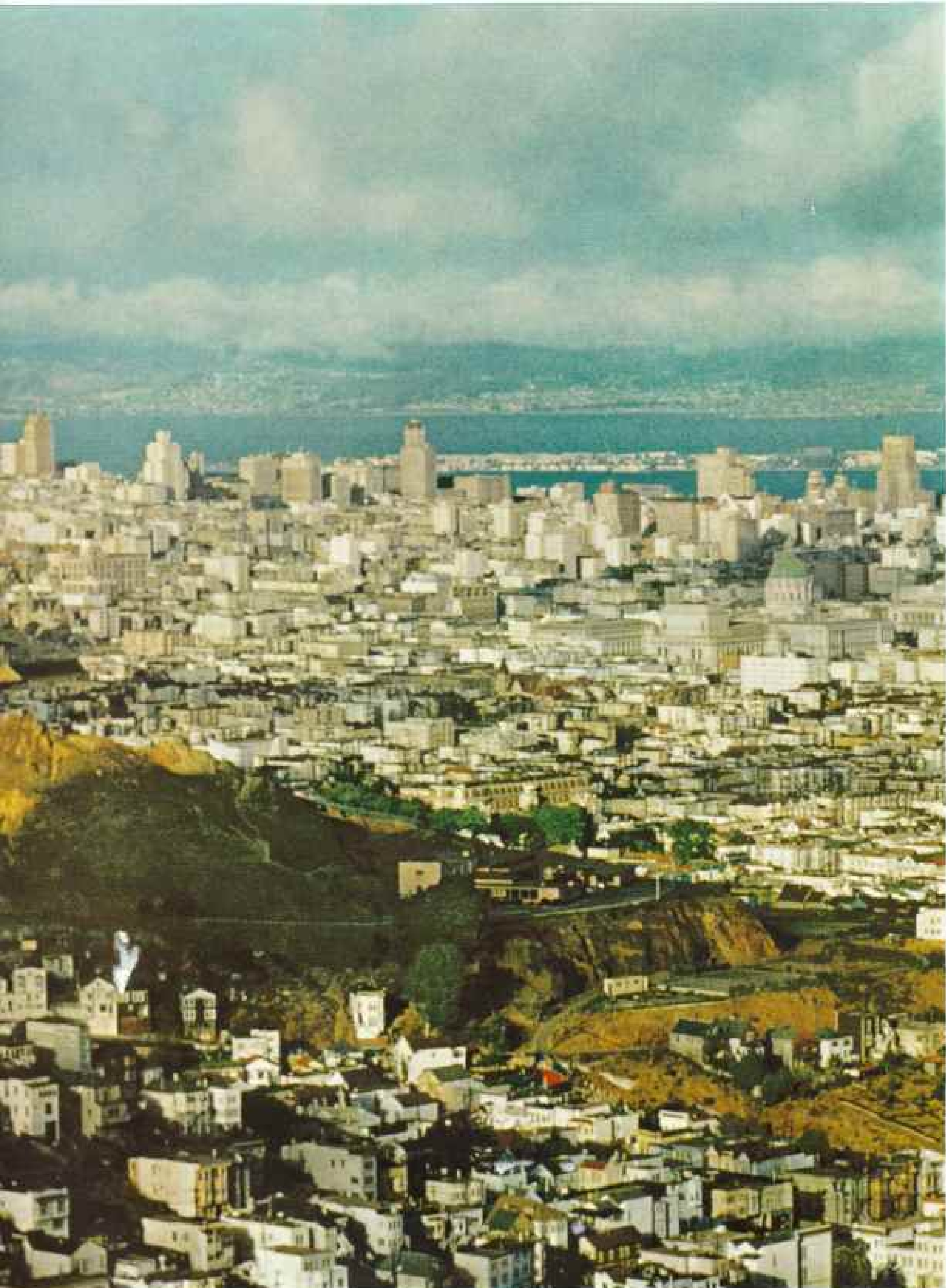
three decades the Palace entertained Presidents, kings, generals, and literary celebrities. On the morning of April 18, 1906, its last guests departed without bothering to check out. The solid structure withstood the earthquake, but the fire gutted it. One of the last to escape was Enrico Caruso, who rushed through the lobby with a towel around his famous throat, clutching an autographed picture of President Theodore Roosevelt and moaning, "We are lost!"

The present hotel opened in 1909 on the same site. Guests can no longer drive their carriages into the central court, but they still lunch and dine there in regal elegance. The Palace's \$100,000 gold-table service is practically a municipal heirloom.

Lotta's Fountain a Beloved Shrine

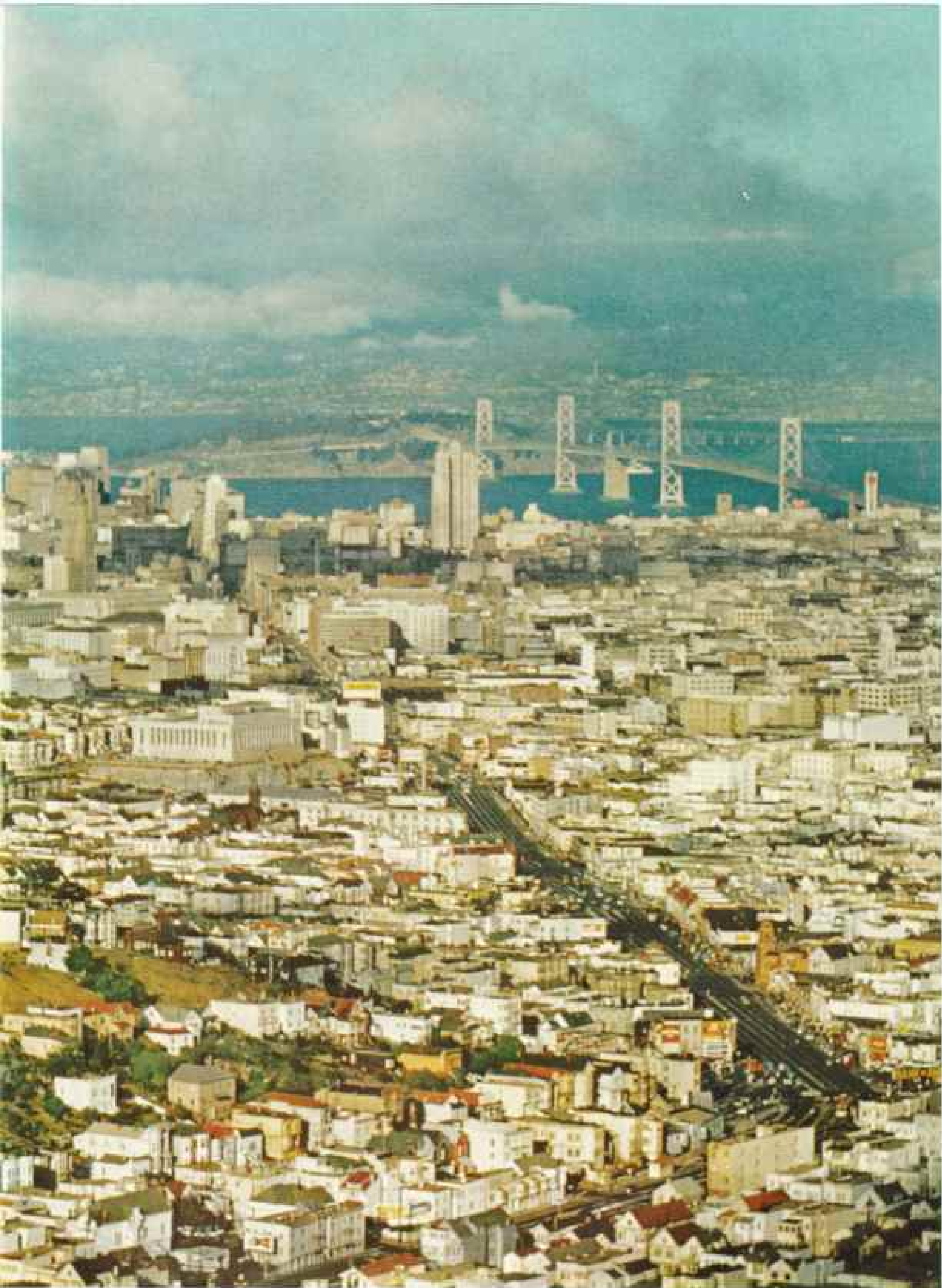
Just across the street from the Palace stands a monument which only a San Franciscan could love. An unattractive cast-iron shaft with a granite base, Lotta's Fountain makes up in memory what it lacks in grace.

Lotta Crabtree was a red-haired youngster



San Francisco Blankets the Bold Hills That Make Her the City with the Built-in View

Corona Heights Playground covers the eminence at left. City Hall dome marks Civic Center (right). Black-topped Mark Hopkins Hotel crowns Nob Hill. Man-made Treasure Island lies between the city and Berkeley (far shore).



Blue Waters of San Francisco Bay Embrace the Peninsula, White-towered and Teeming

Theaters and business houses flank broad Market Street, the city's main thoroughfare. Recessed windows give a columned look to the U. S. Mint (left). Yerba Buena Island tunnel swallows Bay Bridge traffic (upper center).



Bewigged Citizens Fire a Barrage of Humor in Their Battle to Save the Cable Cars

In 1947 city officials announced that San Francisco's clanging antiques must go. Aroused residents and cable-car admirers the world over protested; such stunts as this helped retain parts of the line (page 196).

who started her climb to fame singing and dancing on the bare table tops of San Francisco's waterfront saloons and retired with a national reputation and several million dollars. But her heart remained with the red-shirted miners who had tossed pokes of gold dust at her feet and started her on the way to fortune. So in 1875 she presented the city with a fountain.

The dedication was a memorable affair. Lotta was on tour in the East, but almost everyone else attended. San Francisco accepted the gift and, drinking water not being in great demand in the town in those days, promptly forgot about it.

But on Christmas Eve in 1910 came an event which permanently enshrined Lotta's Fountain in the heart of her favorite city. Luisa Tetrzzini, the great coloratura, found herself involved in a contract dispute in New York. An impresario insisted that she was obligated to sing for him in that city. The singer pleaded a prior engagement in San Fran-

cisco, where she had made her American debut.

"I will sing in San Francisco if I have to sing there in the streets," she cried defiantly. "I know the streets of San Francisco are free."

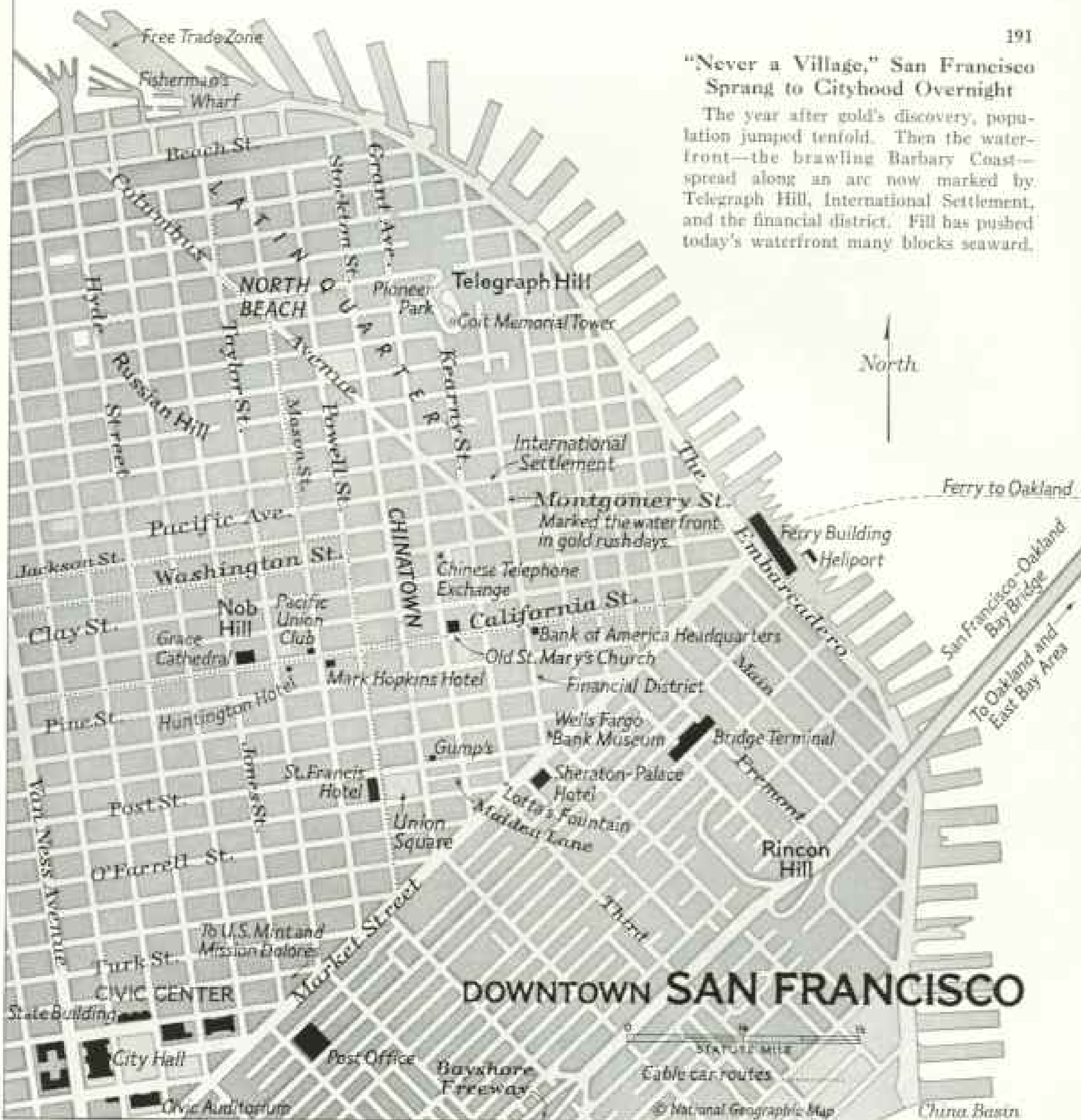
She won her case and returned to California to keep her promise.

"I like San Francisco better than any other city in the world," she beamed, and the citizens returned her adoration. That Christmas Eve they filled the streets around Lotta's Fountain as far as the eye could see. A massed choir sang carols and a symphony orchestra played. Then, her gloved hand resting on the mayor's arm, Tetrzzini appeared, a misty figure in a trailing white gown.

The crowd hushed, and she sang. Standing on a flimsy wooden platform, she filled the streets with song, concluding with "The Last Rose of Summer." Today Lotta's Fountain, wreathed in the memories of two women who were loved by San Francisco and loved it in return, means more to the city than many a more impressive sight.

"Never a Village," San Francisco Sprang to Cityhood Overnight

The year after gold's discovery, population jumped tenfold. Then the waterfront—the brawling Barbary Coast—spread along an arc now marked by Telegraph Hill, International Settlement, and the financial district. Fill has pushed today's waterfront many blocks seaward.



Drawn by Victor J. Kelley



We drove to Ocean Beach for Sunday breakfast at the Cliff House, sitting beside a broad window which looks out over the surf to Seal Rocks (page 198). In summer hundreds of sea lions laze and play in the sun there.

Then we walked down the steep hill to Playland at the Beach, where it seemed half the United States Navy was disporting itself on swings and roundabouts and at various games of what the barkers described as skill.

The rest of the day found us in Golden Gate Park, sharing with thousands of residents a man-made miracle (page 203).

Dreary Wasteland Made to Bloom

A thousand acres of barren sand have been turned into a four-mile-long paradise of flowers, trees, brooks, and meadows, and most of the transformation was the work of a single man. John McLaren was already in his forties when he became superintendent of the park in 1887. It was still very much what it had been called 14 years before in the *Santa Rosa Sonoma Democrat*:

"...A dreary waste of shifting sand hills where a blade of grass cannot be raised without four posts to support it and keep it from blowing away."

When "Uncle John" McLaren, still superintendent, died in 1943 at the age of 96, the park was one of the finest in the world, and he was as much a San Francisco institution as his beloved green acres.

I told Jean about an interview I had with Uncle John on his 93d birthday. I found him in a planting shed full of tiny redwood seedlings. I suggested he might prefer something that would show quicker results.

"Not in my park," he said. "We don't plant for me, nor for you, but for all the

people who will ever come here. A planted tree carries beauty from one generation to those that come after. We're doing that for San Francisco."

Uncle John never let a "Keep Off the Grass" sign appear in his park. "That's what grass is for," he said, "to be walked on and enjoyed." I was glad to see that San Francisco was still happily walking on his grass.

There was almost too much for us to see in our too brief visit. In the 1,500-acre Presidio, once a Spanish fort and now headquarters of the Sixth Army, we saw the oldest building in San Francisco, an adobe structure erected in 1776 as the headquarters of Spanish Lt. José Joaquín Moraga and now an officers' club. We visited Mission Dolores, built in 1782, and admired the hand-carved altars brought from Mexico by the Spanish padres.

A cruise on the Bay took us around Angel Island and grim Alcatraz and past man-made Treasure Island, where the 1939-40 exposition was held. Later we climbed Telegraph Hill, where visitors and San Franciscans alike come for a magnificent view of city and Bay. Coit Memorial Tower surmounts the hill today; once it was the site of a semaphore which signaled to the city below the arrival of sailing ships from the east coast (page 222).

Semaphore Signals Known to All

The position of the semaphore arms indicated the type of vessel sighted, and every resident of the city could interpret the signals. There is a story of an actor in a stock company melodrama who, on a local stage in the 1850's, threw his arms wide in a dramatic gesture as he implored of another member of the cast, "What does this mean?"

"Side-wheel steamer!" roared the audience.

When I first came to San Francisco, Telegraph Hill was a haven for writers and artists and a center of the city's Italian colony. Rents were low and life was comfortably informal.

Progress and prosperity have moved in. Many of the tiny houses which clung to the steep hillside (a neighbor of mine once fell out of his garden and died of a broken neck) have been replaced by towering glass-walled apartment houses. The lovingly tended gardens of the Italian fishermen are disappearing. San Francisco has discovered the view and the climate, and Cadillacs now park where I used to chock the wheels of my old

Page 192

← Passengers Lend a Helping Hand to Turn a Cable Car Around

Rudyard Kipling, visiting San Francisco in 1889, marveled that cable cars had made the city practically "dead level." "They take no count of rise or fall," he wrote. "...turn corners almost at right angles...and, for aught I know, may run up the sides of houses. There is no visible agency of their flight..."

Actually the "agency" is a steel cable pulled along a slot in the street at nine miles an hour. When the car's operator lowers a "grip," or claw, onto the moving cable, his vehicle lurches forth on its run.

This car swings on a turntable before returning up Powell Street.

Atop Union Square,
a Serene Garden;
Beneath It, a Cave
of Concrete for Cars

In 1850, during the high fever of San Francisco's first gold rush, Mayor John White Geary gave thought to the future and presented the city with 23½ acres for a park. A decade later northerners pledging loyalty to the Union cause gave the square its name.

Early in the 1900's, Victory Monument (left), 95 feet of granite and bronze, rose to commemorate Commodore Dewey's victory over the Spanish Fleet at Manila Bay.

After the earthquake and fire of 1906, Union Square looked out on the desolation of hundreds of city blocks almost as flat as the park itself. Then here, as elsewhere, billboards soon proclaimed in large letters: "Don't talk earthquake. Talk business." These handsome office buildings, hotels, and shops attest to the spirit of that time.

During World War II, the monument and park disappeared while a four-story parking garage was constructed below street level. With space for 1,700 cars, the garage handles twice that number during an average day. Firehouse efficiency keeps rapid turnover smooth. Attendants, like firemen, use metal poles for a quick slide between parking levels. Cars at right line up at the entrance.

Office workers bring lunch to a scene of sunshine, green shrubs, and gay colors. Gardeners keep the beds in flower during eight months of the year.

© National Geographic Society

David S. Boyer and (below) D. Anthony Stewart, National Geographic Staff

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jalopy to keep it from sliding down the hill.

Walking is fun in San Francisco, but once Jean discovered the cable cars, I found it difficult to keep her on her feet. If the cars didn't go where she wanted to go, she rode them anyhow.

The San Francisco cable car is a homelbred mode of transport, and the citizens regard it with unshakable affection. Few of the clattering little vehicles remain, but those still in service have been given official status as municipal treasures, guarded from extinction like the bison in our national parks.

The first cable car had its test run on Clay Street in 1873. Within a few years the happy clang of the bells was the city's theme song.

Rudyard Kipling rode the cars in 1889 and pronounced them a "miracle." The reasons for the miracle are the same today. A slot in the pavement between the rails contains an endless steel cable that moves at a steady nine miles an hour. Each car has a "grip," a steel claw hanging in the slot just above the moving cable, actuated by a 5-foot steel lever. When the operator lowers the grip onto the cable, the jaws close, the car lurches off, and passengers grab their hats.

Aroused Citizens Saved the Cable Cars

Municipal authorities rather casually announced in 1947 that the cars would be replaced by motor buses. A highly vocal group of San Franciscans protested vigorously, and a surprising number of former visitors sat down in their homes in Maine and Florida and Idaho and wrote irate letters. Nine residents of Pittsburgh, Pennsylvania, even sent in a petition urging retention of the cars.

Mrs. Hans Klussmann, an energetic native, organized a Citizens Committee to Save the Cable Cars which, in three hotly fought municipal elections, did just that. Some curtailment was allowed, but the Jackson-Powell, Mason-Powell, and California Street lines were retained. An amendment was written into the city charter guaranteeing the continued operation of those segments (page 190).

Once you've ridden the cable cars, the loyalty they inspire is easier to understand.

The rhythmic clang of the bells and the cry of "Look out for the curve!" as the cars lurch around corners and passengers cling to their slippery wooden seats, make a merry obbligato to the city's song of life.

Changes there have been. The "shave-and-a-haircut—six-bits" tempo of the bells which

Artistry of a Chinese Chef Revolves → Before a Family of Connoisseurs

Chinese cookery combines myriad flavors in such a way that not one is lost. Cooks in Grant Avenue restaurants are masters of this art.

Beneath a gilded 18th-century wood carving, the Milton Shoong family observes the Chinese custom of dining out once a week. Kan's Restaurant offers (clockwise from left) barbecued duck rubbed with honey, the crisp skin of which is regarded as a delicacy; hot steamed "thousand layer" buns; a mixture of snow peas, mushrooms, and bamboo shoots; Chinese broccoli with fillet of chicken; and sweet-and-sour chicken wings.

satisfied the conductors of my own day has yielded to rock-and-roll as younger men take over the controls. But the friendly intimacy has never departed.

Jean and I were riding a car past Old St. Mary's Church just as a wedding party emerged. The gripman clanged out a resounding "Here Comes the Bride"—ding, ding, ding—*ding-dong*—as we clattered past, and bride and groom waved a happy acknowledgment as we swayed on up the hill.

It's hard to get cable-car gripmen these days. They draw the same pay as operators of the modern trolleys and buses, but the work is harder. It takes a big and strong man to work the brakes and the grip. Then there's the business of getting out at each end of the line and pushing the car around on the turntable; fun for the visitor, but heavy work for the gripman (page 192).

Since the cable cars are one of the city's prime tourist attractions and collect as many fares from people seeking a thrill as from those interested solely in transportation, gripmen get special training in courtesy. It must work, for on my last ride to Fisherman's Wharf I heard the young operator earnestly advising three middle-aged tourists to order a fish stew known as *cioppino* from a particular waiter in a particular restaurant.

(Continued on page 205)

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A Jade Collector's Dream Comes True → Amid Gump's Oriental Treasures

In its Jade Room, Gump's displays a million-dollar collection of the gem in all its seven colors and manifold shades.

A pair of roosters like the one being shown sells for \$1,100. Two Imperial green urns on the table are valued at \$11,000.

The exquisite white jade hanging vase, wrought from a single block, carries no price tag. Reputedly it once adorned Peking's Imperial Palace.



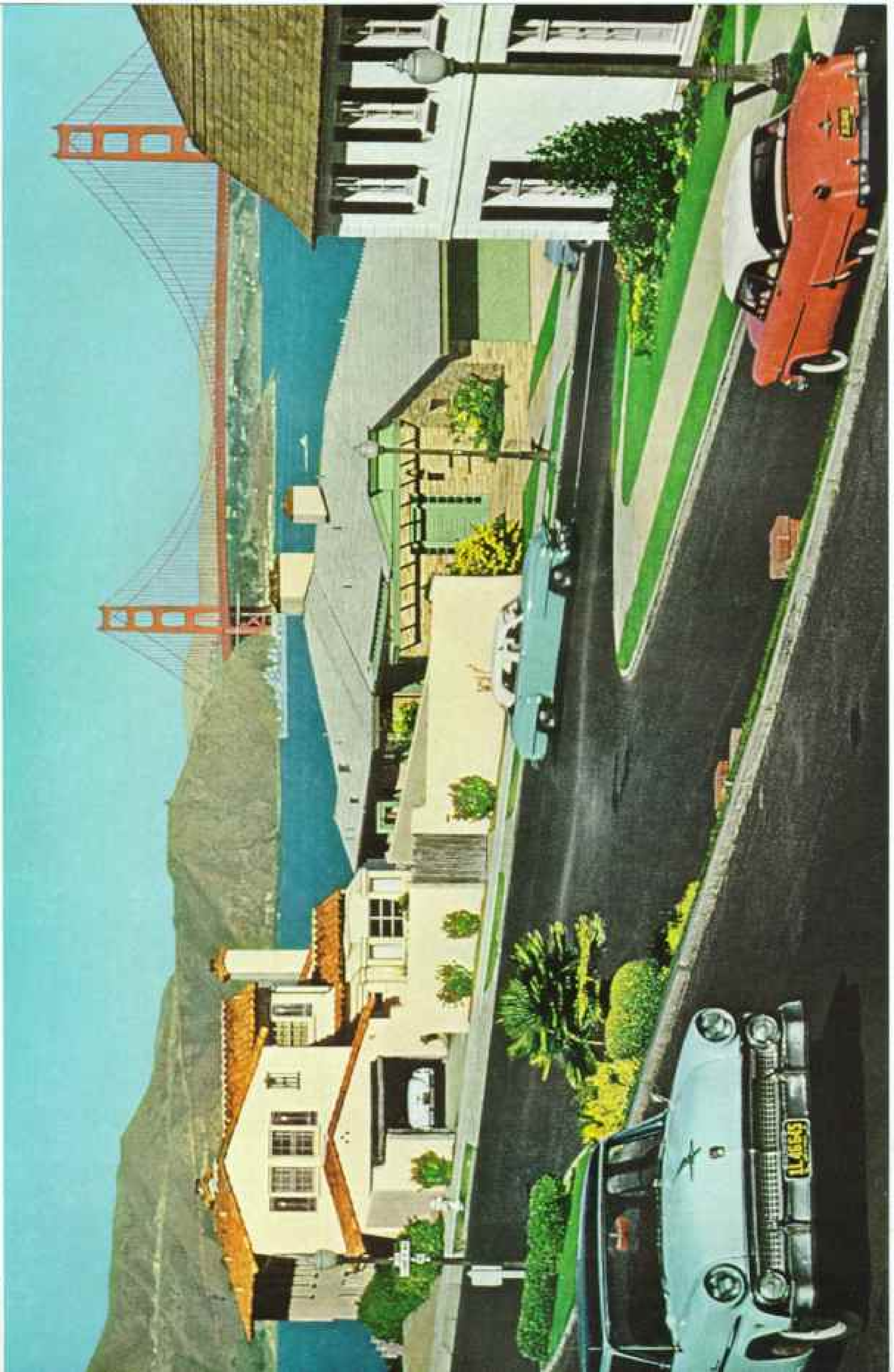


↑ **The Pacific Breaks Foam-white Around Seal Rocks**

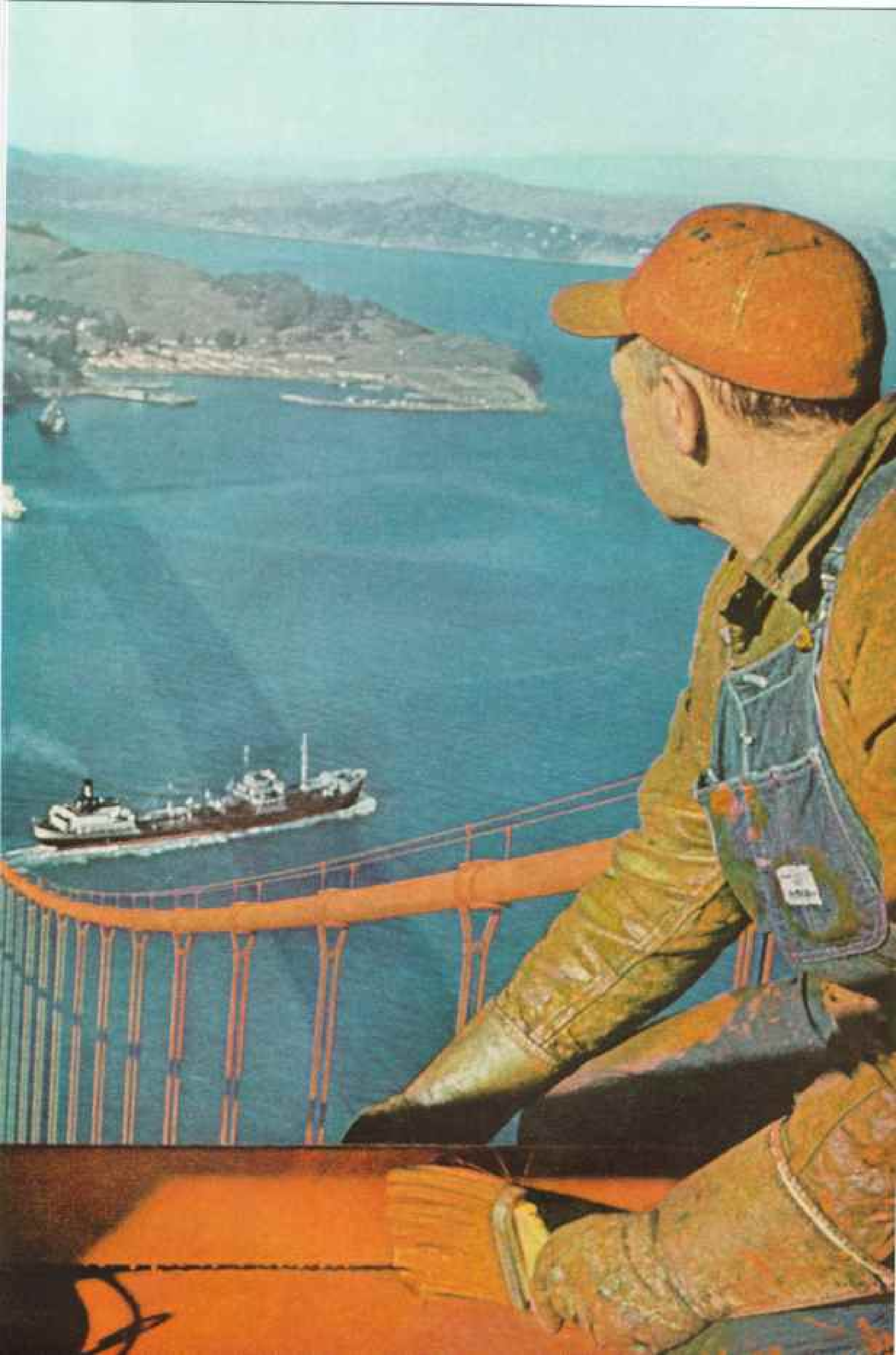
Protected by law, sea lions on these islets at Ocean Beach often stage boisterous shows for diners at Cliff House, a famed restaurant for nearly a century.

↓ **Ships Pass in Review Before Homes at the Golden Gate**

Single span of Golden Gate Bridge, four-fifths of a mile, is the longest ever built; towers equal 65-story buildings. For a painter's-eye view, see pages 200-201.



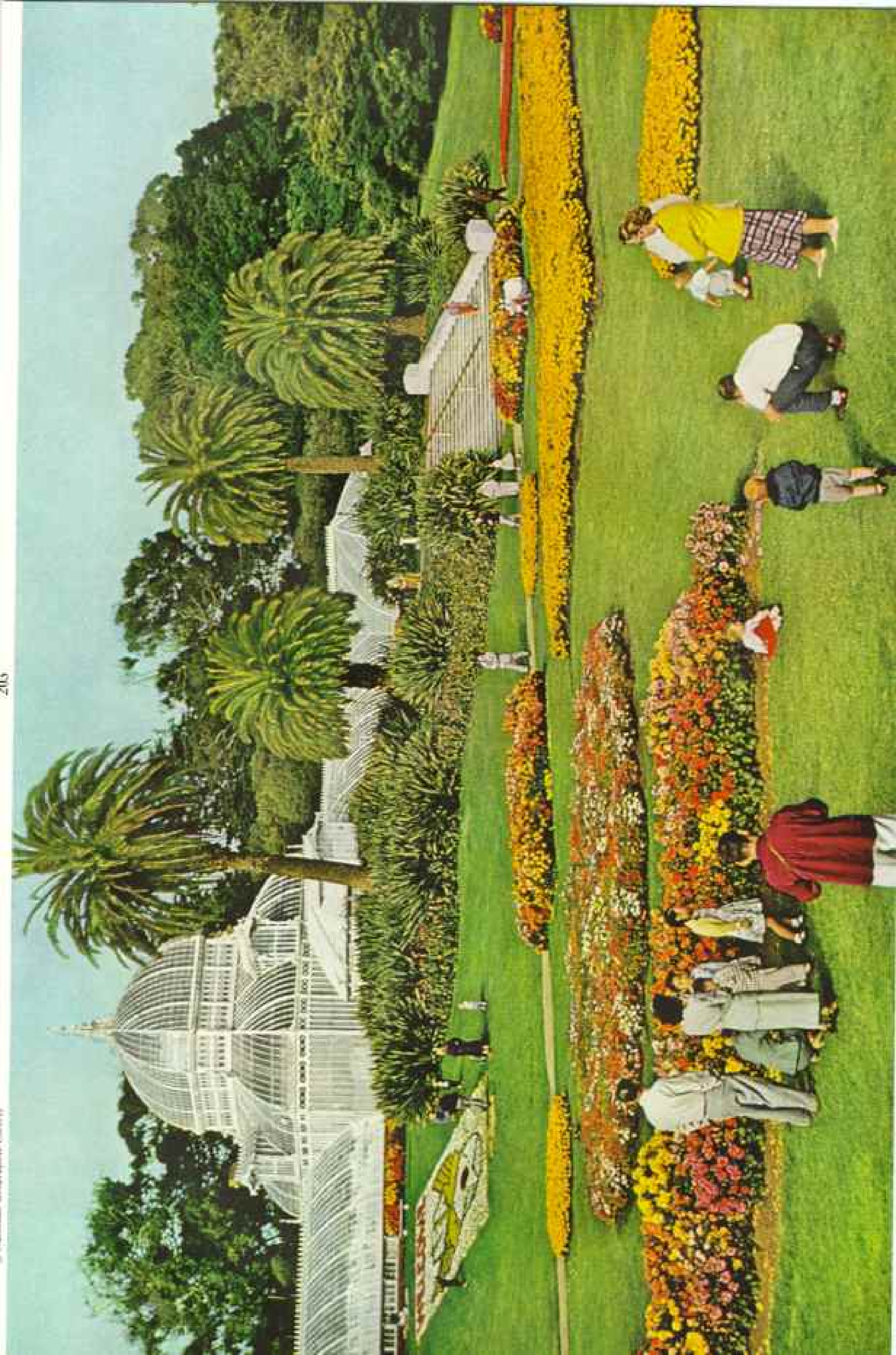


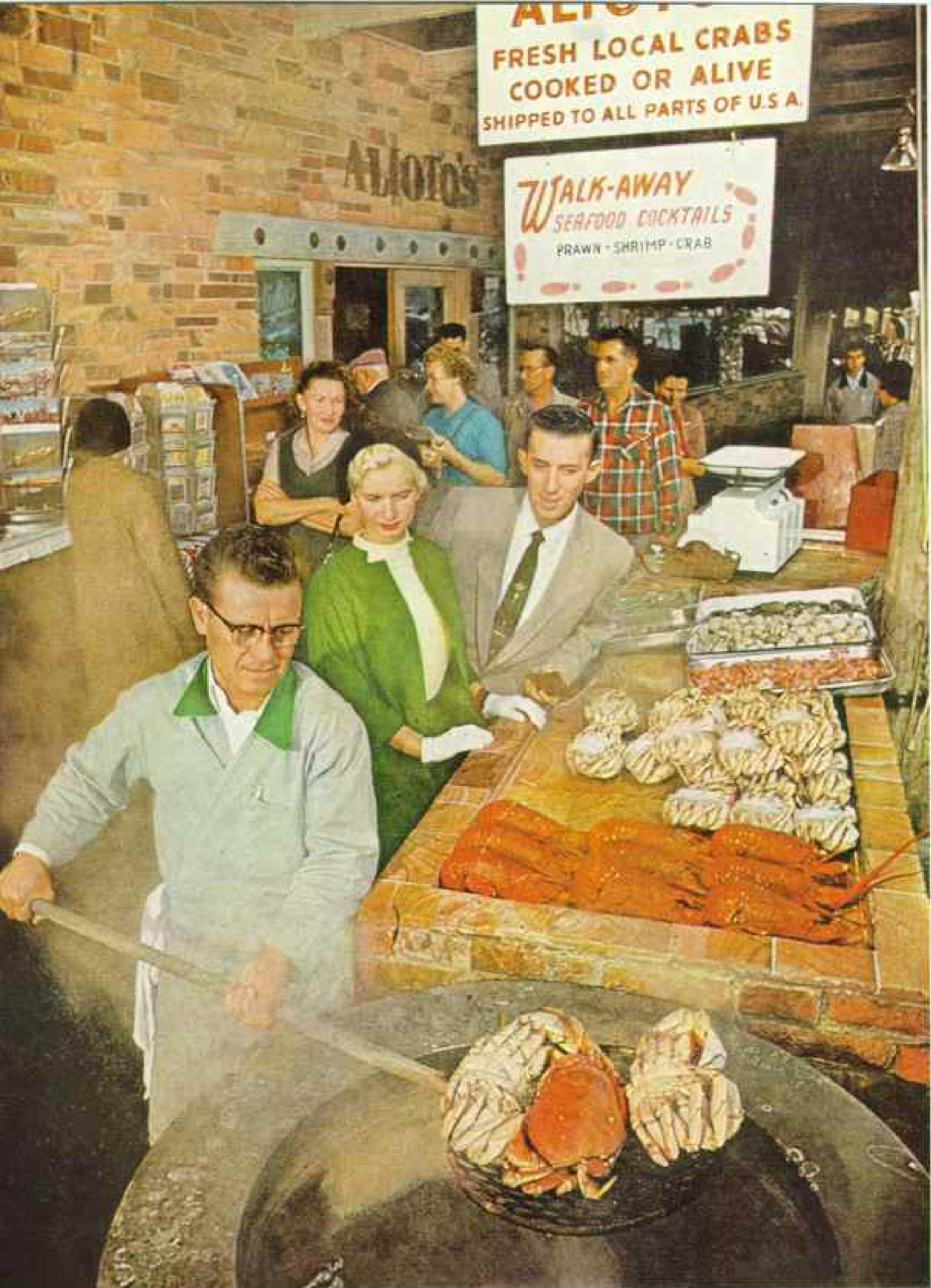




↑ **City Hall's Dome Rises Higher than the Nation's Capitol**
The City Hall is built of California granite in French Renaissance style. With the Civic Center's flowering gardens, it covers four city blocks.

↓ **Golden Gate Park: 1,000 Acres of Beauty from a Desert**
The Conservatory, modeled after that in London's Kew Gardens, houses tropical plants. No "Keep Off" sign has ever denied visitors the park's showy lawns.





Crabs Hot from a Caldron Give Fisherman's Wharf a Mouth-watering Sight and Smell

When the scream of sea gulls heralds the midafternoon return of the fishing fleet, sidewalk chefs fire their kettles. Soon Pacific market crabs are boiling before customers' eyes. Counter displays lobster, crab, and shrimp.

"It's the best dish in town," he assured them as they dismounted and he began to pull the heavy car around for the return trip. "Don't forget, now. Ask for Giovanni's table and tell him Al sent you."

As much fun as a ride on the cable cars is a walk up Grant Avenue from Market to Columbus, a walk that takes you through three worlds and past the memory of a fourth.

Smart gowns, flashing jewels, and modern furniture crowd the brilliant windows at the lower end of the street. Then you pass Maiden Lane, a narrow passageway lined with restaurants and bars and a variety of shops. In the roaring days of the Barbary Coast, Maiden Lane was a two-block sinkhole ruled by a woman known as Iodoform Kate, where sailors and their money were promptly parted.

Suddenly, the Orient

Continue up Grant and suddenly, at California Street, you are in China (pages 210, 211). Jean and I met and were married in Shanghai, and things Chinese hold pleasant memories. She took a long look down the street ahead, taking in the arches and the pagoda roof lines and the profusion of neon signs in Chinese characters.

"It *is* China," she breathed. "China with Cecil B. de Mille."

"Better say China through the courtesy of the Pacific Telephone and Telegraph Company," I amended. "They're really responsible for all this. After the fire and earthquake this whole Chinese section was rebuilt like every other part of town. Then someone in the phone company had the bright idea of building the telephone exchange in the shape of a Chinese pagoda.

"Those were the days when Chinatown was a world of its own and needed a separate exchange. The Chinese had difficulty calling by number; in their own exchange they simply asked for their party by name, and the operators knew thousands of the subscribers by heart.

"But to get back to the pagoda of the telephone: It was such a success that other firms in Chinatown adopted the idea. Now a great many buildings in the section are Chinese in style. And Mayor George Christopher wants a law to force all new construction in the area to conform."

There is endless entertainment for the visitor in this crowded honeycomb of restaurants, night clubs, curio shops, grocery stores—even

a Chinese supermarket. Some windows display the strange pharmacopoeia of Chinese medicine: tiger bones, dried frogs and lizards, powdered wapiti antlers, ginseng root, and a multitude of herbs. There is a temple, opening off its Passageway of Peace, with bells tinkling under its curved eaves, where large numbers of Chinatown's citizens still seek spiritual guidance.

The little courts and alleys off Grant Avenue have prosaic names on San Francisco maps, but not to their residents. The sign that reads Jason Court marks a passage known to those who live on it as the Lane of the Golden Chrysanthemums. And Wentworth Street to its Chinese dwellers is the Street of Virtue and Harmony.

It was there that I was called by name in a familiar voice and turned to greet Gim Pong Lew, whom I had last seen in the uniform of a United States Army sergeant on the streets of wartime Kunming.

"I thought you were from Chicago," I said.

"I was, before the war," laughed Lew, "but that was before I had seen San Francisco. The Army sent me through here on my way to China, and the day I got out of the service I became a San Franciscan. Come to dinner tonight and meet my wife; she was born here."

Changes in Chinatown

The address Lew gave me marked another change from the old days, when all San Francisco Chinese lived in Chinatown. It was a Taylor Street number, on fashionable Nob Hill. Lew and his sparkling Mei Lou welcomed us in a smartly furnished apartment where the only traces of Oriental influence were a couple of porcelain lamps and a carved figure of the Goddess of Mercy.

Nine-year-old Sammy, his black eyes snapping in a round face, was dressed in blue jeans and a plaid shirt. His mother found it difficult to keep him from wearing his coonskin cap in the house. Seven-year-old sister Sally wore her straight black hair in a pony tail. The youngsters greeted us politely and then were off to watch television.

"We've decided not to send them to the Chinese night school," Lew explained, as we sat down to a fine Western-style meal. "It takes so much time they have trouble with their regular schoolwork. Besides, Mei Lou and I don't think they need it. We never speak Chinese except when we visit her par-



Strait-jacketed by the Sea, San Francisco Packs Its Life into 45 Square Miles

Twin Peaks, 922 feet high, hump like islands in a sea of streets and homes (left). Golden Gate Park's rectangle, cloud-drifted, backs up against the Pacific Ocean. The Presidio, 1,542-acre military reservation, faces the Golden Gate. Rail yards, oil terminals, and docks line the Bay waterfront (foreground).



Wharves Like a Multitude of Toes Stretch Along the Foot of the Downtown Section

Golden Gate (left) lies so well hidden amid hills that for two centuries explorers sailed by without seeing it. Spanish soldiers marching overland discovered the two-mile gap in 1769. Marin Peninsula anchors the far end of Golden Gate Bridge. Sausalito fringes Richardson Bay (right). Bay Bridge mounts another highway in the sky.

ents. My children were born Americans, and I want them to grow up that way.

"I know we have a great cultural tradition, and in a way I'm sorry the children will grow up without knowledge of it. But they'll have their American traditions, and we think those are enough. I don't want them to have any semblance of divided loyalties."

Lew is an auto salesman, the only Chinese employee of his firm. "Sure beats those Kunning rickshas, doesn't it?" he laughed as he drove us home in a shining new model.

Chinese Proud of Heritage

I lunched the next day with a venerable Chinese friend of prewar days, an elder in the Six Companies, an organization of family associations which once virtually ruled Chinatown. When I told him I was writing an article about San Francisco, he asked that I not mention his name.

"It is not seemly for one man to put himself above another and presume to speak for his brother," he smiled. "Say only that I am a very old Chinese who was born in San Francisco and have tried all my life to be a good American. And yet I have been proud of my Chinese heritage. I have tried to persuade my brothers and their children to keep alive that tradition."

We spoke of the difficulty of keeping alive the schools where young Chinese learn to read and write in the way of their fathers.

"It is more than just learning the language," he said. "I support the schools because I believe that the Chinese culture and philosophy, if acquired early in life, shape character. It was not an accident that in the old days, when every child went to our own schools, we knew no such expression as 'juvenile delinquency.' For generations no Chinese child ever came before a San Francisco court. The shame would have killed his father."

The third world of Grant Avenue begins at Columbus Avenue, where Long Ping Chung, laundryman, does business next to Antonio Ferrari, pizza baker. Suddenly you are in San Francisco's Italian community, surrounded by restaurant signs bearing the names of Vanessi, Tosca, Capri, and Julio. The scent of oregano wafts from their doors, and *caffè espresso* machines hiss pleasantly. Jukeboxes offer records by Caruso and Gigli and Lily Pons, and fishermen, their lined faces alight with enthusiasm, play *boccie* ball.

San Francisco's Italians have given their adopted city a mayor and a financial leader, and they have added some of the warm color of their native land to the city's cosmopolitan air. They have also contributed Joe DiMaggio and Fisherman's Wharf (opposite).

Near by lies a stretch of Pacific Avenue, marked by arches at both ends, which today bears the name "International Settlement" and offers a series of night clubs and bars. But from the 1860's until the reforms of 1917 this was the infamous Barbary Coast.

Perhaps the least savory of the Barbary Coast rogues were the crimps, who made their living furnishing seamen to ships whose crews had deserted. Many a man, after accepting a crimp's "hospitality" and drugged liquor, awoke to find himself at sea, with no way of escape from a long voyage and brutally hard work. One famous crimp, Shanghai Kelly, shanghai'd 90 men in a single day by inviting them for a cruise, plying them with drugged liquor, and delivering them overside to his waiting customers.

Spaniards Were First Settlers

The astonishing thing about San Francisco's history is that there is so much of it.

The first settlers were a handful of Spaniards led by Lt. José Joaquín Moraga. On June 27, 1776, they pitched their tents beside the Bay, discovered seven years earlier by Don Gaspar de Portolá. This was just a week before the American colonists 2,500 miles to the east declared themselves a nation.

The little settlement which they named Yerba Buena was to know three flags, those of Spain, Mexico, and the California Republic, before the Stars and Stripes finally flew over its huddled roofs in 1848. Even then it had only a handful of inhabitants. Those few had lived in constant danger of another change in nationality: until 1841 Russia had had a well-armed settlement, Fort Ross, a scant 70 miles to the north. Britishers from the Hudson's Bay Company had made frequent

(Continued on page 217)

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Fisherman's Wharf Serves Seafood → in Sight of the Fleet That Caught It

Windows of Tarantino's Restaurant overlook the lagoon where the brightly painted boats of Italian fishermen tie up. The family enjoys marine delicacies including local crab and lobster, shrimp from Louisiana, and oysters from Chesapeake Bay.







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↑ Popeyed Dragon Spits Electric Fire During a Chinatown Celebration

The dragon, symbol of Nature's power, has served as protector of San Francisco's Chinatown for more than a century. This glittering creation, imported from Canton, wears yards upon yards of silk brocade splashed with brilliants, mirrors, and tinsel. A portable generator keeps lights flashing.

← Propelled by some 35 men, the 100-foot monster snakes down Grant Avenue, the Street of a Thousand Lanterns. Where the dragon dances, prosperity follows. This parade honors the 44th anniversary of the Republic of China.

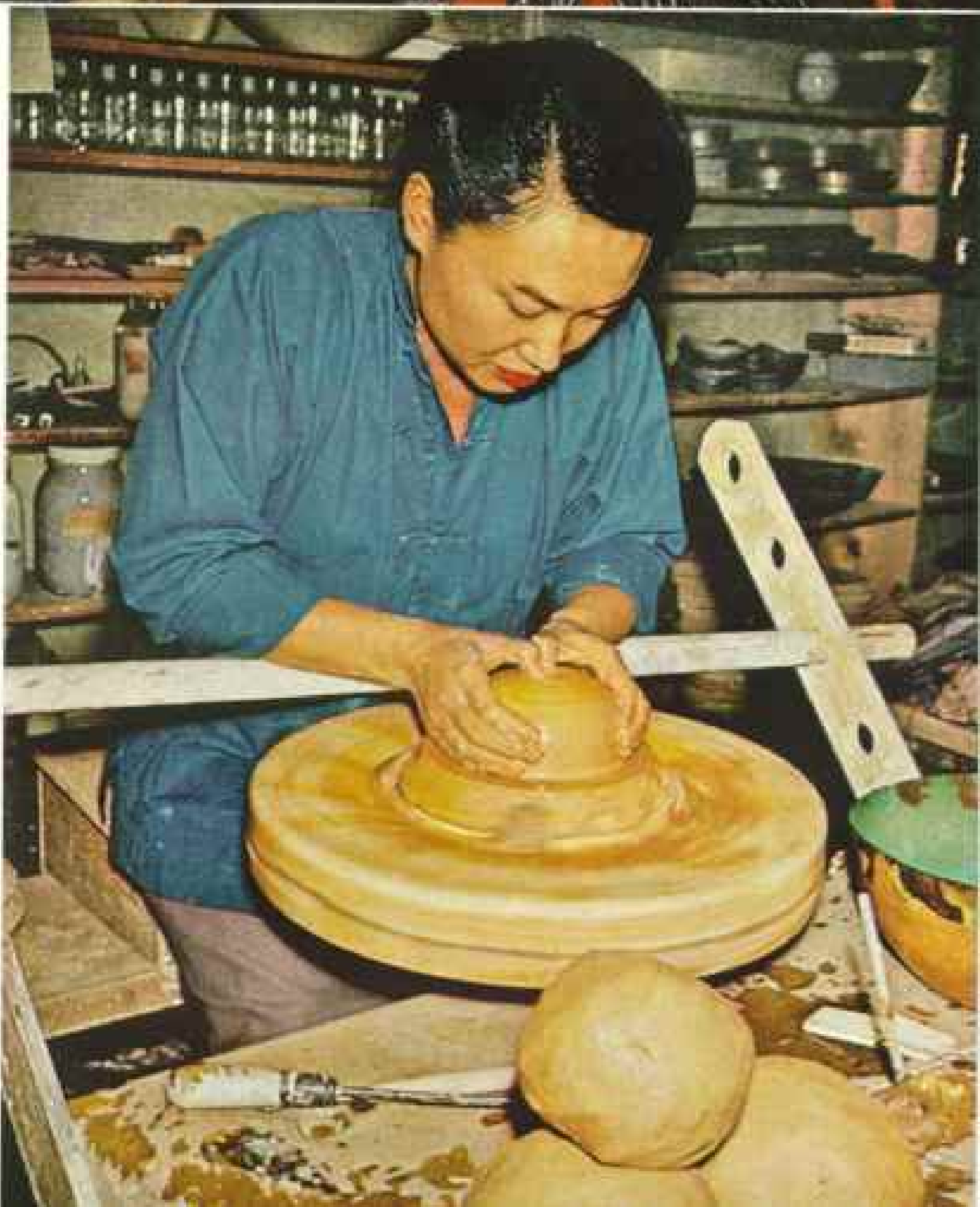
An Ancient Art of China → Finds Modern Expression

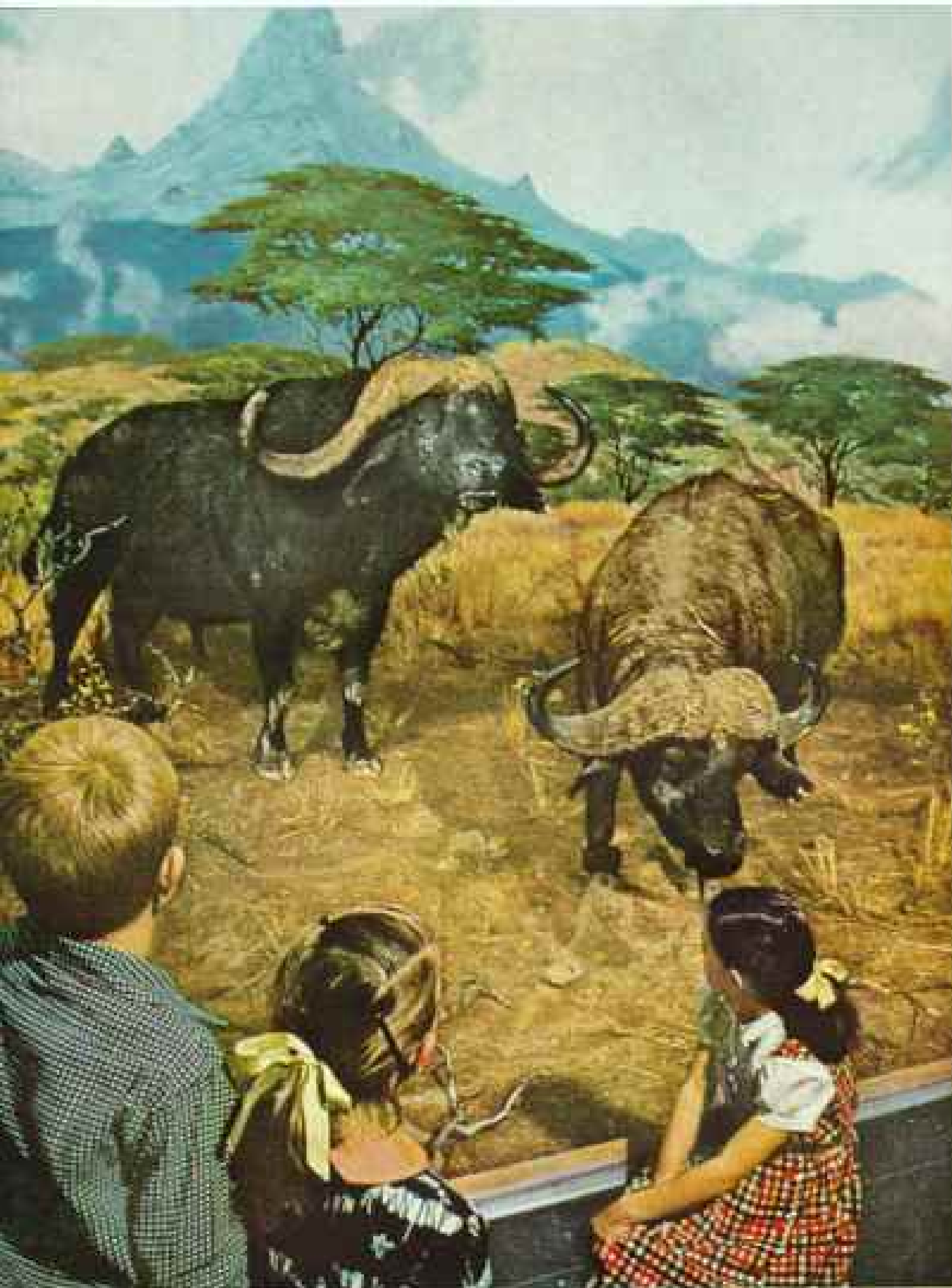
Jade Snow Wong, using an arm rest, throws a vase on the potter's wheel. The artist has exhibited her exquisite ceramics nationwide. Several pieces are among the collections of New York's Museum of Modern Art and Metropolitan Museum of Art. Miss Wong wrote a best seller, *Fifth Chinese Daughter*.

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David H. Boyer and (right)

Francis Snow, National Geographic Staff





Wonders of the Earth Open to Young Eyes at the Academy of Sciences

In Golden Gate Park, this educational and research institution attracts a million and a half visitors annually.

← Mounted African buffalo graze by a papyrus swamp beneath Mount Kenya. Massive horns of the larger male spread 49½ inches, a near record.

Below: Hawaiian fishes bewilder youngsters at Steinhart Aquarium. A yellow foreeps butterflyfish (upper left) swims above double-striped coral beauties and a humuhumunu-kunukuapuaa (above shell). Four red and white squirrelfish glide before the spectators.

Black bands give stripies their name. Spotted puffer (upper right) makes its body a balloon when frightened.

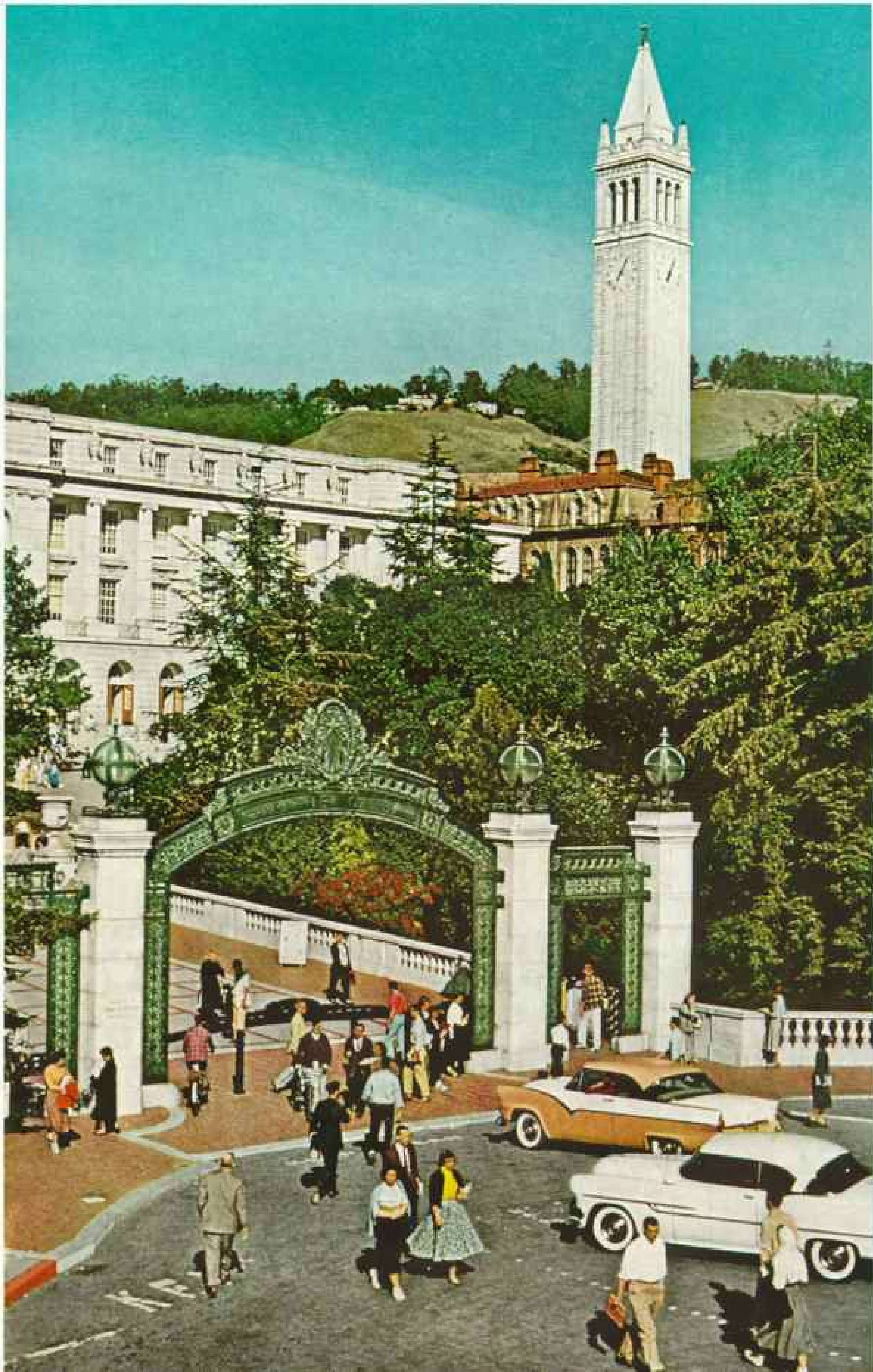
Campanile Proclaims → the Largest University in the United States

Page 113: University of California students flock through Sather Gate to the Berkeley campus. The tower's chimes sound the mournful strains of "Danny Deever" on the eve of final examinations, burst triumphantly into "Hail to California" on Commencement Day.

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A Moated Prison, Alcatraz Anchors Like a Battleship in the Golden Gate Concourse

Sailing here in 1775, a Spanish mariner discovered large numbers of pelicans nesting on the Bay's islands. He called the one of them *Alcatraz* after the birds, and the name was later applied to this 12-acre rock. Winged residents disappeared when the United States Government made the island a military prison in the mid-19th century. "The Rock" became a Federal penitentiary in 1934.

With a normal capacity of 364 prisoners, Alcatraz now holds fewer than 200. Employees, many living on the island, number nearly one for every two inmates.

Here a cable car stops before a plunge down Hyde Street. The pier of San Francisco's free trade zone, where goods may await transshipment without paying duty, juts into the water at center.

Freight Cars Go to Sea to Save Transfer Costs

Transcontinental trains terminate at Oakland. Freight bound for San Francisco crosses the Bay by barge.

Bay Bridge swings across the Embarcadero, San Francisco's commercial waterfront.

© National Geographic Society
Geoffrey M. Smith







"surveys" of the region. The only trade had been with an occasional American vessel which picked up a cargo of hides and tallow from the inland missions.

It was the Treaty of Guadalupe Hidalgo, ending the Mexican War on February 2, 1848, that gave California to the United States. But it was a scribbled entry in the diary of a laborer, made a scant nine days before, that foretold San Francisco's destiny.

"Metal Which Looks Like Gold"

One Henry Bigler, building a mill for Capt. John A. Sutter on the South Fork American River, 35 miles northeast of the present city of Sacramento, had written:

"January 24, 1848: This day some kind of metal which looks like gold was found in the tail race."

There are a number of stories of how the news of the discovery of the metal that "looks like gold"—and *was* gold—was brought to San Francisco. The most colorful records that Sam Brannan, who had brought a ship-load of Mormon immigrants to San Francisco two years previously, rushed through the streets waving a bottle full of gold dust, crying, "Gold! Gold from the American River!"

Whatever the manner of the announcement, there is little disagreement about what happened thereafter. The *California Star*, in an issue of the spring of 1848, declared that "as if by a plague, the town was depopulated." Another contemporary report revealed that of a population of about 900, all but a dozen left for the diggings. And the *Californian* on July 15, 1848, complained that the municipal council had not met for two months because all its members had joined the rush to the gold fields.

The sudden depletion of the population was only temporary, however. Within weeks thousands of easterners were rushing west, some overland, some by ship around the Horn,

others across the Isthmus of Panama. In early 1849 San Francisco boasted a census of some 2,000. A year later about 40,000 gold seekers had landed, and at least half had either stayed in the city or returned to it after a quick venture with pick and pan.

In seven and a half months of that incredible year, 697 vessels dropped anchor within the Golden Gate. Hundreds of them were deserted as crew joined passengers in the frantic rush northward (page 186).

By 1852 the population was 34,776; the city of sprawling tents and board shacks had burned down and been rebuilt six times. The first Vigilance Committee, infuriated by waterfront toughs who had taken over the city, had restored a semblance of order after publicly hanging a man caught with a stolen strongbox.

Prices had touched fantastic levels. Flour sold for \$60 a barrel, eggs for \$1 apiece. An ounce of gold bought an ounce of tacks. A stable for six horses rented for \$75,000 a year. Laundry was so expensive that some San Franciscans, so the story goes, sent their soiled linen by sailing ship to the Sandwich (Hawaiian) Islands or Canton, preferring the long delay to the astronomic prices.

Clipper Ships Speed Supplies

The brawling infant city needed supplies of every sort—in a hurry. The promise of speedy profits brought fulfillment; between 1850 and 1854 east coast shipyards launched 160 clipper ships to get goods to San Francisco quickly.

Then the early placer deposits began to play out. Bankrupt miners flocked back to the city. In 1854 it was estimated that half the citizens were unemployed. Lawlessness was again rife. A second Vigilance Committee hanged a few more offenders, and order was restored.

For five years San Francisco hung on, supporting itself on the produce of its fertile surrounding valleys and its booming ocean trade, while it dreamed of striking it rich once again. And in 1859 it did. Over the mountain passes in Nevada a miner's pick turned up the first traces of the Comstock Lode, a trove of gold and silver which was to pour an estimated \$250,000,000 into San Francisco before the turn of the century. Once again the city by the Golden Gate was off on a joy ride.

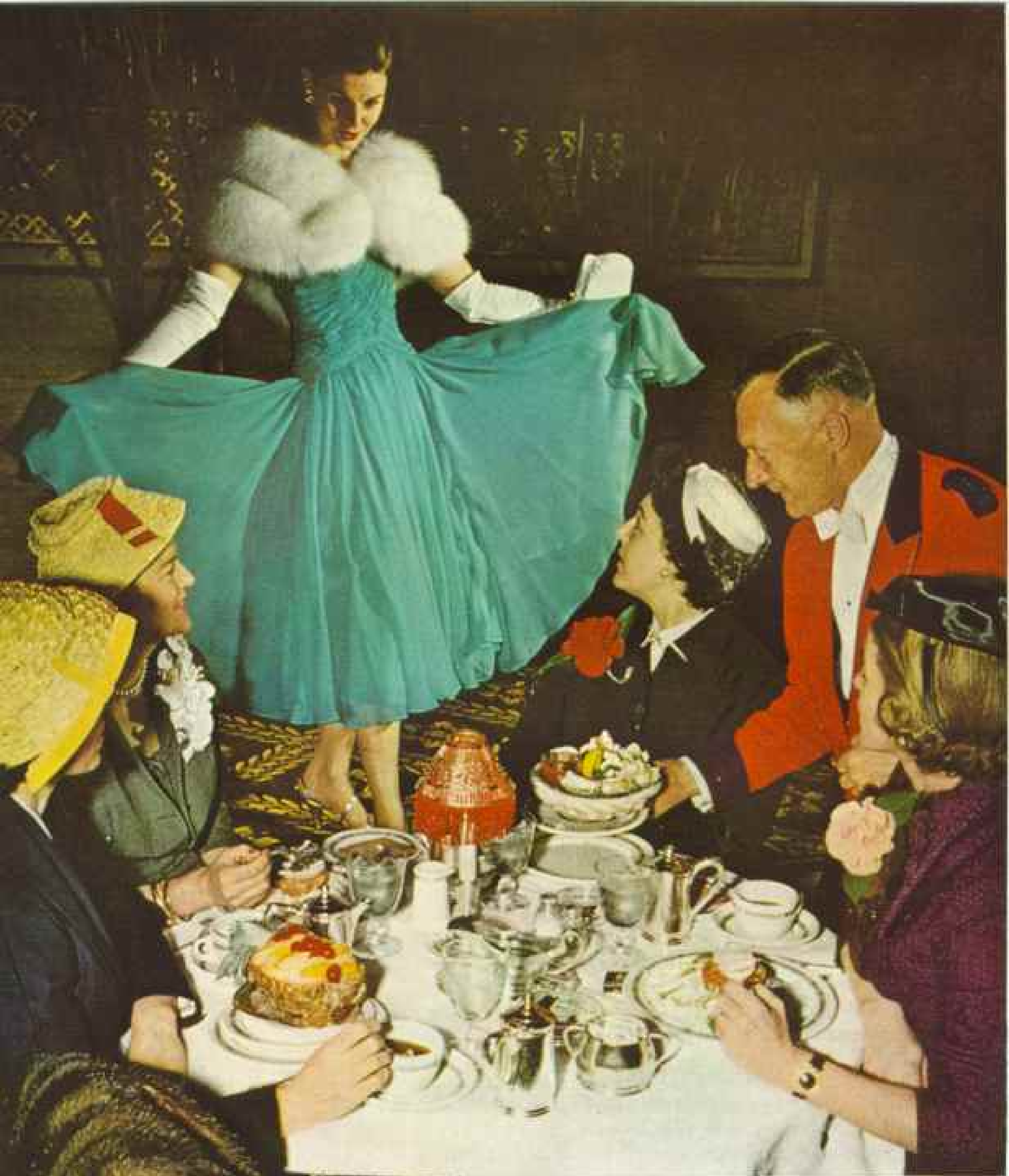
A lot of quick millions from the Comstock Lode went into Nob Hill mansions and high living. But a great deal more was invested

★ Suki-yaki Sizzles at the Table;

Guests Sit on the Floor Japanese-style

In the Tokyo Suki-yaki Restaurant on Fisherman's Wharf, a Marine sergeant who learned to use chopsticks in Japan teaches the art to his date. Waitress Masumi King married an American soldier in Tokyo, came to this country as a war bride.

Raw ingredients (foreground) of suki-yaki—the "friendship dish"—await the stove: prime rib of beef sliced thin, bamboo sprouts, fresh mushrooms, dry and green onion, soybean cake, and potato noodles.



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**Flowers and Furs Are Worn
All Year in "Air-conditioned"
San Francisco**

In part, the city owes its reputation for well-dressed women to its climate, a kind of eternal autumn with a mean annual temperature of 56.7 degrees. With only slight variation in the seasons, lady can wear an outfit 12 months of the year. The fact that she rarely chooses to do so inspires such fashion luncheons as this one at the St. Francis Hotel. The model shows a chiffon evening gown and a white fox capelet.

**This Gold Spike Pinned →
a Continent Together**

When track-laying crews of the Central Pacific and Union Pacific Railroads met at Promontory, Utah, in 1869, former Governor Leland Stanford of California hefted this silver-headed hammer to drive home the last spike of 23-carat gold. Telegraphic contact rang bells in Washington, D. C., New York, Boston, New Orleans, and Omaha. Stanford University preserves the mementos.

**↓ The Old West Lives On
in the Wells Fargo Bank**

Forty-niner Joshua Norton (right), an amiable eccentric, proclaimed himself "Emperor of the United States" and issued his own money. Derby-hatted Black Bart robbed 28 stagecoaches single-handed; his calling card was a mocking verse.

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Photographer B. Anthony Stewart

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in solid construction, in improvement of the surrounding farm lands, and in farsighted investments in railroads and shipping lines. That money kept the city growing.

The ten years from 1860 saw the first Pony Express rider arrive from Missouri and the linking of the tracks of the Central Pacific and Union Pacific Railroads at Promontory, Utah. As the golden spike was set to hold the final rail, a cannon was fired in San Francisco Harbor. That was the night the city paraded with illuminated transparencies announcing: "San Francisco Annexes the United States!"

In round figures, the census tells the story: 1870, population 150,000. 1880: 234,000. 1890: 299,000. 1900: 343,000. The city had spread out across Twin Peaks toward Ocean Beach. The harbor was the busiest on the Pacific coast. Trade, manufacturing, agriculture—all were flourishing.

On the Eve of Disaster

But the city still found time to enjoy itself. The greatest actors and opera stars of their time bowed to San Francisco audiences in those last decades of the 19th century. Fine restaurants and magnificent hotels flourished. In a short half-century, sleepy Yerba Buena had become one of the great cities of the world. There seems little doubt that most San Franciscans went to sleep on the night of April 17, 1906, content with their city and their lot.

It is perhaps true that a city, like a nation or even a human being, must know agony before it can know greatness. San Francisco, in the six decades following the discovery of gold, had known boom and bust, glory and privation. But stark terror had never visited the city until that April morning 50 years ago. With that dawn came a three-day horror which was to prove the mettle of the city of the Argonauts and its 400,000 dwellers.

The first earthquake tremor ripped from the north, along the San Andreas fault, just after 5 a.m. It and the second shock lasted a total of less than a minute. Slight tremors were to follow all that day, but the death knell of the city had sounded in those first terrible 60 seconds.

The temblor itself, one of the strongest and most destructive ever recorded, did damage enough. It left the new \$7,000,000 city hall a twisted skeleton, stripped of brick and mortarwork. It tumbled homes and factories and

office buildings into shapeless heaps of rubble from which came the terrified cries of trapped and injured people. And then, to seal the city's doom, it broke both gas and water mains.

Nearly 90 percent of San Francisco's buildings were made of wood. There were gas fires burning in kitchen ranges that morning. And when Brig. Gen. Frederick Funston, acting commander of the Army's Pacific Division, leaped from his bed on Nob Hill and rushed out into the street, he saw a dozen small fires already snapping at the ruins of the business section and the South of Market residential district.

By noon, when General Funston had turned out his 1,700 regulars to help fight the blaze and keep order, the entire business district was one solid sheet of flame. And the fire was moving inexorably toward Russian Hill, Telegraph Hill, Chinatown, and North Beach.

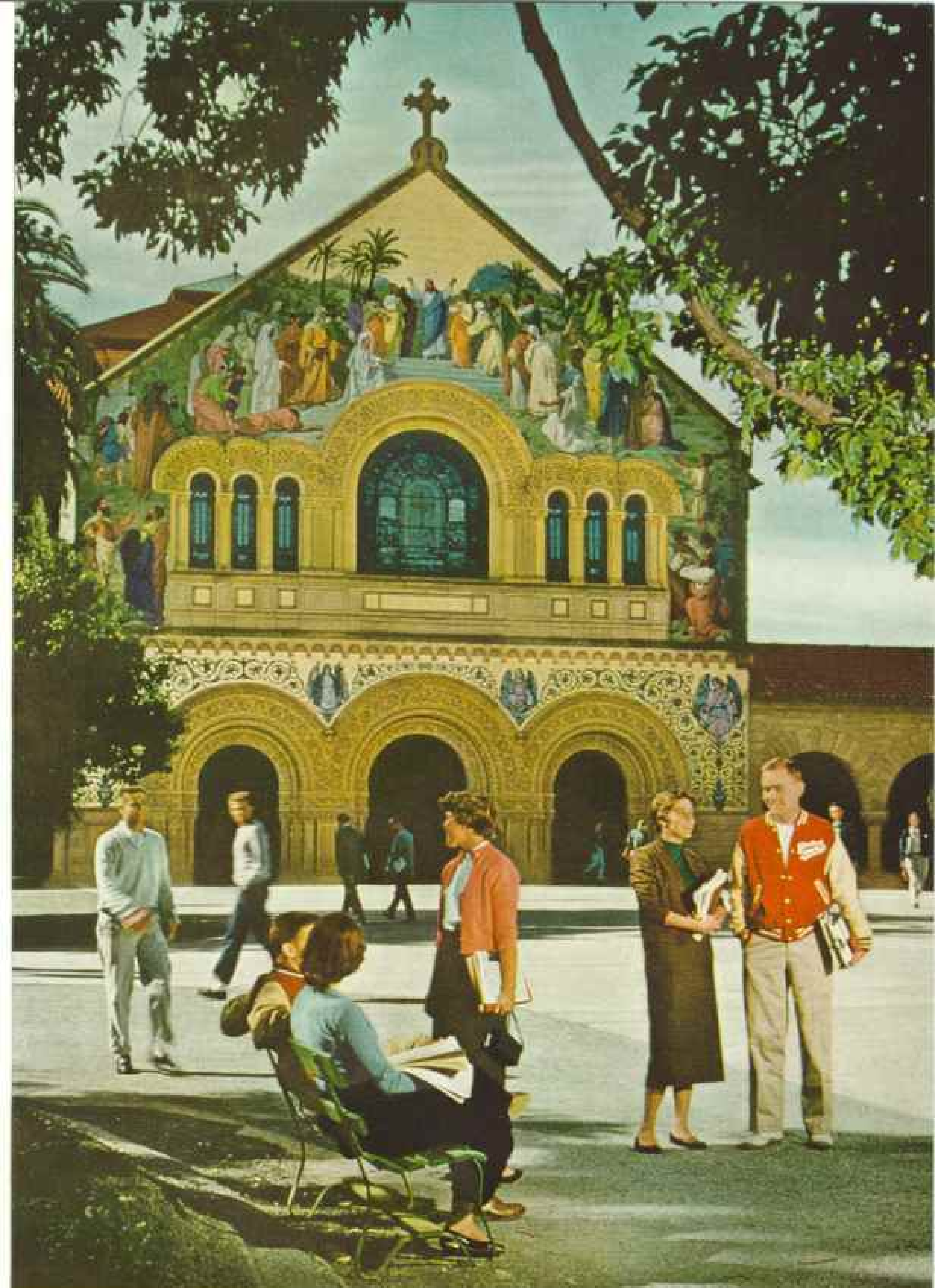
By 3 o'clock, when Mayor Eugene E. Schmitz called to order an emergency Committee of Fifty amid wrecked buildings, the flames were in command. Fire hoses hung limp and useless from empty hydrants. Mayor Schmitz ordered police and troops to "shoot to kill any and all persons found engaged in Looting or in the Commission of Any Other Crime," and called for dynamite. If there was no water to put out the fire, corridors of blasted buildings might stop its spread.

Fortune in U. S. Mint Endangered

That afternoon a sea of fire had swept around the United States Mint, well out Market Street toward Twin Peaks. Inside, a handful of loyal employees sloshed what water they could get on sashes and framework of the stone building, where \$200,000,000 in currency and specie jammed the vaults. Downtown the 18-story Call Building, one of the city's tallest, seemed to go all at once. Flames burst simultaneously from a hundred windows. Then there was only a pillar of fire and a rising column of smoke.

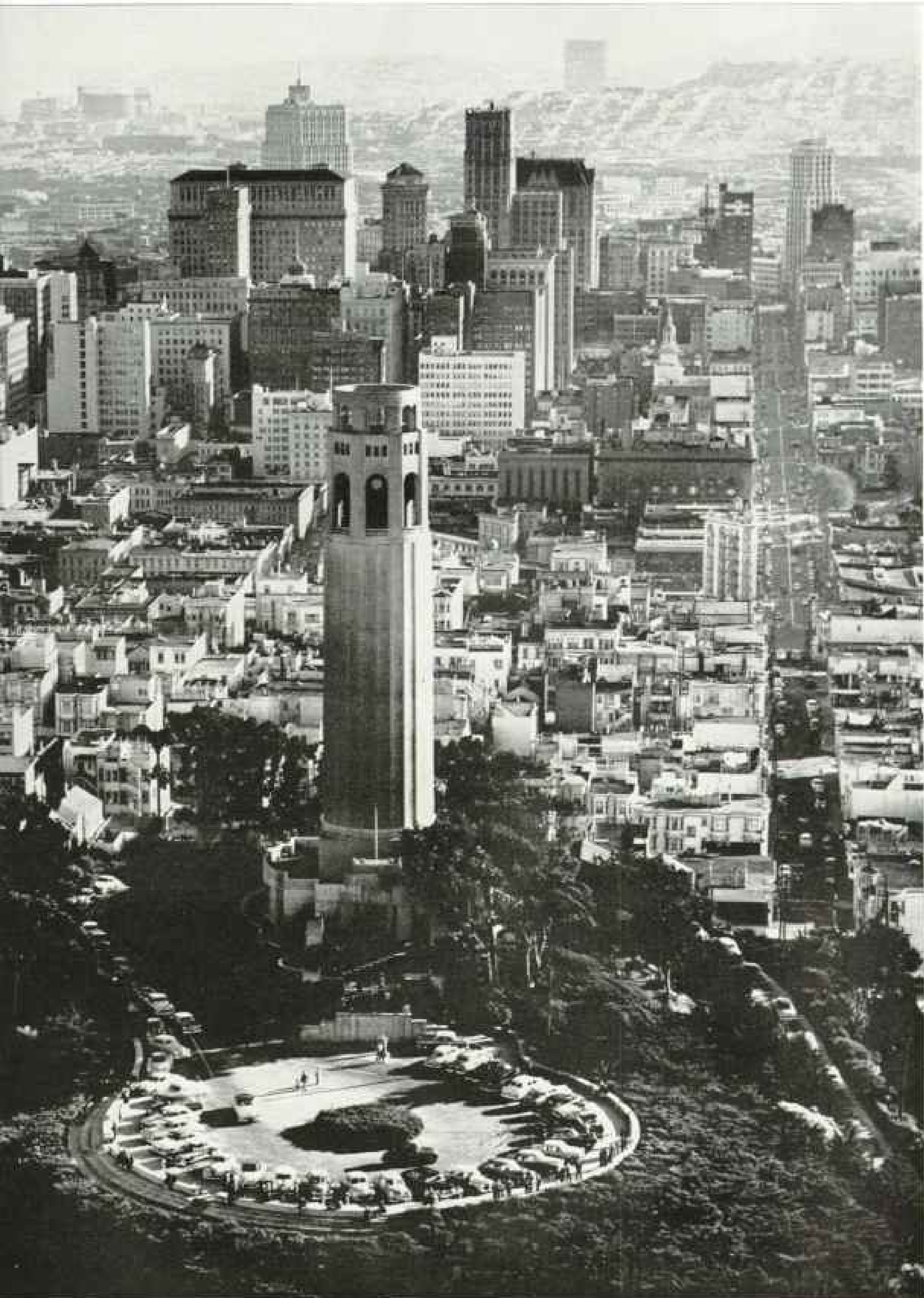
That night in San Jose, 40 miles to the south, incredulous men read newspapers by the light of the flames reflected in the sky.

There was no relief the next day. The Navy's Pacific Squadron steamed into the Bay, and bluejackets poured ashore to fight the flames and guard the smoking ruins. They brought food and medicine for the quarter-million harried people who had fled across the hills to take refuge in the Presidio and Golden Gate Park. But the fire crept steadily up



Sermon on the Mount Adorns the Pediment of Stanford University's Memorial Church

Leland Stanford, governor, senator, and railroad magnate, endowed the university as a memorial to his son. His widow built this interdenominational church in memory of her husband. Venetian artists created the mosaic.



Coit Tower's Fluted Column Raises a Glass-walled Lookout 400 Feet Above Bay Level
Telegraph Hill, once used as a ship watch, provides the leafy pedestal for this memorial to firemen.

from Market Street and Chinatown and across the crest of Nob Hill. Millionaire industrialists and Chinese laundry workers saw mansions and hovels flame and disappear. That night they took their evening meal from Army soup kettles and slept side by side in the park.

The third day saw the beginning of the end. On Russian Hill, a family saved its frame dwelling by dousing the smoking roof with cases of champagne and squirting it with seltzer bottles. And over on the slope of Telegraph Hill a group of Italian fishermen made a successful stand with blankets soaked in the barrels of new wine which they had rolled out of their cellars.

Saturday morning, three days after the earthquake, survivors heard the Army bugles sound a victory call. The refugees came back from the parks. The city, still under virtual martial law, counted up its losses.

Four-fifths of San Francisco had been destroyed, with some four square miles a sea of ashes. Between 450 and 500 people were dead; many of these victims were never to be accounted for. There were 1,500 injured and 250,000 homeless.

It was then that a reporter named Will Irwin wrote for his eastern paper a story that was to become famous. He titled it "The City That Was."

"The old San Francisco is dead," he began. "The gayest, lightest hearted, most pleasure loving city of the western continent... is a horde of refugees living among ruins... Those who have known that peculiar city by the Golden Gate... feel that it can never be the same."

"The City That Was" Comes Back

San Franciscans who knew both the old and the new cities will tell you emphatically today that Irwin could not have been more wrong. Even while he was writing, defiant homeowners were picking still-hot bricks from the rubbish of the dwellings, preparing to rebuild. Their estimated half-billion-dollar loss was eased by payment of about \$225,000,000 on fire insurance policies. After all, the city had been devastated six times previously by fire, and it had always come back bigger and better than ever. Why not this time?

Irwin overlooked one thing, and that the most important—the spirit of San Francisco. That spirit can burn with a white flame, but fire cannot destroy it. A poem by Lawrence W. Harris that was soon on everyone's lips

pointed that up. Harris called upon the world to note that San Francisco might lie in ruins, but that as for him:

I would rather bore a hole
And live right in the ashes than even move to
Oakland's mole.

The rebirth of the city was phenomenal. By 1910 a visitor could find little evidence of the holocaust. And the steady development of the city paused only briefly in its stride. The census of 1910 counted 416,912 residents in San Francisco.

Bay Area Population Keeps On Growing

That same census, however, showed even more strikingly the growth of the area which San Francisco serves. Oakland had more than doubled in size in 10 years, standing at 150,174. And neighboring Berkeley had tripled to 40,434. San Francisco, it was becoming evident, no longer stood alone. It was the center of an agricultural, industrial, and shipping complex which was to become known as the Bay Area.

The Bay Area today embraces the nine counties which touch on San Francisco Bay: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. Together they hold more than 3,000,000 people, almost double the 1940 population.

Frank E. Marsh, general manager of the Bay Area Council, told us something of the remarkable expansion of recent years.

"When the war ended, we expected our growth to slow down a bit," he said. "If anything, it picked up. Population increased nearly a million between 1940 and 1950, but it has gone up another half a million since then. Even our estimates for the future have had to be revised.

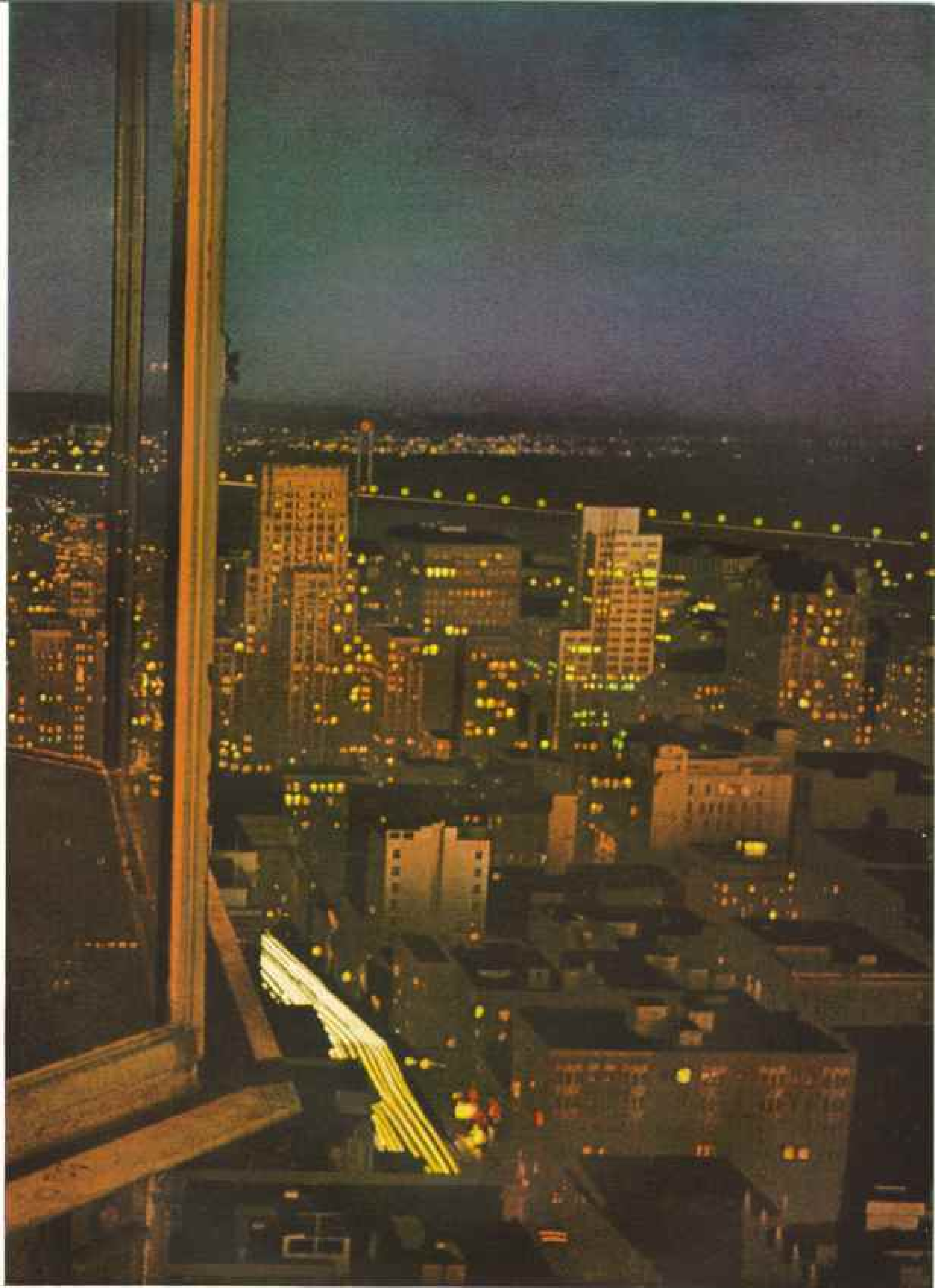
"In 1952, the Bay Area Rapid Transit Commission hired a firm to make population projections for 1970. The experts predicted that San Mateo County would have 350,000 people by that year, and Santa Clara County 400,000. Look what happened. By 1955 San Mateo County had reached 337,300, and Santa Clara had more than 425,000. We just can't keep up.

"The best index of growth is the price of land," Marsh continued. "An acre of industrial property in San Carlos that sold for \$220 in 1940 brought \$8,000 in 1950. Today it's priced at \$20,000. San Francisco property that brought \$3,800 an acre in 1941 sold for



From the Top of the Mark, San Francisco's Lights Weave Glittering Magic

Set high on Nob Hill, the Mark Hopkins Hotel rears 537 feet above sea level. Its glass-walled, top-floor lounge commands a breath-taking panorama. A visit here has become a tradition for San Francisco sightseers.



Bay Bridge Drapes a String of Jewels Across the Harbor's Dark Velvet

Pine Street streams ribbons of light. Massive buildings of San Francisco's financial district, the "Wall Street of the West," rise on the onetime gold rush waterfront. Oakland and Alameda twinkle across the Bay.

\$130,000 in 1955. Those are extremes, of course, but they show what's happening."

I asked Marsh if he expected the growth to continue.

"As long as we have space to hold it," he replied. "Our experts predict another 50-percent increase in population by 1970. And their predictions thus far have all been on the conservative side."

To find out a little more about what makes the Bay Area tick financially, I went over to the Montgomery Street headquarters of the Bank of America, largest private-enterprise bank in the world. The bank has been intimately connected with the growth of San Francisco since 1904, two years before founder A. P. Giannini escaped from the fire with the bank's cash hidden under a load of vegetables in a horse-drawn cart. He returned as soon as the ashes were cool to resume business at a desk placed on the Washington Street wharf. Today, with 592 branches, the bank has resources of nearly \$10,000,000,000.

President S. Clark Beise is a San Franciscan by choice rather than birth. He joined the bank in 1936 and became president in 1954. We sat in his paneled office, a vista of city and Bay behind us, a huge map of California on the wall in front.

Biggest Growth on Perimeter

"You must think of San Francisco as part of the Bay Area," he told me. "Remember that most of the growth of the past 15 years has not been in San Francisco and Oakland, but on the perimeter. Shopping centers in outlying districts serve many of the needs of their people. This is going to result, I think, in San Francisco's becoming even more 'citized' than it is today. Our department stores will tend to feature only high style, the sorts of things that can't be found in the neighborhood stores. But the scarcity of space downtown should keep property values increasing."

The population of San Mateo and Contra Costa Counties tripled between 1940 and 1955; Santa Clara and Marin Counties more than doubled. And Alameda County, with 852,700 residents, now surpasses the estimated 800,000 of San Francisco itself.

Getting all those people into and out of San Francisco is a matter which taxes the ingenuity of civic officials. Mayor George Christopher regards it as the city's No. 1 problem. A \$1,500,000,000 master plan, including an underwater tube between San Fran-

cisco and Oakland, a subway system within the city itself, and an elevated electric railway system linking San Francisco with its peninsula, has been presented by the Bay Area Rapid Transit Commission.

The San Francisco-Oakland Bay Bridge and the Golden Gate Bridge, marvels of the engineering world when they were opened 20 years ago, are already inadequate. A four-mile-long \$68,000,000 structure, the Richmond-San Rafael Bridge, will open in November to connect Contra Costa and Marin Counties. Today the Bay which once meant life itself to San Francisco is an obstacle to growth.

Many of the new plants along the peninsula supply materials for the electronics industry. An official of the Stanford Research Institute explained this million-dollar mushrooming.

"It's difficult for the west coast to compete nationally in the manufacture of heavy goods," he said. "Freight costs price us out of the market. But transistors and similar products weigh little in comparison with their value. These plants are selling skill instead of bulk.

"The important ingredient is brains. A lot of young scientists have come out here because living is so pleasant. Add that to the excellent research facilities at Stanford, the University of California at Berkeley, and our own institute, and you have the principal reason for the development."

Where Living Is an Art

President William Howard Taft once called San Francisco "The City That Knows How." It still does. But today, looking about at its burgeoning surrounding area, at factories where prune orchards once flourished, and at its harbor, it must occasionally ask: "The city that knows how to do what?"

The answer must come from one aspect of San Francisco which nothing has ever been able to change, and which for a century has given it a unique hold on the hearts of resident and visitor alike:

"The city that knows how to live."

Best of all, the beauty of the setting has not changed. An English visitor, quoted in Herb Caen's column in the *San Francisco Examiner*, summed it up perfectly.

"I feel sorry for the children who are born here," she sighed. "How terrible it must be for them when they grow up and find that the rest of the world is not as beautiful as San Francisco."

Alexander Graham Bell Museum: Tribute to Genius

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A Canadian Memorial Reveals New Facts About the Work of an American Scientist

BY THE HONOURABLE JEAN LESAGE

Minister of Northern Affairs and National Resources, Canada

RECENTLY we Canadians acquired—in trust for citizens of all the world—a priceless collection of experimental models, inventions, photographs, and notes that reflects the extraordinarily versatile mind of Alexander Graham Bell.

As I delved through this remarkable material, I found my thoughts going back to the birth of the Renaissance and the emergence of a new type of man—a daring, original thinker with a mind that tirelessly questioned and probed. So broad were his inquiries into Nature's endless enigmas that we know him as the Universal Man. Leonardo da Vinci is an example that immediately comes to mind.

Researches Led into Many Fields

Modern times, with their emphasis upon specialization, have produced only a few such men, among them Dr. Bell. We recall him as the inventor of the telephone, but his researches led him into many fields, including aeronautics, marine engineering, medicine, electrical science, genetics, eugenics, and the science of sound and speech. Everything seemed grist for his mental mill, and often his thoughts and experiments were far ahead of his day.

It is this engrossing but relatively little-known aspect of the inventor's life that Canada will portray in the new Alexander

Graham Bell Museum at Baddeck, Nova Scotia, near the distinguished scientist's beloved estate, Beinn Bhreagh. Government officials of Canada and the Province of Nova Scotia, and members of the Bell family, will formally open the building August 18.

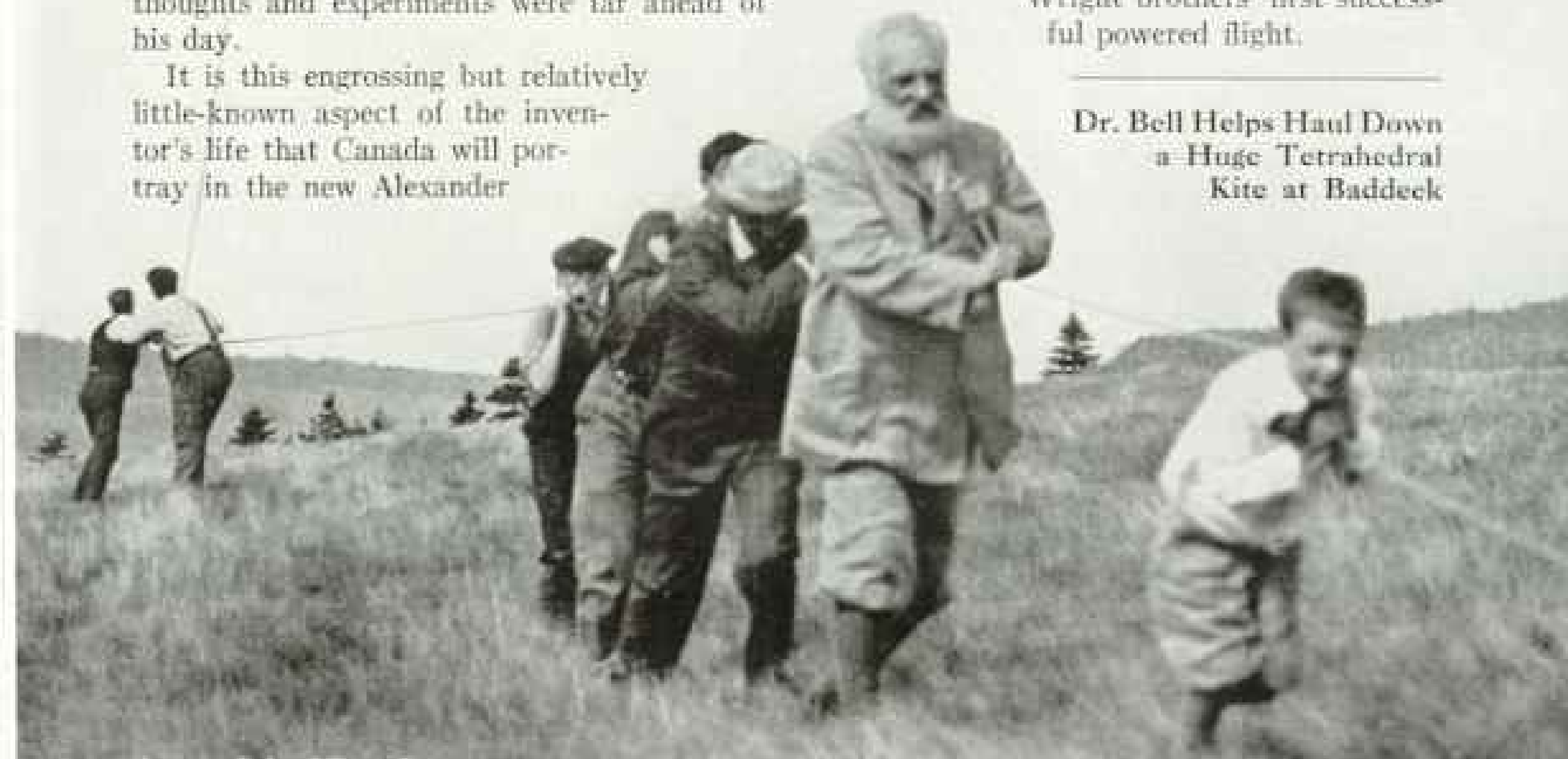
Here the visitor will see a remarkable legacy to science: scores of original items produced at the laboratory on Dr. Bell's estate. Some reveal researches never before made public.

Take, for example, the museum's collection of ingenious "winged fly-wheels," as Dr. Bell called them: small three-bladed propellers set in metal rings. They date from the 1890's, and today we would classify them as a form of helicopter rotor, for the inventor launched them vertically into the air.

Some he powered with a mechanical device, but on others he attached rockets at the blade ends. One large nonflying model, unringed and with a single blade, rotated by jet thrust! Tubes within the propeller fed alcohol vapor to the blade tips; the vapor, when ignited, spun the device.

Dr. Bell began the experiments in 1891, more than a decade before the Wright brothers' first successful powered flight.

Dr. Bell Helps Haul Down
a Huge Tetrahedral
Kite at Baddeck



Photograph by Gilbert Grosvenor



Alexander Graham Bell's Portrait Captures the Inquiring Gaze of a Scientist

Posing in 1919, Dr. Bell characteristically dictated notes while the artist painted. Canada is honoring the inventor this August by dedicating the Alexander Graham Bell Museum at Baddeck, Nova Scotia.

These researches, and others equally intriguing, are minutely described in his unpublished notebooks, all recorded on microfilm for the museum's collection. Notebook pages can be projected for viewing, and in years to come the valuable documents will draw many scientists, scholars, and historians to Baddeck.

The story behind the new museum begins with this small Cape Breton Island community, a picture-book village on the shores of the magnificent Bras d'Or Lakes (page 231).

Seeking a peaceful summer retreat for his family, Dr. Bell first came to Baddeck in 1885, nearly 10 years after his invention of the telephone. He was impressed by the bold grandeur of a wooded peninsula across Baddeck Bay, and it became Beinn Bhreagh, Scottish Gaelic for Beautiful Mountain. There he lived from spring to autumn for more than 35 years, and there he died August 2, 1922.

During this residence the Beinn Bhreagh laboratory turned out a flood of devices reflecting the inventor's genius. They ranged in size from big hydrofoil speedboats and man-carrying tetrahedral kites to complicated electrical apparatus and small units for distilling fresh water from the sea (page 248).

On all these projects Dr. Bell kept voluminous notes. He also recorded many of his thoughts and day-to-day activities, as well as his speeches and numerous articles.

Second President of National Geographic

When he died, his family preserved at Beinn Bhreagh all the laboratory products then existing, and his papers were carefully filed in a special room at your own National Geographic Society headquarters in Washington, D. C. Dr. Bell, a winter resident of Washington, was a leader in the small group of scientists who founded The Society, and he became its second President, 1898-1903.

Six years ago the laboratory collection, obviously of unique interest to Canada, became a subject of nonpartisan discussion on the floor of Parliament. Could the objects be acquired and exhibited?

Later this question was put to Alexander Graham Bell's daughters, Mrs. Gilbert Grosvenor and Mrs. David Fairchild. They generously donated not only their father's laboratory materials but copies of his notebooks and other volumes. Moreover, the National Geographic Society, as a memorial to its distinguished second President, presented to the Canadian Government big display enlarge-

ments of hundreds of historic photographs owned by Mrs. Grosvenor and Mrs. Fairchild.

These pictures illustrate many of Dr. Bell's researches and warmly portray his magnetic personality and his life at Baddeck. Many have never before been published.

It was agreed, in return, that the Canadian Government, through its Department of Northern Affairs and National Resources, would construct and maintain a suitable building for this extensive family collection. A committee composed of Canadian officials, members of the Bell family (grandson Melville Bell Grosvenor and granddaughter Nancy Bell Fairchild Bates), and leading citizens of Baddeck was organized to plan the museum.

Tetrahedral Principle Used in Design

"Suitable," I feel, is far too prosaic a word for the building design that evolved; it became an expression of the inventor himself. Architect O. H. Leicester brilliantly employed as motif the tetrahedron, a cell with four triangular faces, which Dr. Bell used in constructing his huge man-carrying kites. Mr. Leicester's plans were developed by the Canadian architectural firm of A. Campbell Wood and Associates.

Strikingly unique in appearance, the \$375,000 structure stands atop a hillside knoll in Baddeck, part of a 14-acre site donated by the Province of Nova Scotia (pages 231 and 232). Big picture windows, set in heavy timbers, look across blue waters to the wooded heights of Beinn Bhreagh (page 250).

Mrs. Grosvenor and Mrs. Fairchild will dedicate this handsome building not only to their father but to four of his associates: F. W. Baldwin, John A. D. McCurdy, Glenn H. Curtiss, and Lt. Thomas E. Selfridge. With Dr. Bell as leader, they formed at Baddeck the Aerial Experiment Association, which pioneered in the construction of aircraft and introduced to American aviation the hinged-surface, wing-tip aileron control.

On February 23, 1909, McCurdy flew a distance of half a mile, skimming the ice of Baddeck Bay, in the Association's *Silver*

The Author

Montreal-born Jean Lesage, of French-Canadian origin, holds degrees in arts and law from Laval University, Quebec. A former Crown Attorney, he was first elected to Canada's House of Commons in 1945 when only 33. Since 1953 he has served as Minister of Northern Affairs and National Resources, equivalent to U. S. Secretary of the Interior. His department planned and will supervise the Bell Museum.



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↑ Beinn Bhreagh Hall,
Bell's Beloved Home,
Stands near Baddeck

In 1885, nearly a decade after the telephone's invention, Dr. and Mrs. Bell spent a summer at Baddeck. It was their first visit to Cape Breton's serene and lovely Bras d'Or Lakes, and never again were they long away. Buying a wooded peninsula near the town, they named it Beinn Bhreagh (Scottish Gaelic for Beautiful Mountain). They built their spacious home as a refuge from the summer heat of Washington, D. C., and occupied it in 1893.

Here the scientist's daughter, the former Elsie May Bell, strolls Beinn Bhreagh's grounds with her husband, Dr. Gilbert Grosvenor, and their son, Dr. Melville Bell Grosvenor. The United States flag flies in honor of the Fourth of July.

→ Beinn Bhreagh estate looks across Baddeck Bay to the village of Baddeck. These waters witnessed many of Dr. Bell's scientific researches.

→ Page 231, upper: Bell Museum stresses the tetrahedral shape that Dr. Bell used in designing his man-carrying kites. Canada built this \$375,000 structure to house a priceless collection donated by the Bell family.

© National Geographic Society

Establishment by Anne Grosvenor (upper),
Joseph P. Blair III (lower right),
and Melville Bell Grosvenor







*Dart.** This was the first airplane flight in Canada and the first by a British subject anywhere in the British Empire.

A former Lieutenant Governor of Nova Scotia, Mr. McCurdy is the sole survivor of that little group and will attend the ceremonies.

Later I want to tell you more about the A. E. A.'s historic work, but right now let's stroll through the museum.

Entering its broad portal, one of the first things you see is this printed statement, photographically enlarged and prominently displayed near the foyer:

The inventor is a man who looks around upon the world and is not contented with things as they are. He wants to improve whatever he sees, he wants to benefit the world; he is haunted by an idea, the spirit of invention possesses him, seeking materialization.—Alexander Graham Bell.

This is an excerpt from a speech he delivered to the Patent Congress of 1891 in Washington, D. C. It describes, in far better words than I can command, both the man himself and the message of the museum.

Many people, I suspect, think of a museum as a rather somber place with echoing corridors and a maze of rooms. But visitors to the Bell memorial find themselves in a very different atmosphere.

The ground floor, one spacious room beneath massive beams, runs the length of the building, with open staircases leading to a mezzanine and lower level—an arrangement that suggests the modern split-level home (opposite and page 237). Warm colors are everywhere, and there is even a flower garden in a corner nook.

Old Notebooks Forecast the Future

But the architect owes his most intriguing touch to Dr. Bell. Pages from the unpublished laboratory and home notebooks were reproduced on glass by a photographic process, and the builders inserted these glass panels in doors, windows, and partitions. Each facsimile shows the scientist's pen-and-ink notes, enlivened by his own sketches of some new device or idea (page 240).

Many will startle you, so prophetic do they seem today. Glancing at a panel dated June 30, 1910, you see a little one-man helicopter hovering in mid-air. And here, on July 1, 1893, a model rocket plane roars aloft (p. 249).

A man-carrying kite powered by airplane propellers and designed for a water take-off streaks across the page for September 4, 1907.

*See "Fifty Years of Flight" (Historic Photographs), NATIONAL GEOGRAPHIC MAGAZINE, December, 1953.



← **Bell Museum's Design
Suggests a Modern Home
with Tetrahedral Motif**

Canadian officials and members of the Bell family are formally opening this striking building August 18.

Visitors will see many experimental models and inventions produced at Dr. Bell's Brinn Through laboratory prior to his death in 1922. The inventor's daughters, Mrs. Gilbert Grosvenor and Mrs. David Fairchild, recently presented these valuable objects to the Canadian Government. They also donated microfilm records of their father's unpublished notebooks, and the National Geographic Society provided display enlargements of some 600 historic Bell photographs (page 239).

Triangular roof, entrance, and windowpanes call to mind the scientist's many experiments with tetrahedral construction (pages 234, 238, and 243). Heavy slates on roof came from England. This view shows the museum before recent landscaping.

↓ The interior, a split-level three-story arrangement, commands a magnificent view through picture windows of the Bras d'Or Lakes. Display cabinets in tetrahedral style hold hydrofoil boat models and small experimental propellers.

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Joseph P. Blatz (left) and Willard H. Cullver, National Geographic Staff





Tetrahedral Observation Hut Shields Dr. Bell and Father from Chill Winds

Tetrahedral forms might be called a Bell trademark, so widely did the inventor employ them in kites and engineering construction. He built this shelter for viewing kite experiments at Baddeck. Patriarchal beards and snowy hair gave father and son a remarkable resemblance. Here, in 1902, Dr. Bell (left) lounges on a couch and dictates to a secretary. Alexander Melville Bell, inventor of the phonetic system called Visible Speech, shaped his famous son's interest in the science of sound.

Dr. Bell's notation says, "Exhaust might discharge to the stern and thus help engine thrust." Today this same principle gives additional speed to several airliners.

Other pages reflect the amazing breadth of his interests. You examine one dated May 23, 1911, and find an underwater swimmer breathing through a device resembling the submarine snorkel. Or perhaps you pause before my favorite, an experiment of September 14, 1892. It shows one of his workmen wearing a forerunner of the iron lung!

Near by is the actual apparatus, a snug-fitting metal vacuum jacket attached to a hand bellows. By pumping the bellows, one could vary the air pressure within this strange garment, and the changing pressure would alternately squeeze and release the subject's chest, forcing him to breathe. Dr. Bell

thought that the device might save the lives of premature babies and drowning persons.

Walking past the other exhibits, you may reflect that here, indeed, is the "spirit of invention"—strangely shaped propellers taller than a man, a racy-looking model boat with miniature aircraft engines, bizarre helicopter blades... These are relics of Baddeck days, but no portrayal of the inventor would be complete without the telephone.

Years ago the American Telephone and Telegraph Company gave to Dr. Bell's daughters numerous reproductions of their father's original instruments. These are on display, together with examples of several very important but lesser known inventions: a multiple telegraph, the photophone, and the graphophone.

But I am not going to attempt a lengthy recital of contents, some 1,000 individual

items. Instead, let us turn to the museum's unique research sources for the story of Dr. Bell's life and achievements. Most of our original material deals with post-telephone days, a busy and productive period of his life that should be better known.

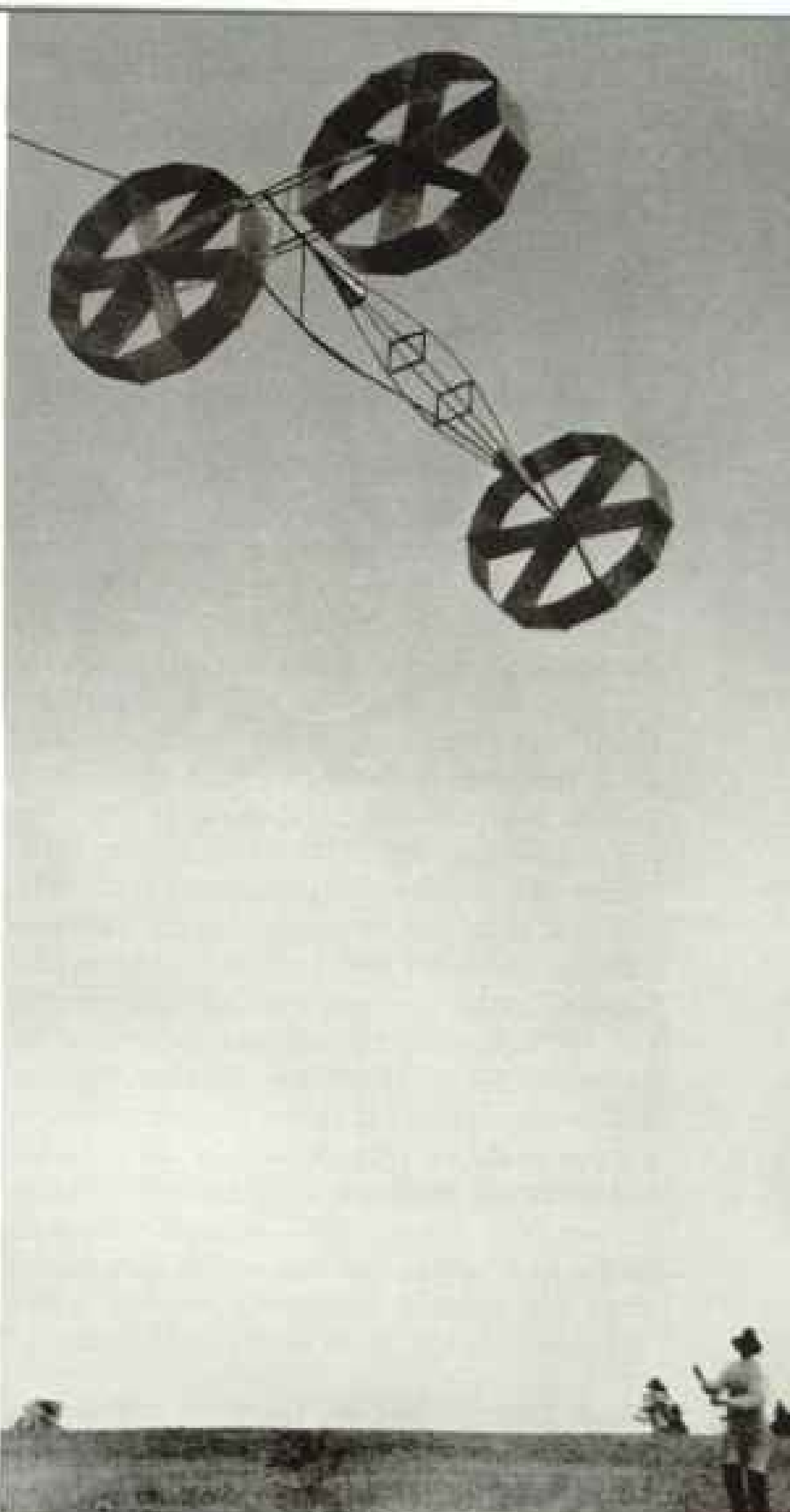
A Debt to Famous Forebears

The father of the telephone always believed in the predominant role of heredity in shaping one's course, and his own career might be cited as a case in point.

He was born March 3, 1847, at Edinburgh, Scotland, into a family noted for its pioneering in the science of speech. His grandfather, Alexander Bell, had gained wide reputation as a lecturer and speech teacher. The inventor's father, Alexander Melville Bell, brilliantly pursued the same calling and became famous as the inventor of Visible Speech. His phonetic system gave a symbol to each position taken by the organs of speech in reproducing sounds. A person who mastered these relatively few symbols could reproduce any sound in any language.*

Alexander Graham Bell and his two brothers

*See "Deaf Children Learn to Talk at Clarke School," by Lillian Grosvenor, NATIONAL GEOGRAPHIC MAGAZINE, March, 1955.



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♣ Bizarre Wheels Float Like Feathers Above a Beinn Bhreagh Field

In the 1890's, when Dr. Bell began his aerial experiments, engines could not support a heavy machine in the air, let alone a man. The inventor thought a big stable kite might be the answer to manned flight. If strong enough, it could support both engine and pilot.

So the father of the telephone experimented with many kite shapes, including this 1902 model flying from a pole (not shown).

Each of the three wheels has 12 fabric-covered sides braced by six "wings" arranged like spokes. A workman holds a cord tied to the tail.

♣ Mrs. Bell Measures the Tug of a Kite Attached by Cord to a Scale

Mabel Hubbard Bell played an inconspicuous but active role in all her husband's projects. At her suggestion, he formed the famous Aerial Experiment Association in 1907, and she backed it financially (page 249). The photograph was taken in 1903.

David G. McCurdy, © Bell Family



became expert in Visible Speech at a tender age. Soon the inventor-to-be tried his own wings as a music and speech teacher at a school in Elgin, Scotland. Later he rejoined his father, who had built an extensive practice in correcting speech defects and needed his son's help.

Visible Speech had developed into an important tool for unlocking the tongues of persons born deaf, or those deafened at an early age. Separated from mankind by a wall of silence, they could not learn to speak by imitation, as normal persons do.

Young Bell plunged into his work with enthusiasm. One of his earliest journals, dated 1868, describes in detail how he taught speech to four deaf children. He drew in his notes the symbols studied, and he listed the capabilities and step-by-step progress of each child.

Then, with little warning, tragedy intruded into the dedicated Bell household. Alexander Graham's two brothers died of tuberculosis, and for a time he himself was threatened by the same illness. His father, who had lectured in Canada, decided to move there in search of a more healthful climate, and in 1870 the bereaved family settled near Brantford, Ontario.

Soon the young man regained buoyant health and rededicated himself to penetrating what the beloved Helen Keller once called "inhuman silence which severs and estranges."

A Lecture Begins American Career

In 1871 he substituted for his father as a lecturer to teachers of the deaf at Boston, Massachusetts. This venture, triumphantly successful, launched his career in the United States. He gave several other lectures at that time and returned the next year to open in Boston a "school of vocal physiology."

His work soon brought him to the attention of Gardiner Greene Hubbard, a wealthy Boston lawyer, later a founder and the first President of the National Geographic Society. Mr. Hubbard's daughter, Mabel, had been deaf since an attack of scarlet fever as a small child, and he wanted the young specialist's advice on improving her speech.

Here fate dictated a chapter in Bell's life more romantic than any work of fiction. Mabel Hubbard, an attractive, intelligent girl with a gift for painting, became his pupil, and soon the couple fell in love. From that moment, Mabel Hubbard's inspiring influence was present in every project the distinguished scientist undertook (pages 235 and 256).

Not until 1877 were they married, for the suitor, a relatively poor man, felt that he had to prove himself before he could hope for marriage. From 1873 to 1876 he worked at an exhausting pace on several bold inventions suggested by his expert knowledge of sound.

Industry promised rich rewards for a device that would send two or more Morse messages over the same telegraph wire. Though he then had little knowledge of electricity, Bell attacked the problem with characteristic optimism.

Early Researches Lead to Telephone

It had long been known that a tuned reed would vibrate when its own note was sounded near by. Here, he thought, was a fact worth exploring, so he devised a series of reed transmitters and receivers attuned to signals of different pitch. Each receiver would vibrate only in response to the proper signal from its own transmitter. Bell called this device the multiple, or harmonic, telegraph and obtained two patents on it.

Another idea produced a novel modification of the phonograph, a device for tracing sound patterns on smoked surfaces. The young inventor thought that this machine, if it could be improved to reproduce the pattern of speech, would be useful in his work with the deaf. Tracings could be reproduced and used in teaching correct speech.

On the advice of an aurist he obtained a human ear for his machine. Attaching a straw to the back of the ear, he made many successful tracings of his voice pronouncing vowels.

These various researches in electricity and sound did not prove of commercial value, but the experience gained led unerringly to Bell's consummate achievement, the telephone.

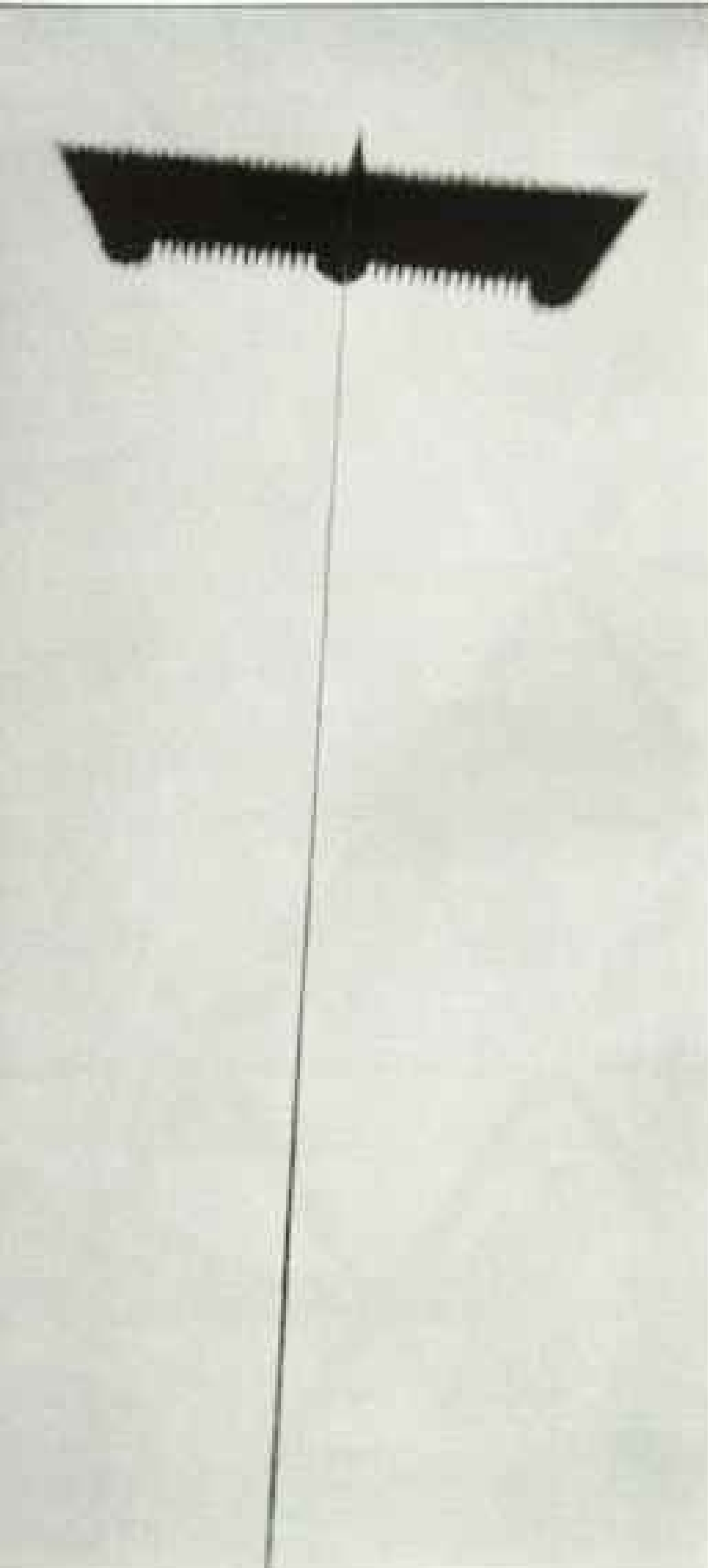
The story of the telephone is one of the most familiar in modern science. I shall not retell it beyond stressing the inventor's brilliant fundamental concept: that a current of electricity could be made to vary in intensity with the sound of the human voice, and that these variations could be reproduced by a receiver as speech. Bell, who had the financial backing of his future father-in-law in these early researches, obtained his basic patent on the invention in 1876.*

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "New Miracles of the Telephone Age," by Robert Leslie Conly, July, 1954; "Miracle Men of the Telephone," March, 1947, and "Miracle of Talking by Telephone," October, 1937, both by F. Barrows Colton.



Fifty-year-old Kites and Modern Window Reflect a Kinship in Design

Dr. Bell's tetrahedral kites inspired architect O. Howard Leicester. The two-story window, 35 feet high, contains 45 triangles. Curator Charles M. Bowman stands on the main-floor landing.



← **Huge *Cygnets*, a Bird on Leash, Bears a Man to a Height of 168 Feet**

Beinn Bhreagh became the center of a strange industry in the early 1900's. Seamstresses covered thousands of tetrahedral cells with colorful silk, and workmen assembled these cells, honeycomb fashion, within the framework of giant kites. The cellular arrangement proved ideal, giving stability, strength, and powerful lift.

Dr. Bell's experiments culminated in his 208-pound *Cygnets*, designed to carry both a man and an engine.

On December 6, 1907, the inventor ordered *Cygnets* out for a trial run prior to engine installation. Lt. Thomas E. Selfridge, U. S. Army, rode the kite as volunteer passenger.

Cygnets was placed aboard a barge and towed by steamer into the wind on Baddeck Bay. Soon she became airborne and flew gracefully for seven minutes at the end of a towline before settling on the water.

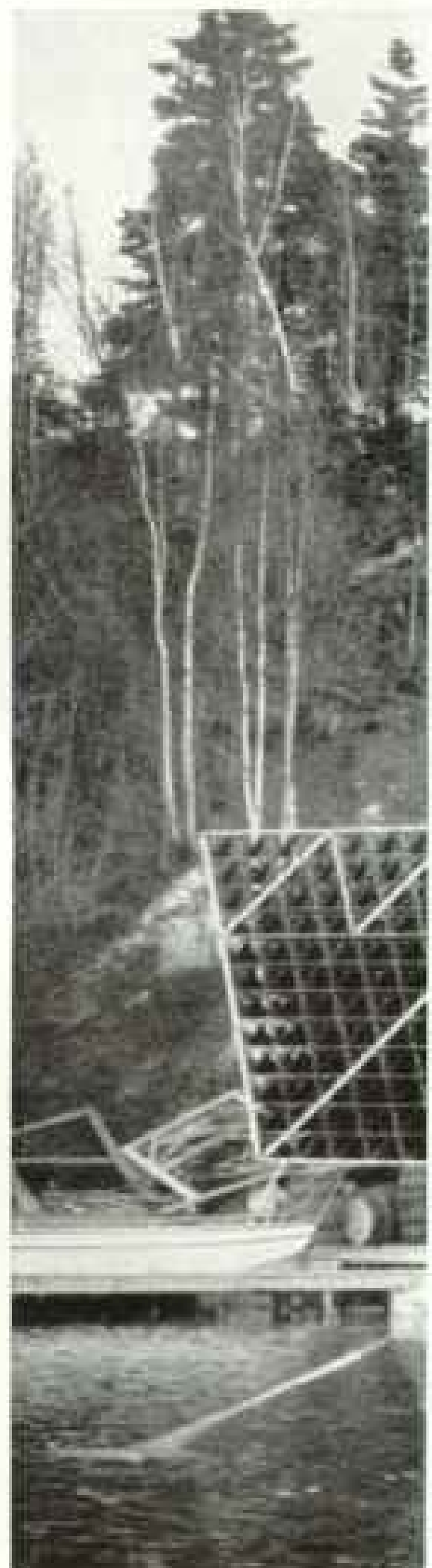
→ Several days earlier workers tested the barge's balance with *Cygnets* in position and her passenger aboard. Dr. Bell (right) supervised the work.

The Lodge, Bell's first home at Baddeck, stands above the kite shed.

Lower right: The kite had no controls. Her "pilot" rode on his stomach in the center of the structure, which contained 1,393 cells. Here a workman takes Selfridge's position.

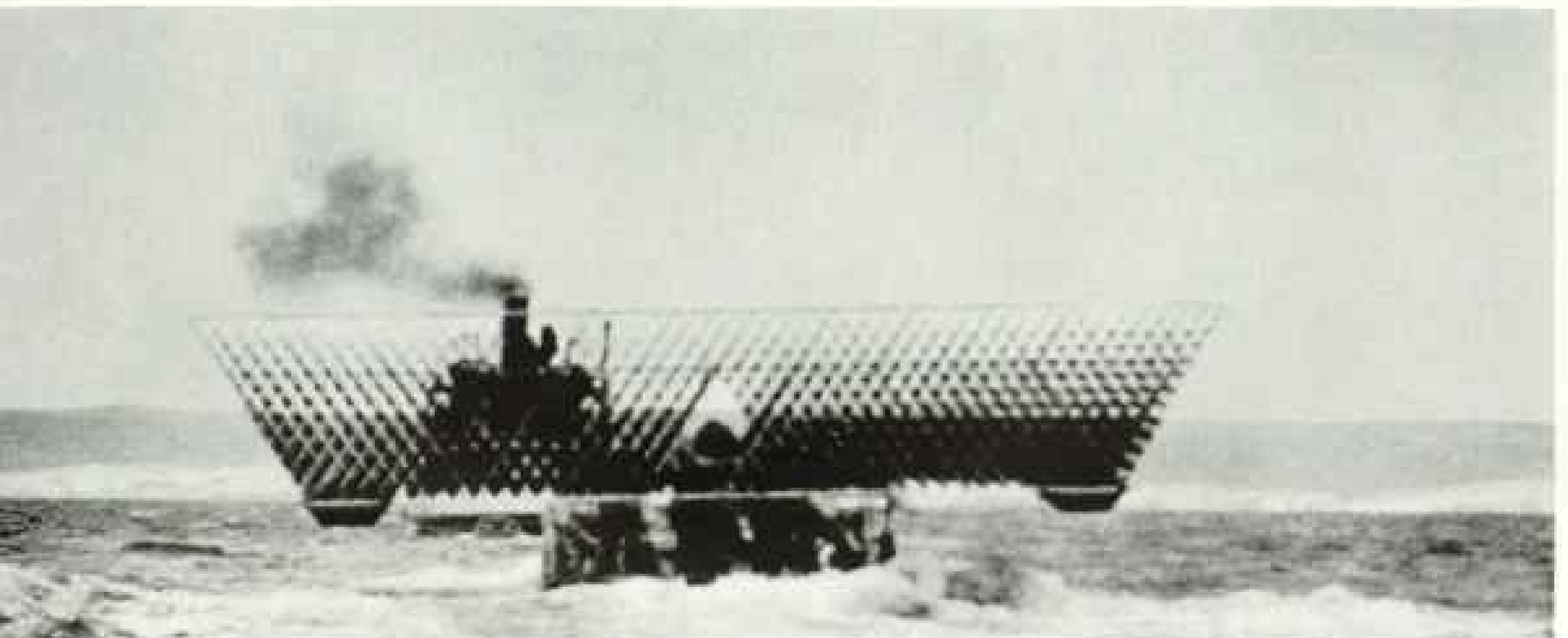
Later Lieutenant Selfridge died at Fort Myer, Virginia, in the crash of a Wright brothers' plane being tested for the United States Army. He was powered flight's first fatality.

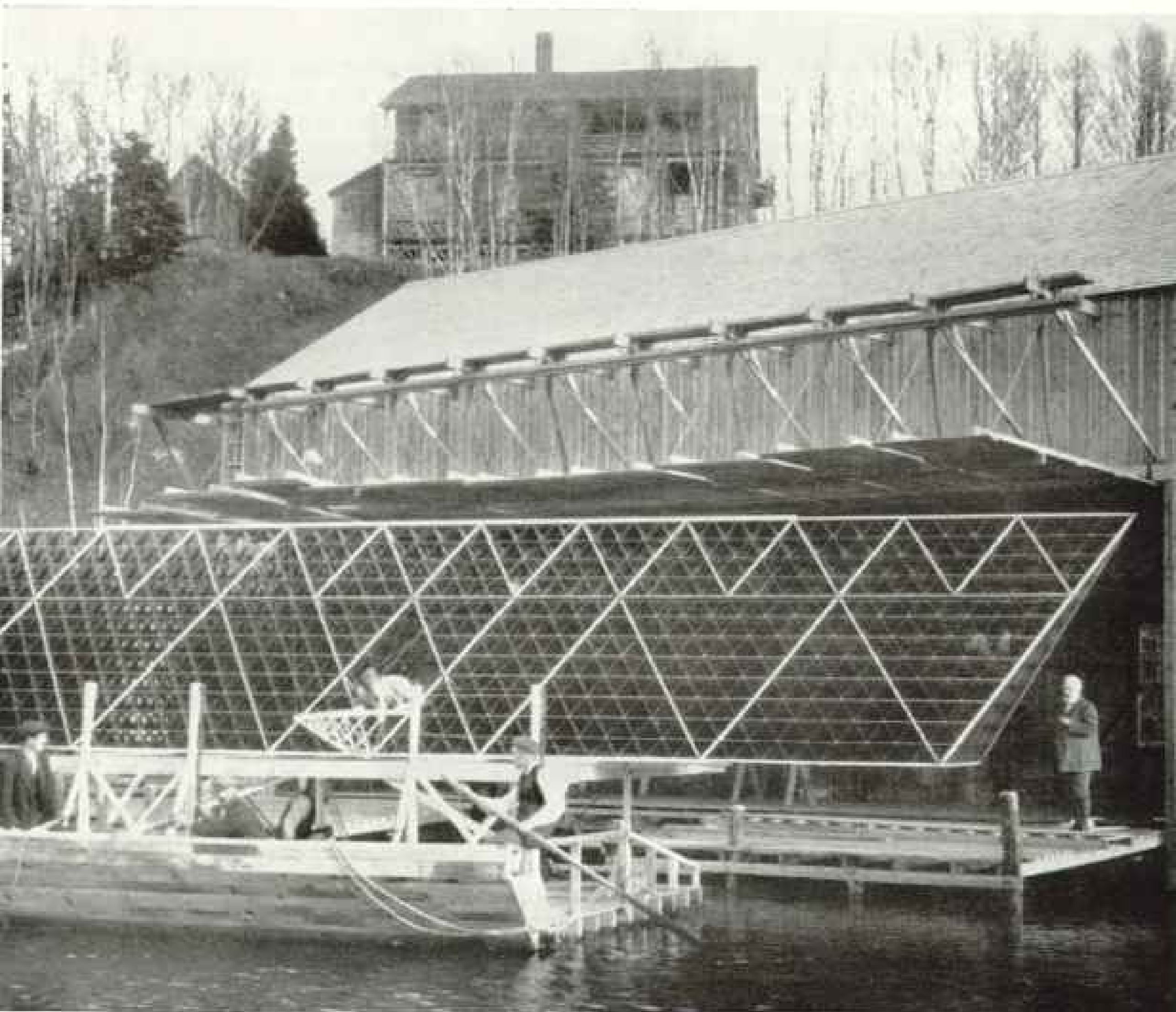
John G. Davidson (left) and John A. D. McArthur. © Bell Family



↓ **A Steamer Tows *Cygnets* Across Baddeck Bay Toward a Rendezvous with History**

Crewmen, mouths agape at the sight of a man flying, forgot to sever *Cygnets*' towrope when she settled gently on the water. The kite was dragged and destroyed, but Selfridge suffered only a chilly wetting.





With the telephone came recognition and, eventually, the independence of moderate wealth. While still a young man, he moved his family to Washington, D. C., became a United States citizen, and plunged anew into scientific research.

Certainly he looked the part of a distinguished scientist. Contemporary accounts describe him as tall, with pale complexion and bushy black beard and hair, now beginning to show traces of gray. Invariably those who met him remarked upon his piercing black eyes and beautifully modulated speech.

This era saw the birth of perhaps his most unusual device, the photophone. With it, he and his associate, Sumner Tainter, attained the first wireless transmission of speech.

The photophone utilized a then strange and wondrous element called selenium. In crystal form its electrical conductivity increases with the amount of light. Dr. Bell reasoned that,



by using this conductivity, it should be possible to talk over a beam of light!

And he did. He placed near the selenium a mirror thin enough to vibrate with the tones of the voice. Words spoken to the back of the mirror caused vibrations in a beam of light falling on the mirror's face. This light was then directed with a lens onto a parabolic reflector that contained a sensitive selenium cell. When in circuit with a telephone, the crystal reproduced speech.

The invention would even send beams of speech over a distance, so long as transmitter and receiver were in line-of-sight operation. Tainter once climbed atop the Franklin School building in Washington and directed these words to his chief, who had stationed himself

in a workshop more than 250 yards distant:

"Mr. Bell, Mr. Bell, if you hear what I say, come to the window and wave your hat!"

Soon a bearded figure appeared at the window, joyfully brandishing a hat.

As a means of communication, the photophone could not rival the telephone or the later radio. But it did embody principles that link it to development of the motion-picture sound track, photoelectric cell, and modern transistor.

The next year, 1880, France awarded Dr. Bell its Volta Prize of 50,000 francs for his invention of the telephone. In May, 1881, he used the money to establish in Washington the Volta Laboratory Association, with Tainter and a cousin, Chichester A. Bell, as associates.

Their most impressive legacy to us was the graphophone, the first commercially successful recording machine. Edison had invented the phonograph, which recorded on cylinders of metal foil. The Volta Associates, however, invented wax cylinders, which recorded more distinctly, and they also experimented with the flat disc, ancestor of the modern record.

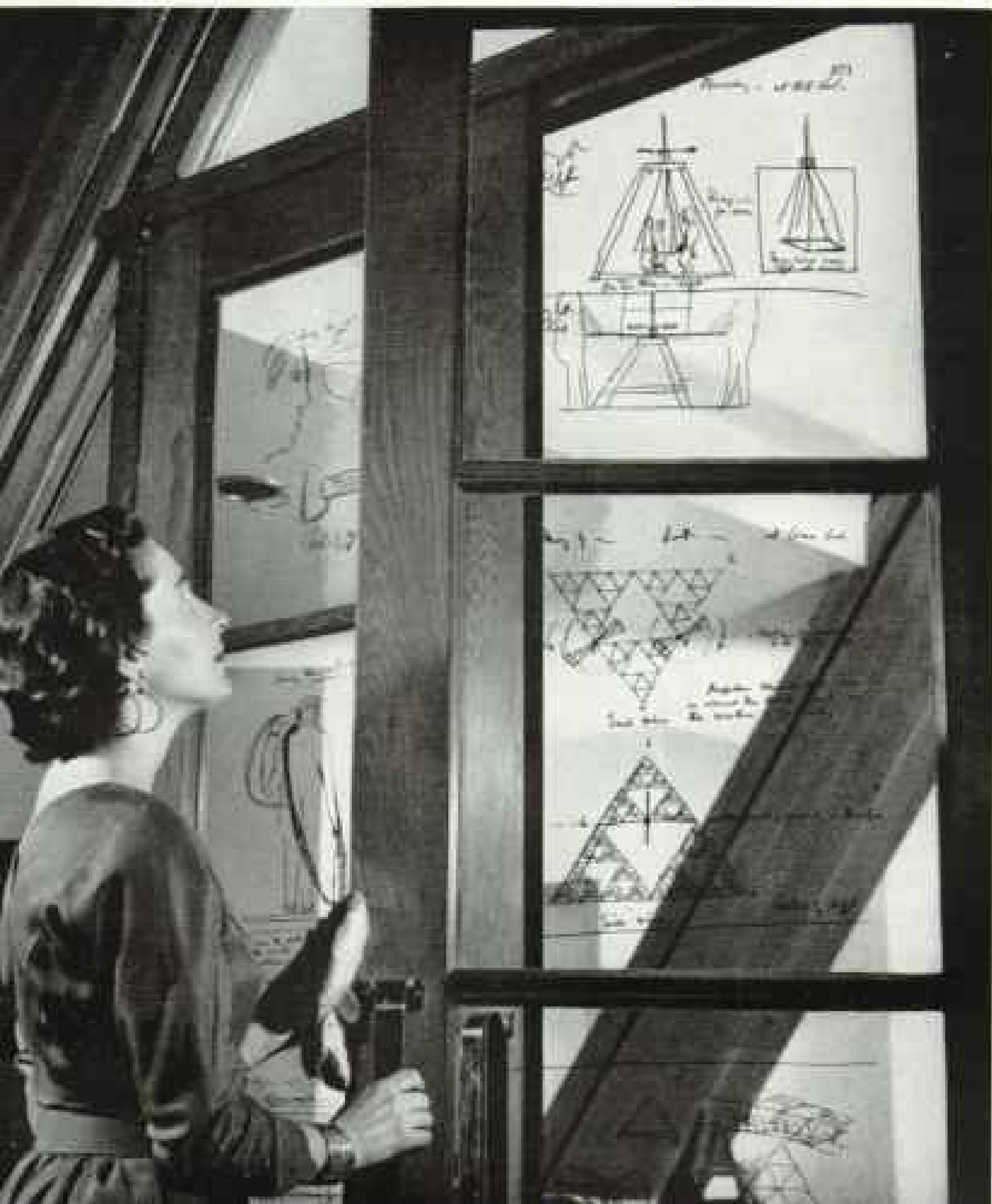
Dr. Bell received \$200,000 as his share from the sale of graphophone patents and promptly gave it all to the Volta Bureau, formed by him "for the increase and diffusion of knowledge relating to the deaf." This agency continues its good work today at 1537 35th Street, N. W., in Washington, D. C.

Throughout his long life the scientist fought for humane education of the deaf. He wanted them taught speech and lip reading, not a sign language that set them apart from normal persons. Helen Keller, who was

Dr. Bell's Notebook Sketches Intrigue a Visitor

The inventor's notes contain hundreds of pen-and-ink drawings illustrating his devices and ideas (pages 244 and 249). A British firm reproduced many of them on glass for insertion in the museum's doors and windows. This visitor, at the front entrance, examines an 1894 sketch (upper right). It represents Dr. Bell's conception of how workmen might launch into the air small "winged fly-wheels" resembling helicopter rotors.

Willard B. Carter, National Geographic Staff



blind and deaf from early childhood, and whose education he helped direct, showed what could be done (page 254).

Invariably, even until his death, when asked to state his profession he replied proudly, "I am a teacher of the deaf."

Dr. Bell conducted extensive researches in the heredity of deafness and showed that people born deaf, from families with a history of deafness, who intermarry were more prone than hearing persons to have deaf children. He urged that these people be integrated into society, where they might marry normal persons.

Later he published a massive work on longevity and, in classic studies, attacked the "sense-compensation theory." This popular notion maintained that a person defective in one sense attained greater sensory acuity in another.

The development of his surgical probe shows Bell the improviser at his brilliant best.

When President Garfield was shot, July 2, 1881, the famous inventor offered his services to help locate the imbedded bullet. He devised an induction balance wired to a telephone and an alarm clock. With the system in balance the clock was inaudible, but the presence of a metallic object near by would throw the system out of balance and the clock's ticking could be heard in the telephone.

Bell's device failed to locate the bullet because President Garfield's attendants had placed him on a steel spring mattress without telling the inventor, who had directed that no metal be in or around the bed. As a result, the experiment was not successful.

Lessons learned in developing the induction method led to Dr. Bell's successful probe, used



"Comes a Pause in the Day's Occupations ..."

Like Longfellow, Dr. Bell enjoyed a "Children's Hour." Adults might have been awed by his towering fame, but his grandchildren were not. To them he was "Gampy," who told exciting stories and liked to romp with youngsters. Here he enjoys a stroll with daughters of Dr. and Mrs. Gilbert Grosvenor: Gertrude (left), Lillian (in arm), and Mabel.

by surgeons for many years before X ray's advent. It consisted of a fine needle, wired to one terminal of a telephone, and a metal plate connected to the other terminal. Contact of needle and bullet produced an audible click in the telephone.

Pioneer in Air-conditioning

As a Canadian, I might be neutral on the subject of Washington's summer weather—but Dr. Bell was not. He disliked the heat. Though he cleverly air-conditioned the study of his home—thus pioneering in home air-conditioning—the ultimate solution seemed



Dr. Bell Boosts a Grandson on His Favorite Horse

The inventor encouraged his grandchildren's interest in nature and introduced them to Beinn Bhreagh's farm animals.

Here, in 1903, the scientist studies grandson Melville Bell Grosvenor aboard "Champ."

Old and intelligent, Champ grew accustomed to the Bell routine. When harnessed and hitched to a buggy, he would trot off by himself to the Hall. There he waited patiently until Dr. Bell emerged with a gift of sugar, mounted the carriage, and clapped his hands. Thereupon Champ carried his master a mile to his office without a touch from the reins. A handclap sent him back alone to the stable.

Gilbert Grainger

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to be a summer residence elsewhere. His thoughts turned to Canada, land of his youth, where in August, 1876, over the eight miles separating Paris and Brantford, Ontario, he had conducted the first long-distance telephone conversation.

Cape Breton's rolling hills and windy seascapes reminded him of his native country. The families, of Scottish descent, bore names reminiscent of a roster of Highland clans. Here the Edinburgher felt much at home.

Beinn Bhreagh's strange experiments became the talk of the countryside. Mighty queer antics for a grown man, the local people thought, and shook their heads. But they liked and respected their famous resident and developed a strong civic pride in his presence among them.

Studies the Flight of Birds

Dr. Bell was soon preoccupied with the problems of artificial flight. He had long pondered the subject. His papers show many notes, made during his honeymoon in 1877, on the flight of crows. He concluded that a heavier-than-air machine was feasible and thought it should be "supported by the revolution of a fan wheel or screw."

Now, in the 1890's, he reaffirmed that faith in numerous public statements. In 1893 he told an interviewer, "I have not the shadow of a doubt that the problem of aerial navigation will be solved within 10 years." And it was—in 1903.

The kind of aircraft he first envisioned is revealed in an unpublished statement dictated to a secretary and entitled, "The Flying Ma-

chine of the Future; as Conceived in 1892."

Said Dr. Bell: "In order that there may be safe ascent and descent, it seems to me necessary that the machine must have the power of hovering in the air at any desired height, and of ascending and descending slowly without horizontal velocity.

"In order that there may be translation from place to place, the machine must also be capable of horizontal motion in any desired direction."

These, of course, are the essential characteristics of the modern helicopter, perfected more than 40 years later.

The basic idea of a man traveling through the air beneath rotating blades was not new. Leonardo da Vinci, Universal Man prototype of Dr. Bell, once sketched such a device. But what shape should the rotor take? And how would it be powered for testing? The inventor sought answers with the "winged fly-wheels" mentioned on page 227.

He experimented with many blades of different design, seeking ones that would give good lift. Usually he mounted them on a wheel-shaped turntable, then spun the turntable with a rope wound about its base. A tripping mechanism released the "wings" at his command, and they took off and soared. On November 21, 1893, he noted in his journal: "Went up higher than ever before—certainly over 150 feet. Mr. Ellis [an assistant] says safe to say 200 feet."

A year earlier he had begun experiments with rocket propulsion, and his notebooks record many attempts to develop a satisfactory fuel. Assistants mixed gunpowder with vari-



Dedicatory Bunting Flies from a Tetrahedral Tower Atop Beinn Bhreagh: August 31, 1907

Dr. Bell built the 80-foot viewing stand to demonstrate the tetrahedron's strength. Weighing less than five tons, it supported heavy loads despite seeming fragility. Men assembled its iron legs on the ground and jacked them up.

ous inert ingredients—plaster, sand, sugar, and others. They used shellac as a binder, then touched off a pinch of each mixture with a red-hot poker to test combustion.

If a batch looked promising, the men poured it into slender paper containers, which their chief called "quills," and attached the home-made rockets to tips of rotor blades. Dr. Bell installed on several models a system of electric fuses to fire each rocket in sequence, one tak-

ing over as another burned out, while the rotor whirled madly.

A number of these devices rose into the air, though not to very great height.

The experiments must have been hair-raising, as the inventor indicates in a cartoon-like notebook sketch (below). It shows one of his men peering from behind a tree at a thrashing blade while a second figure, possibly Dr. Bell, writes notes.

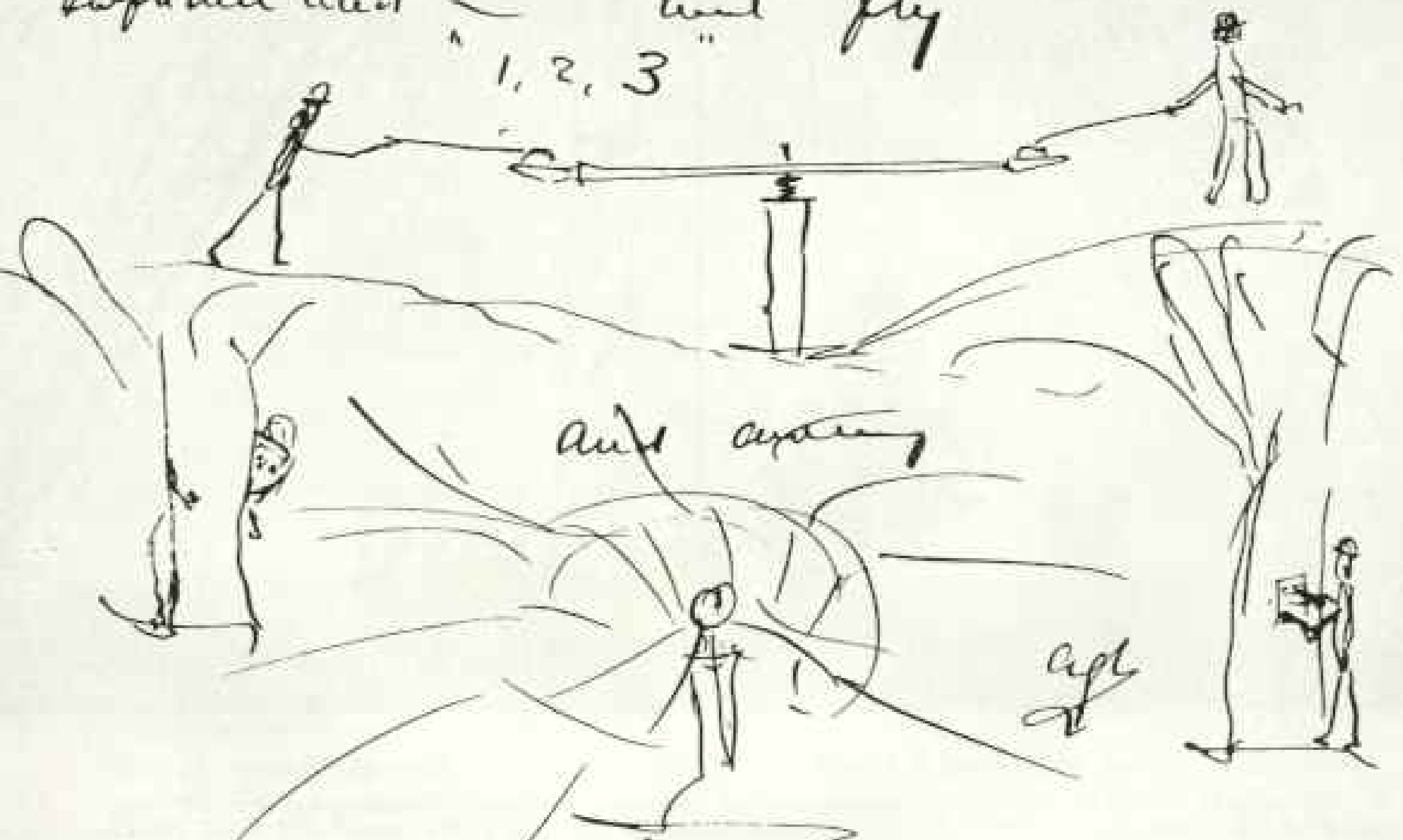
Dr. Bell Illustrated Scientific Notes with His Own Cartoonlike Sketches

The notebook pages, a priceless record in the inventor's own handwriting, reveal many startling researches during the 1890's into jet- and rocket-powered blades resembling helicopter rotors. Here, on May 25, 1893, Dr. Bell sketched one such device, a shaped hollow tube packed with chlorate of potash mixed with powdered sugar. Top drawing: figures representing Dr. Bell and his assistant, C. H. Ellis, ignite the fuel with iron rods dipped in sulphuric acid. Lower: the propeller roars into action while both men take refuge behind trees and one scribbles notes. A later page (not shown) records an unhappy ending—the propeller exploded after turning briefly. Dr. Bell wrote, "Fragments picked up about ten feet away account for little more than half of tube. Mr. Ellis is looking for the rest."

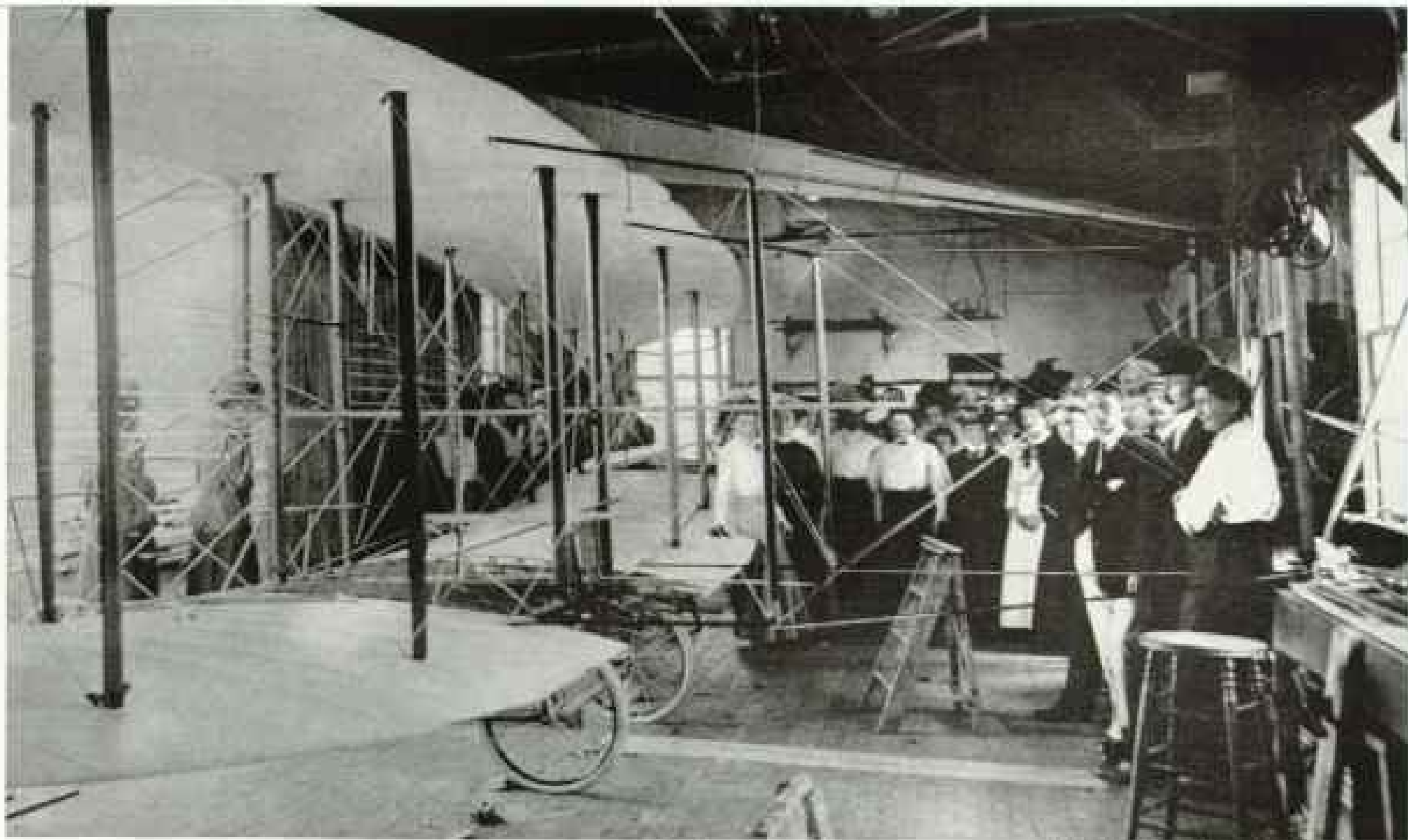
© Bell Family

1893 May 25th - Thursday - at W. H. Lot 235

Mr. Ellis & I will touch off each
leaf by means of iron rods. ~~Each rod~~ Each rod
dipped into sulphuric acid. Let signal will
simultaneously touch of chl. of pot. mixture with
sulphuric acid — and fly
" 1, 2, 3 "



now we will try it - and note results.



July 9, 1909: *Baddeck I*, a Craft Destined for Fame, Is Unveiled at the Bell Estate

Dr. and Mrs. Bell financed two young Canadian engineers, John A. D. McCurdy and F. W. Baldwin, in the construction of pioneer aircraft. They formed the Canadian Aerodrome Company and built several flying machines. *Baddeck I* was the first successful aircraft made in Canada. Here guests of the company inspect the machine. A few hours later it was crated and shipped to Petawawa, Ontario, where McCurdy took it up on a maiden flight August 12, 1909, for the Canadian Army.

The jet-power research, briefly described on page 227, was equally bizarre. Dr. Bell suspended his big rotor on a pulley and counterbalanced it with weights. A firebox heated alcohol to vapor, which rose through a pipe, entered small tubes in the blade, and emerged hissing from the tips. One can imagine the racket when workmen ignited these jets!

Visitors will see this unique device prominently displayed in the museum.

Now, looking back, we realize that Dr. Bell's experiments with ingenious power sources were too far ahead of the technology of his day to have practical application. His jet theory was, in fact, more than 50 years ahead of his times. Only since World War II have we seen the development of helicopter rotors powered by jets at the blade tips. Rocket rotors are still in early experimental stages.

Research with Multinippled Sheep

A single project was never enough to preoccupy the inventor; he liked to work on others at the same time. So, while experimenting with helicopter blades, he also busied himself developing a flock of twin-bearing sheep.*

He had noted that some of Beinn Bhreagh's sheep had rudimentary nipples in addition to two normal ones, and that these particular ewes gave birth to twins occasionally. By careful breeding he developed a strain that had as many as six nipples, all functioning normally. In time the multinippled ewes presented him with twin or triplet lambs in more than 50 percent of the births.

Earlier the local farmers had laughed at his experiment; now they tried to imitate it.

So solicitous was Dr. Bell of his sheep's health that he built them a little village of small houses atop Beinn Bhreagh and named it "Sheepville." There were numerous streets, and each had a name.

"Nearly every day for some years," Mrs. Bell once wrote, "he conducted his sometimes rather reluctant family up the mountain, often through deep snow, to visit those sheep, and they became personally acquainted with Generals Grant and Lee, the first sires of the breed."

Dr. Bell continued this research with unflagging enthusiasm for many years (page 255). After his death his daughters gave the

* See "America's 'Meat on the Hoof,'" by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, January, 1952.

John A. D. McCurdy Pilots *Silver Dart*: First Plane Flight in the British Empire

In 1907 Dr. Bell and four young disciples, Baldwin, McCurdy, Selfridge, and Glenn H. Curtiss, attacked the problems of powered flight. Banding together as the Aerial Experiment Association, they built four craft in a year and a half, using engines designed by Curtiss, a motorcycle racer and manufacturer.

On the morning of February 23, 1909, Dr. Bell and nearly 150 townsmen gathered on frozen Baddeck Bay to witness Canada's first flight. Presently a sleigh towed *Silver Dart* into position. While four skaters kept pace (right), the plane ran forward on its tricycle landing gear, a surprising forerunner of the modern undercarriage. Taking off from the ice, *Silver Dart* flew across the wintry landscape for half a mile.

While working with Dr. Bell, McCurdy became the sixth man in the United States to pilot a heavier-than-air machine. In 1910 he set the biplane speed record (at Belmont Park, New York) and flashed the world's first wireless message from a plane aloft. In the following year he received the first ground-to-air message by wireless. Also in 1911 he flew 95 miles from Key West, Florida, to Cuba, but dropped into the sea near Havana when his motor failed. A destroyer picked him up.

In 1908, under Dr. Bell's guidance, the Aerial Experiment Association developed the New World's first hinged, wing-tip ailerons (here shown on *Silver Dart*, their third plane to use the device). Later the Canadian Aerodrome Company employed similar controls (page 245).

© H. M. Bennett

flock to the Agricultural Experiment Station of the University of New Hampshire, which continued his breeding plan. A new strain improved the flock's fleece and mutton qualities, but the twinning capacity was retained. Later the experiment ended after transfer of the sheep to another station.

In 1896 the scientist was a delighted spectator at the flight of a large propeller-driven model aircraft invented by his friend, Samuel Pierpont Langley, Secretary of the Smithsonian Institution, whose researches he had helped finance. The success of this demonstration near Quantico, Virginia, fired anew his enthusiasm for aerial experimentation.

Inventor Turns to Kites

Returning to Baddeck, he pursued a new line of thought. The engines of the 1890's could not support a heavy machine in the air, let alone a man. Perhaps the solution was a strong, stable kite, big enough to carry both a man and an engine safely. A propeller would draw air back against the kite, keeping it aloft and pulling it forward at the same time.

Patiently he tested many types of kites—circular, polygonal, triangular (page 235). Finally he decided upon the tetrahedral cell, ideal for his purpose. Kites honeycombed



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with these cells were light but extremely strong. Seamstresses covered thousands of cells with colorful silk, and Beinn Bhreagh's workmen assembled kites of many sizes.*

* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Dr. Bell's Man-Lifting Kite," by Gilbert Grosvenor, January, 1908.





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↓ **Workmen Roll *Silver Dart* Along a Frozen Runway on Baddeck Bay**

This historic craft performed better than any other machine built by the Aerial Experiment Association, but her engine was subject to fits of temperament. Though rated at 50 horsepower, it sometimes delivered only 8. Baldwin and McCurdy became adept at tune-ups, and in February and March, 1909, McCurdy made many flights, some more than eight miles. Here, led by observers in a sleigh, *Silver Dart* moves into take-off position.

Although the association disbanded in 1909, it left a profound influence. Curtiss gained fame for flight records and for plane and engine manufacture. McCurdy became Lieutenant Governor of Nova Scotia (1947-1952).

© Dill Family





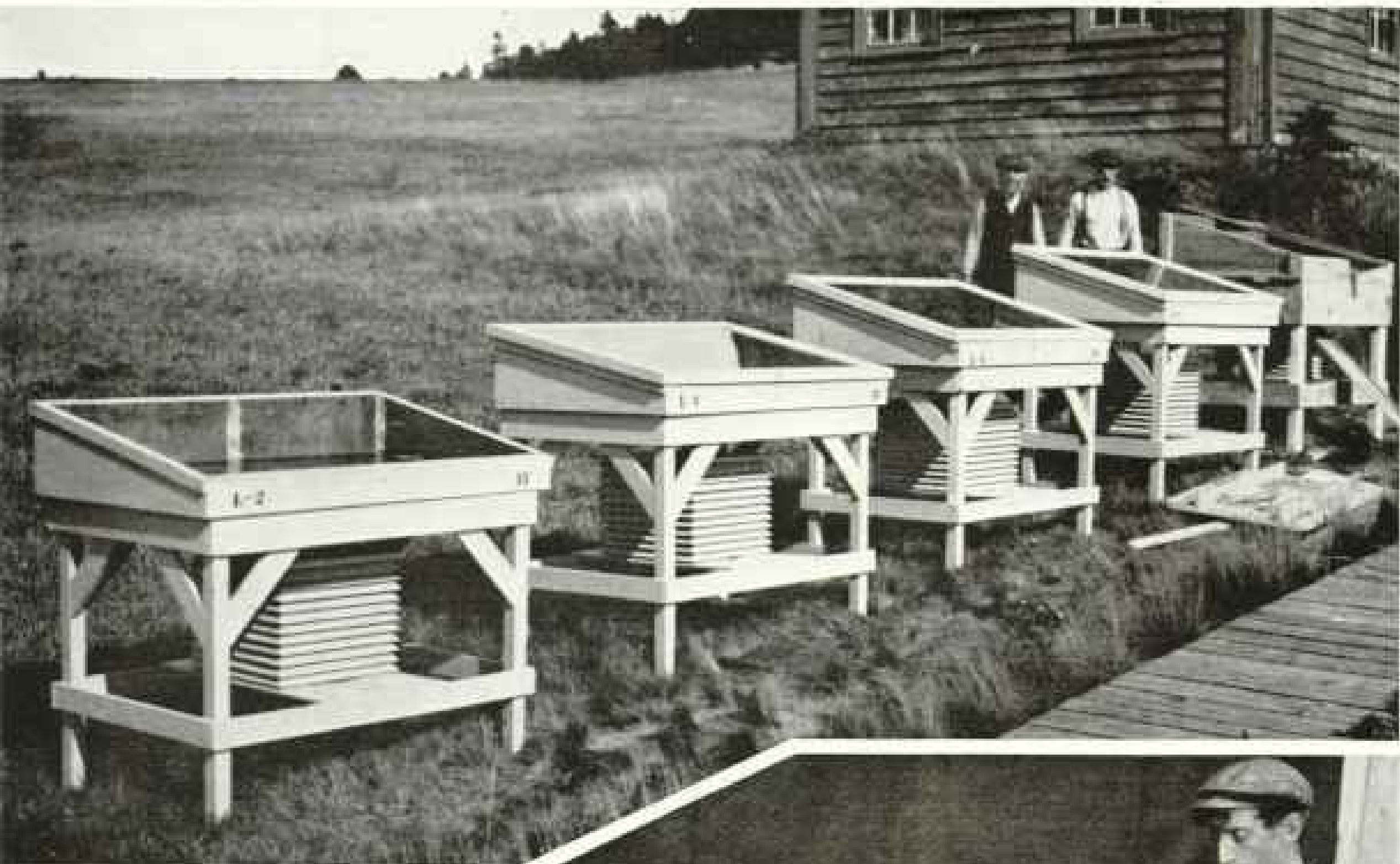
Dr. Bell fretted so when the wind was too slack for tests that his wife suggested he tie his smaller models to a galloping horse and haul them aloft. The suggestion delighted him, and on November 18, 1902, he wrote in one of his journals:

"Tried it yesterday with small kite. Results so promising that we tried three of our large kites today in same way. Found I could study their mode of flight in the air as

↓ Beehive-like Stills Refine Salt Water

Dr. Bell reasoned that solar stills might provide drinking water aboard small boats adrift at sea. These tablelike devices expose sea water to the sun. Moisture condensing on glass lids trickles into receptacles as distilled water. At left, Dr. Bell explains the apparatus to Mrs. Gilbert Grosvenor in 1921.

Gilbert Grosvenor



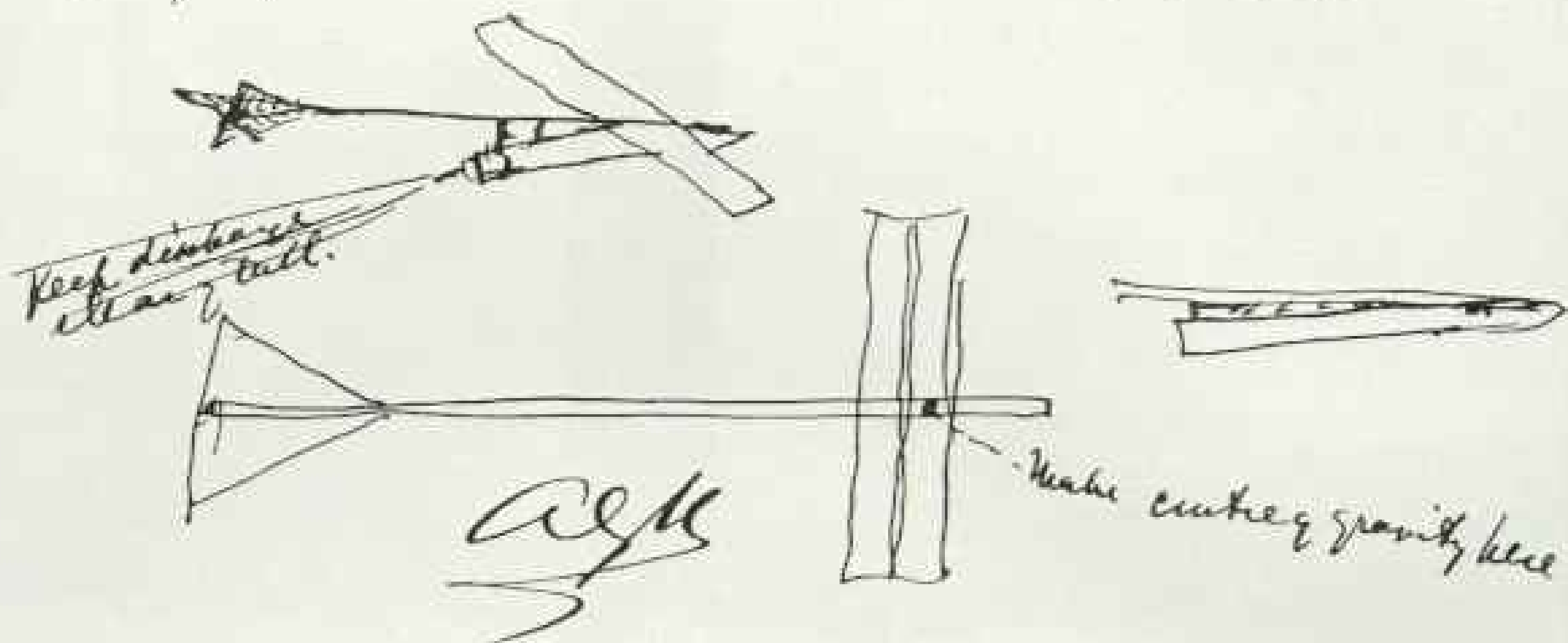
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Water Is Recaptured → from Human Breath

In 1900 Dr. Bell experimented with a simple method to help save lives endangered by thirst. Here one of his workmen breathes through a tube into a bottle immersed in sea water. Dr. Bell noted that moisture condensed in the bottle. Two hours' breathing produced enough for a "moderate drink"—fresh, but not very palatable.

John McNeill, © Bell Family





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© Bell Family

A Rocket-powered Model Aircraft Streaks Across the Page of a Laboratory Notebook

Dr. Bell conducted his experiments with jet and rocket power more than a decade before the Wright brothers flew near Kitty Hawk. His researches seem prophetic in the light of today's developments. This little model had tin wings and tail and a hollow brass fuselage packed with fuel. The inventor recorded that it rose 30 feet and flew 75. His notation, "Keep discharge clear of tail," indicates a lesson learned from an earlier experiment when the rocket blast buckled the tin.

well as if I had wind—or nearly so—and could judge of their way of falling better than with wind."*

In 1905 he successfully flew his big *Frost King*, made up of 1,300 silk-surfaced cells arranged in 12 layers. It lifted into the air a total of 227 pounds—62 pounds of rope and rope ladder as well as a 165-pound man clinging to the ladder.

Two years later, further progress in kite research produced the even larger *Cygnat*, designed to carry a man and an engine. It was taken out on December 6, 1907, for a test run prior to engine installation. Towed by a steamer on Baddeck Bay, the *Cygnat* soared gracefully to a height of 168 feet with Lt. Thomas E. Selfridge of the U. S. Army as passenger (pages 238 and 239). Unfortunately, the kite was destroyed when dragged through the water after descending.

Mrs. Bell Suggests a Partnership

Meanwhile, a group of brilliant and imaginative young men had formed about Dr. Bell. His first disciples were two Canadian engineers, John A. D. McCurdy and F. W. "Casey" Baldwin. Soon two Americans were added, the motorcycle builder and engine expert, Glenn H. Curtiss, and Lieutenant Selfridge.

Mrs. Bell suggested that her husband and his youthful colleagues form an organization, and she offered them her financial support. So, on September 30, 1907, the five men

signed articles of agreement establishing the Aerial Experiment Association. They would help Dr. Bell to develop a tetrahedral "aerodrome" (a term the scientist always preferred to "aeroplane"), and he, in turn, would assist them in designing machines incorporating their own ideas. Working "individually and conjointly," their purpose was simply to "get into the air."

When their first project, the *Cygnat*, ended in an unlucky accident, the partners moved their work temporarily to Hammondsport, New York, so they could be near Curtiss's motorcycle factory and engine facilities. Here they built four successful powered aircraft, all biplanes.

The first, Selfridge's *Red Wing*, had a fixed stabilizer and rudder at the rear and an elevator mounted at the nose. It was designed to take off on runners from the ice of near-by Keuka Lake under power of a 25-horsepower Curtiss engine.

* Alexander Graham Bell wrote prolifically for the NATIONAL GEOGRAPHIC. Among his two dozen articles were: "Tetrahedral Principle in Kite Structure," June, 1903; "Our Heterogeneous System of Weights and Measures," March, 1906; "Few Thoughts Concerning Eugenics," February, 1908; "Discovery and Invention," June, 1914; "Prizes for the Inventor," February, 1917; "Who Shall Inherit Long Life," June, 1919; and "Prehistoric Telephone Days," March, 1922. The scientist also signed three Geographic articles "H. A. Largetamb," a pseudonym devised by rearranging letters in his name. These titles were: "Purple Veil: A Romance of the Sea," July, 1925; "Extinct Reptiles Found in Nodules," March, 1906; and "Notes on the Remarkable Habits of Certain Turtles and Lizards," June, 1907.



Museum's Windows Look upon the Bras d'Or, Scene of Plane, Speedboat, and Kite Tests

Belm Bbrough Hall (upper left) crowns a wooded peninsula jutting into the lake. Hydrofoil boat in showcase is the same model held by Dr. Bell's laboratory superintendent on the opposite page.

In its maiden effort, March 12, 1908, the *Red Wing* carried Baldwin a distance of 318 feet 11 inches. His feat was recorded as the first public flight in America. By then the Wright brothers had flown numerous times, beginning in 1903, but the public had paid little attention and not much was known of their achievements.

Red Wing had been extensively damaged in a landing, so now the associates built their second machine, Baldwin's *White Wing*. It was similar to its predecessor except for two important innovations: tricycle undercarriage and the New World's first wing-tip, hinged-surface ailerons.

The Wright brothers had obtained lateral control in their machines by "wing warping," an arrangement that twisted the outer trailing edges of the wings up or down at will. Now Dr. Bell, in a letter to Baldwin on March 20, 1908, suggested a better method. Make the wing tips movable and arrange the controls so that when one set of wing tips was raised, the other would be lowered.

The suggestion's worth was immediately recognized by Dr. Bell's young colleagues. These hinged surfaces would produce a turning movement, giving the plane maneuverability. But, more immediately important, if the plane tipped to one side, the new surfaces would bring the low side of the machine up and the high side down.

Unknown to Dr. Bell and his associates at the time, similar devices had been tried out in Europe.

With the great advantage of the new aileron, *White Wing* made several successful flights. Baldwin piloted it first, a distance of 279 feet,



Hydrofoil Boat Model Skims the Surface Like a Water Skier

While experimenting with airplanes, the master of Beinn Bhreagh decided that principles of powered flight could be applied to water craft. He and his associate, F. W. Baldwin, utilized aircraft propellers for power and attached hydrofoils, thin, ladderlike strips of metal, to boat hulls. Even heavy hulls rose from the sea on foils, greatly lessening water resistance.

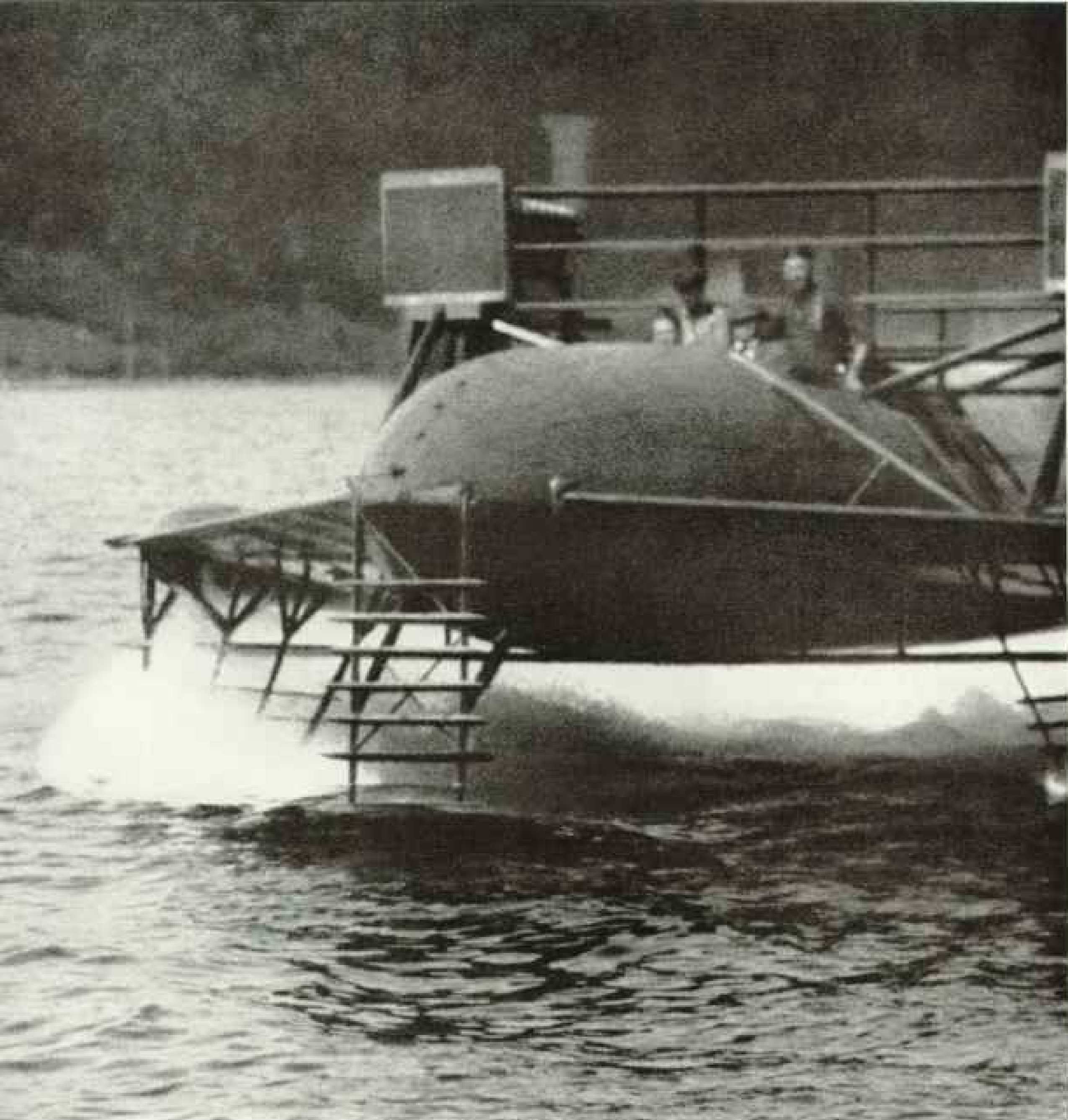
Top: Dr. Bell and his modelmaker, Hector P. McNeil, examine two 1912 models. Bottom: a catamaran, twin-hull model, also of 1912 vintage, performs in a tow test.

on May 18, 1908. Later, on May 22, Curtiss flew *White Wing* 1,017 feet, landing without damage in a plowed field.

Wing Coating Improves Lifting Power

Curtiss's *June Bug*, completed on June 19, was the third venture. To gain lifting power, the associates coated the wing's fabric surfaces with a mixture of gasoline, yellow ocher, paraffin, and turpentine, making the fabric airtight.

On July 4, 1908, Curtiss won the *Scientific American* trophy by piloting *June Bug* in



America's first public flight over a measured kilometer course. Dr. Bell, who could not be present, telegraphed exuberant congratulations:

"Hurrah for Curtiss! Hurrah for the *June Bug!* Hurrah for the Aerial Association!"

The fourth machine, McCurdy's *Silver Dart*, was built at Hammondsport and then taken to Baddeck early in 1909 (pages 246 and 247). On February 23 McCurdy made his historic flight above the ice of Baddeck Bay, trailed by a crowd of excited skaters and a horse-drawn sleigh bearing his snowy-bearded chief, Dr. Bell.

In February and March of 1909 the associates tried unsuccessfully to fly the new

Cygnets II, last of the group's tetrahedral kites. Though they mounted it on runners and installed controls, the engine was not powerful enough to lift it aloft.

By the terms of its agreement, the Aerial Experiment Association was dissolved March 31, 1909, a year and a half after its formation. In that brief time it had written a brilliant chapter in aviation history and had more than fulfilled its objective of "getting into the air."

The group's captain always possessed the uncommon faculty of choosing his associates wisely. His faith in the young men, and that of Mrs. Bell, had been justified. Their only regret was that Selfridge had not lived to see the work successfully concluded. He had



↑ Water Monster Skims Across Baddeck Bay

The Bell-Baldwin hydrofoil design reached its pinnacle in the torpedo-shaped *HD-4*, launched in 1918. Though the boat weighed more than 10,000 pounds, she rose on her hydrofoils even at low speeds.

HD-4's twin Liberty aircraft engines powered her to a world speedboat record of 70.86 miles an hour on September 9, 1919. Dr. Gilbert Grosvenor shot this dramatic view during a speed run.

→ Dr. Bell tries the cockpit, with Mr. Baldwin at his side.

William W. Northon (right)



been killed September 17, 1908, in the crash of the Wright *Flyer* at Fort Myer, Virginia, in which Orville Wright, the pilot, was injured.

Baldwin and McCurdy later formed the Canadian Aerodrome Company, with the financial backing of Dr. and Mrs. Bell. They built several aerodromes; two of these, the *Baddeck I* and *II*, were very successful (page 245). But the Canadian Army showed little interest in purchasing a machine, and the venture was abandoned.

Unfortunately, not a single aircraft built by this company or by the A.E.A. survived, although they seem to live again in the remarkable flight photographs, greatly enlarged, on exhibition in the museum. Our collection also includes the original radiator and one of the propellers from the *Silver Dart*, as well as a set of ailerons from *Baddeck II* (page 247). So far as we can determine, these ailerons are the oldest in the world.

Experiments with Boats That "Fly"

While experimenting with airplanes, Dr. Bell and his young associates sought to apply the principles of powered flight to boats. Airplane engines, they knew, would give a boat great power, but freeing its hull from water resistance promised to be a thorny problem.

By trial and error over a number of years they developed hydrofoils—thin, ladderlike strips of metal—which they attached to the hulls of several experimental craft below the waterline (opposite and page 251). These foils were arranged in vertical tiers, wide at the top and narrow at the bottom.

In trial runs it was discovered that even a large hull would rise on its foils until, virtually free of the water, it sped along only



on the bottommost strips of metal.

Baldwin remained with Dr. Bell at Baddeck, becoming his closest associate. Returning from a trip around the world in 1911, Dr. and Mrs. Bell and Mr. and Mrs. Baldwin stopped at Lake Maggiore, Italy, to visit Enrico Forlanini, who was also experimenting with hydrofoils. The travelers sped over the lake in Forlanini's hydrofoil boat, powered by an underwater propeller. Dr. Bell, however, continued to use air power in the experiments that were resumed when he returned to Beinn Bhreagh.

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← **Helen Keller Flies
a Kite with Dr. Bell,
Her Beloved Friend**

If asked to state his profession, the famous inventor invariably replied, "I am a teacher of the deaf." Thus did he begin his career, and education of the deaf enlisted his talents and money throughout his life.

Helen Keller was taken to Dr. Bell as a six-year-old, deaf, blind, and unable to speak. He helped direct the education that enabled her to communicate with others. Years later Miss Keller dedicated her autobiography to the scientist. Writing of their first meeting, she said, "I did not dream that that interview would be the door through which I would pass from darkness into light, from isolation to friendship, companionship, knowledge, and love."

Top: Visiting Beinn Bhreagh in 1901, Miss Keller clings to a kite line.

Lower: Dr. Bell clasps Miss Keller's hand and taps out a message. John Hitz (left), superintendent of the Volta Bureau for the Deaf, and the inventor's father (center) await their turn to "speak" to Miss Keller. Dr. Bell endowed the Volta Bureau with quarters in Washington, D. C.

Finally, after exhaustive research, their design reached its pinnacle in the huge torpedo-shaped *HD-4*. In 1919 Baldwin piloted this craft on Baddeck Bay to a world's speedboat record of 70.86 miles per hour.

It is curious that hydrofoil research should have languished in North America after the trail-blazing research of these two men. But little similar work was undertaken outside Europe until World War II. Since then both Canada and the United States have played leading roles in developing the hydrofoil for naval use.

The Baddeck years were happy, fruitful ones for Dr. Bell. Pure research, not the developmental aspect, interested him most. When he felt he had solved a problem or blazed a trail to its heart, he dropped it. An invention then became something for the engineers, technicians, and businessmen to exploit, while he turned to some new frontier.

The last superintendent of his laboratory, Walter Pinaud, a boat-builder, still lives in Baddeck. Recently he gave one of my colleagues a vivid word picture of the inventor at work.

"Late each morning he would come down to the shop and knock on the door," said Mr. Pinaud. "I would open it, and he would ask politely, 'May I come in?' Of course he was the boss, but that was his gentlemanly way of emphasizing that you were his foreman.

"Usually he would take a towel and stuff it around the telephone, so no one could call and interrupt us. Then he would light up his pipe, get a good fog of smoke going, and say, 'Now a man can think!'

"He had an art I've never seen before or since. When explaining a problem, he would talk of little things first and gradually lead up to the difficult ones. Pretty soon he'd have you in his own boots, seeing the problem as he did."

Predicts the Course of Aviation

Occasionally, even in remote Baddeck, the press would seek out Dr. Bell for his opinions on world topics, particularly aviation. These later years show no diminution in his remarkable gift for prophesying the future.

In 1914 he predicted:



The Scientist Examines a Twin-bearing Ewe

By crossbreeding sheep that had extra, rudimentary nipples, Dr. Bell developed a flock whose ewes had as many as six functioning nipples. These sheep bore twins or triplets in more than 50 percent of the births (page 245). Here Bell makes detailed notes on a ewe's condition. Sir Wilfred Grenfell, devoted Labrador medical missionary, sits beside him.

"I have no doubt that, in the future, heavier-than-air machines of great size, and of a different construction from anything yet conceived of, will be driven over the earth's surface at enormous velocity, hundreds of miles an hour, by new methods of propulsion..."

Later on in the interview he said:

"Think of the enormous energy locked up in high explosives! What if we could control that energy and utilize it in some form of projectile flight!"

Here he came remarkably close to one of the sobering facts of our day—the ballistic rocket missile.

The United States Government, too, often sought his views. For example, in 1919, when Dr. Bell was a youthful-thinking 72, the Army asked him to outline a policy for military aeronautics. Science's elder statesman, writing in reply, re-emphasized a view he had stated previously to the press; that air power would "prove to be the decisive factor in



Hand in Hand, the Bells Stroll Beinn Bhreagh's Garden Walk

future wars." World War I, he said, had demonstrated that inescapable fact.

"Applying this lesson to America," he added, "we may conclude that neither our Army nor our Navy can defend the United States from attack through the air: This requires the addition of a third arm to our system of military defense, a National Air Force, quite distinct from the Army and the Navy, capable of cooperating with both and also capable of acting independently of either.

Suggests a West Point of the Air

"This might well be made a distinct department of the Government, on the model of the Army and Navy Departments, and should be provided with a special college upon the model

of those at West Point and Annapolis . . ."

I am sure the forward-looking nature of this advice is strikingly apparent to any citizen of the United States, where a separate Air Force and Academy finally were realized after World War II.

Beinn Bhreagh's work routine in the spring of 1922 seemed, at first, much the same as in previous years. Dr. Bell returned from Washington and made his usual careful examination of each sheep in his prized flock. He wrote page after page of notes on the condition of the ewes and entered all of the newborn lambs in his ledgers.

But, as Mrs. Bell said later, "The languor of illness was already on him." He was 75; yet he made little concession to either his years or his health as long as there was work to be done.

Now, in midsummer, he fought a growing weakness, and only his indomitable will sustained him. Specialists were summoned from Washington, but they arrived too late. Dr. Bell had died on the night of August 2.

He was buried at Beinn Bhreagh in a very simple but moving ceremony. For one minute during the service every telephone in America remained silent. Mrs. Bell survived him by only five months, and today they both lie on the summit of their Beautiful Mountain.

At his express wish, Dr. Bell's tombstone bears the words, "Died a Citizen of the U.S.A." He was extremely proud of his two adopted countries, and his resting place in Canada's "New Scotland" marks a link between his birthplace and the United States. But everyone surely will understand if I say that, in a larger sense, this Universal Man died a citizen of the world, for his genius enriched the lives of all peoples in all lands.

The Weeks Expedition, Collecting Birds and Mammals, Visits Saucer-lipped "Ubangi" Belles and Giant Jungle Chiefs

BY GERTRUDE S. WEEKS

AT the mention of a trip, my ears prick up and I am ready to go. It has always been this way—at least since I got out of school and went on my first pack trip in Wyoming. Then came travels in British Columbia, Alaska, Kenya, and Tanganyika.

The love of wildlife and remote places got into my blood. As time went on, I found myself on expeditions to collect birds and mammals in Ethiopia, Indochina, and Iran for the American Museum of Natural History, in west Africa for the Philadelphia Academy of Natural Sciences, and in Nepal for the National Geographic Society, the Smithsonian Institution, and Yale University.*

And now it was French Equatorial Africa for the American Museum of Natural History and the National Geographic Society. One of our chief objectives was to fill in what Dr. James P. Chapin, ornithologist of the American Museum, described as "a blank spot in French Equatorial Africa as far as our collection of birds is concerned."

Our party included my husband, Dr. Carnes Weeks, who for years has been interested in birds and photography; Walter Weber, the National Geographic's noted wildlife artist and naturalist; and Volkmar Kurt Wentzel, the gifted Geographic photographer who had been on the Nepal expedition. T. Donald Carter, Assistant Curator of Mammals of the American Museum of Natural History and veteran of three previous African expeditions, collected most of the specimens.

Masked Dancers Greet Expedition

As usual in planning expeditions, we set up tents and tested equipment on the lawn of Medway Plantation, our home at Mount Holly, South Carolina. A few weeks later we stepped out of an airplane into furnace heat and clouds of red dust at Fort Archambault, principal town of French Equatorial Africa's interior (map, page 258).

Awaiting us were our jeep truck and two official cars—and a reception committee that let us know instantly that we had indeed penetrated deep into the heart of Africa.

On the fenders of the vehicles perched a

score of naked youths covered with red clay paint. Over their faces they wore rattan fiber masks. Feathers were stuck in their hair, and pompons dangled from strings that swayed back and forth in front of the masks. Around their waists hung strings of beads and strips of serval cat fur with the tails dangling down behind.

The youths brandished wooden spears, and their leather anklets and bracelets shook to a rhythm pounded out by a native drummer. They were undergoing initiation into a secret society and had just emerged from the jungle. Their strange masks hid fresh, deep scars inflicted as part of the ritual.

Safari into Game-rich Land

Marc de Possesse, chief game warden of the region, invited us to set up headquarters at his bungalow five miles from Fort Archambault. A few days later we started our safari by ferrying across the Salamat River and heading northeast toward Lake Iro.

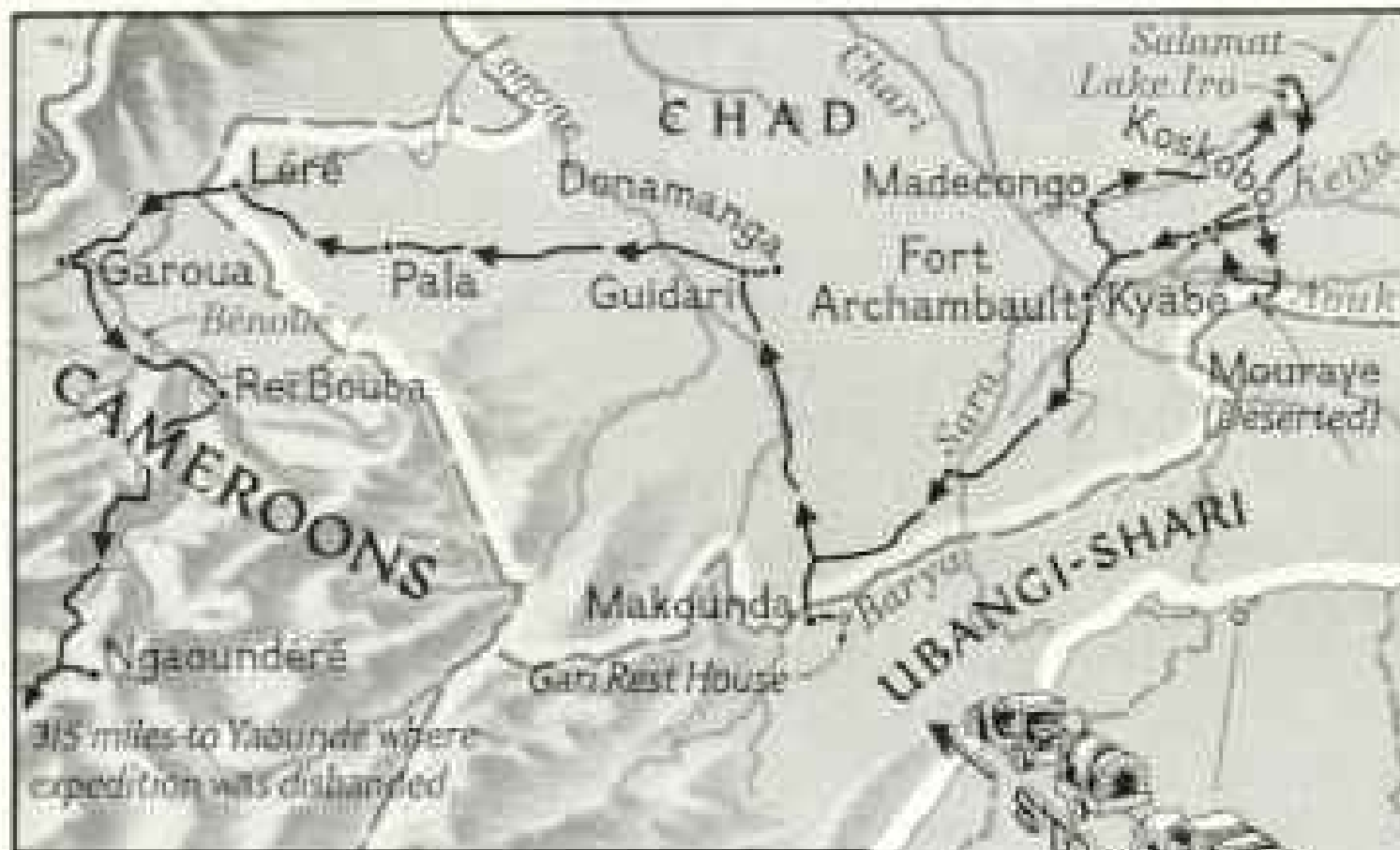
At the village of Madecongo, in the Territory of Chad, we found ourselves in a game-rich district. There was also a flying swarm of termites; some got into the tape recorder and ate part of the wooden case. We pitched our tents in a grove of sausage trees at the edge of the Salamat. The thermometer registered 113° F. in the shade!

The people of Madecongo catch fish by a method I have never seen anywhere else. Men went downstream and held large nets, while women upstream splashed and beat on the water with bell-shaped baskets to drive the fish into the nets. The huge Nile perch called *capitaine* that were trapped in the nets proved delicious (page 275).

Later, 40 miles east of Madecongo, we came upon the Chad village of Kyabé, a home of the famous platter-lipped women (page 259).† A French official located an especially bizarre veteran known as La Parisienne. On her

* See "Peerless Nepal—A Naturalist's Paradise," by S. Dillon Ripley, NATIONAL GEOGRAPHIC MAGAZINE, January, 1950.

† See "Trans-Africa Safari," by Lawrence Copley Thaw and Margaret Stout Thaw, NATIONAL GEOGRAPHIC MAGAZINE, September, 1938.



**Africa's Steaming Heart:
Untamed Animal Kingdom**

The Weeks Expedition collected mammals and birds in Chad and Ubangi-Shari—French Equatorial Africa—and in French-administered Cameroons. This region once yielded slaves by the shipload; few Europeans penetrated the interior until the 1800's.

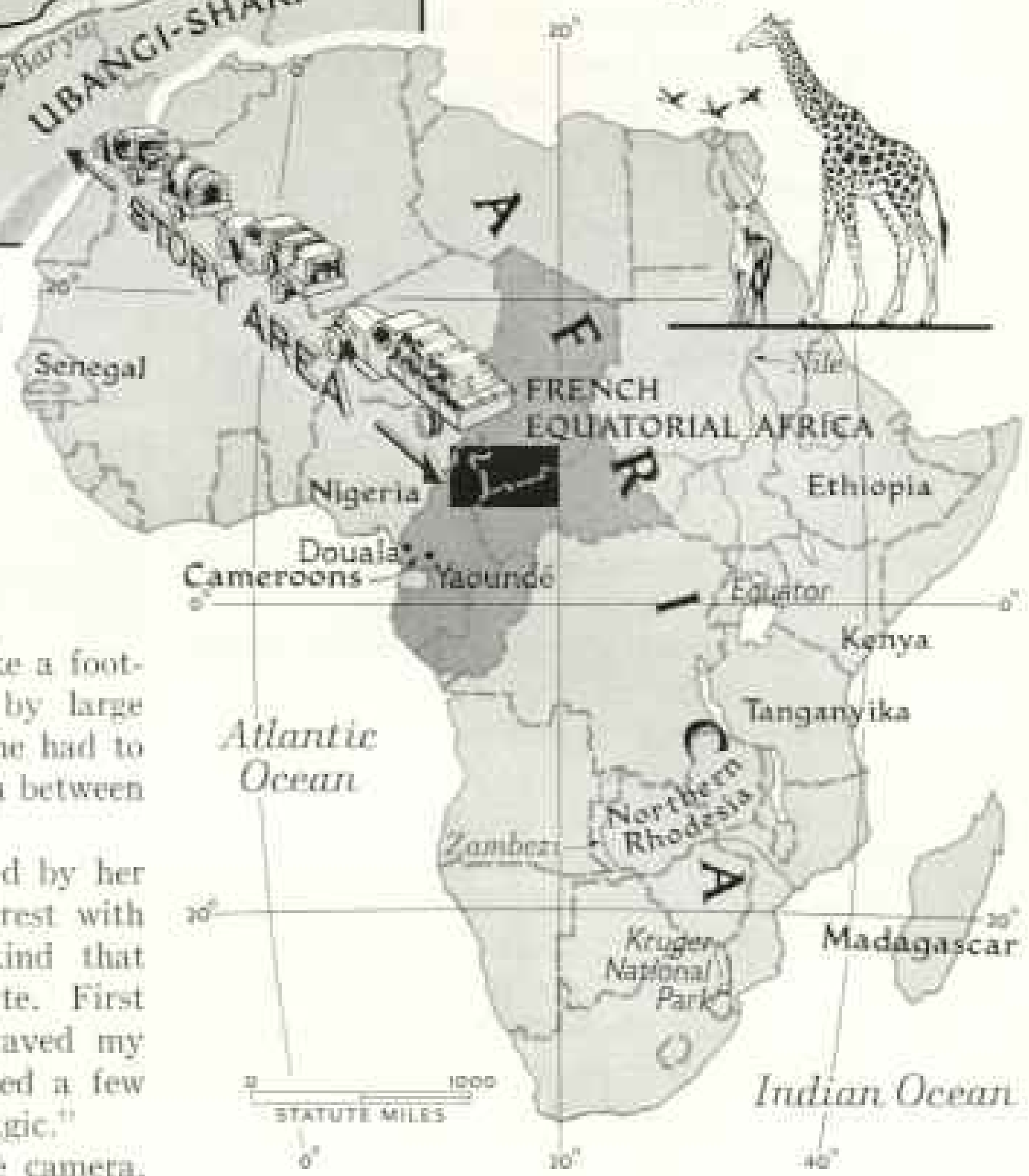
The WEEKS EXPEDITION



Route of Expedition →

© National Geographic Map

Drawn by Gilbert H. Emerson and Victor J. Kelley



head she wore a calabash shaped like a football helmet. Her lips, distended by large wooden disks, were so heavy that she had to support them with her hands. From between the disks protruded a pipe.

La Parisienne seemed rather bored by her visitors. I tried to arouse her interest with my Polaroid Land camera, the kind that delivers a finished print in one minute. First I snapped her picture. Then I waved my hands over the camera and mumbled a few words to convey a hint of "white magic."

Finally I opened the back of the camera, peeled off the print, and proudly handed it to La Parisienne.

She looked at it glumly and handed it back. "So what?" seemed to be her reaction. Then she gargled sullenly.

"She wants a hundred francs for posing," said the French official, translating.

"Ubangis" Named by Ringling Circus

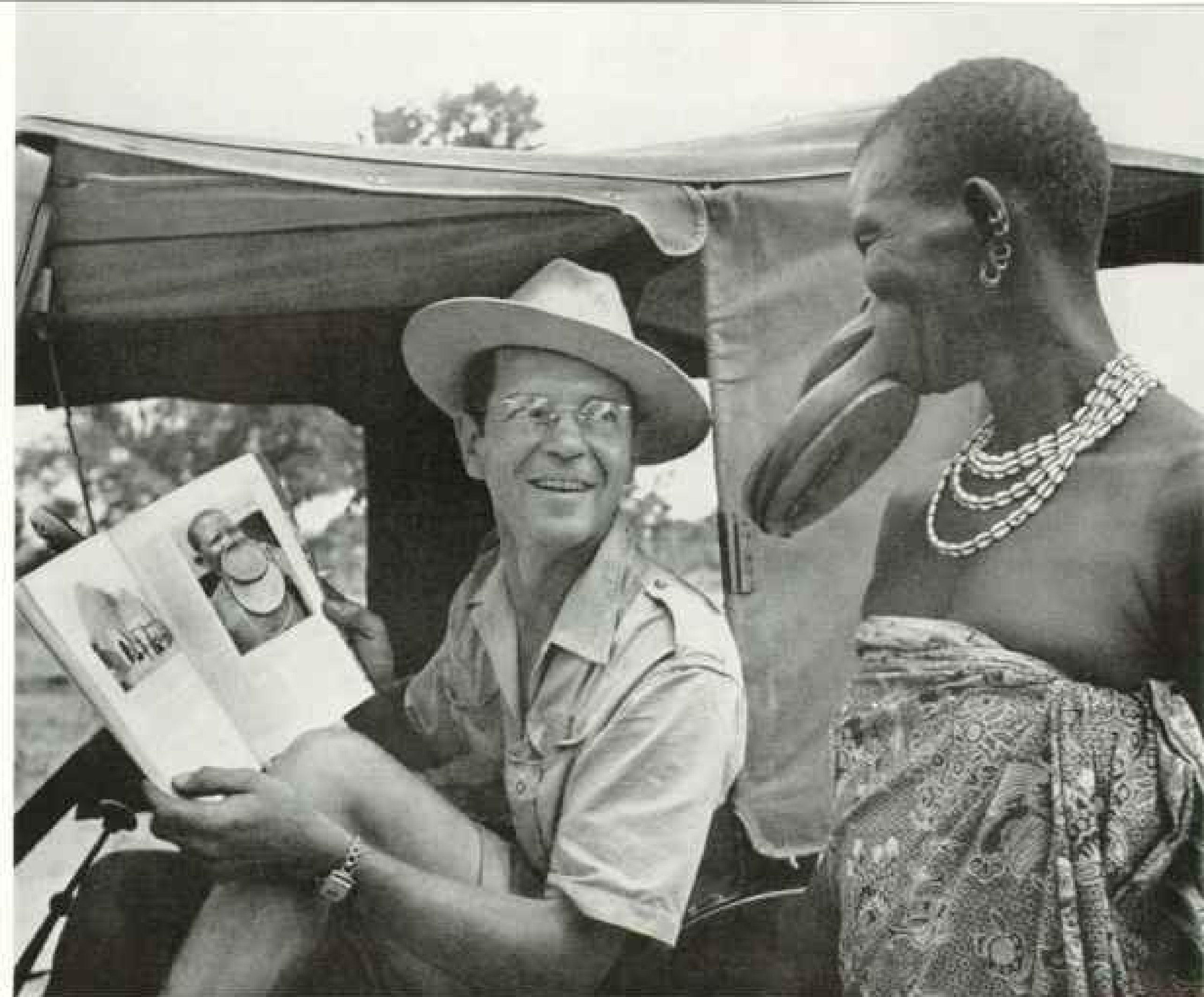
Later I learned the reason for La Parisienne's ennui, and also something about a triumph of press agency through which these strangely disfigured women became known to most of the world as "Ubangis."

In the 1930's La Parisienne was one of a platter-lipped bevy imported into the United States by the late John Ringling, then head of the Ringling Brothers and Barnum & Bailey Circus. Ringling felt that the group needed a colorful name that circus fans could pronounce, spell, and remember.

There is no evidence that Ringling knew the women actually were members of the Sara tribe of Chad. If he had known, presumably he would have rejected this label as "not circus."

Ringling's publicity chief, Roland Butler, found the name. Studying a map of French Equatorial Africa, Butler had come upon Ubangi-Shari (the region) and the Ubangi River. The single word Ubangi, he felt, had everything: it rolled sonorously off the tongue and was easy to spell; in its very sound and look it seemed to carry some of the wild mystery of the once "Dark Continent."

Soon the country saw a spate of vividly illustrated newspaper stories, advertisements, and posters proclaiming the Big Top's newest sensation: "Monster-mouthed Ubangi savages—the world's most weird living humans!"



Platter-lipped Woman Peers at Her Look-alike in the Mirror of NATIONAL GEOGRAPHIC

Here in Kyabé, French Equatorial Africa, staff artist Walter Weber greets a Sara disk wearer. She can only gurgie a welcome and smile with her eyes. The woman adopted the grotesque fashion in childhood when lips were pierced. Through the years successively larger wooden plates stretched the openings. The practice may have originated in slave-taking days to make women unattractive to raiders, or it may have started as a kind of engagement ring for brides-to-be. Young girls today go in for smaller disks.

After two seasons with the circus, the "savages" (actually they were and are extraordinarily docile) went back to Africa. La Parisienne had also appeared in Paris—hence her nickname.

Thus the aging La Parisienne I met at Kyabé was a woman who had been around; she had traveled probably more than I had. She was not one to be overwhelmed by a camera, even if it did make instantaneous pictures.

Canned Prunes, Africa Style

Near Makounda, several days later, we lashed several dugout canoes together to ferry our vehicles across the clear, rocky Barya River (page 260). We had to leave our big Citroën truck behind; it was too heavy for the crossing.

Beside the stream, we set up our table for lunch. I had told Gabgoto, the cook, that we would have prunes. When they were served, I tried a spoon on them and spoke to Gabgoto.

"Can't you remember to soak them overnight?" I asked.

"Yes, yes, I have done so," said Gabgoto.

"But it isn't possible! They are like bullets!"

Gabgoto then explained that he had soaked the can overnight.

"But didn't you open the lid?" I asked.

"No," he replied, "I didn't think of that."

A day's long, hot drive brought us to Guidari and the resthouse of Charles de Decker, a businessman.

Our host represented Cotonfran, a concern that gins native-grown cotton for export to French textile mills. Some of the cotton re-





turns to the jungle in the form of printed cloth bearing all manner of designs, including the faces of famous people.

I was entranced one day when, walking down a village street, I fell in behind a buxom matron whose cotton wrap-around bore an undulating likeness of Sir Winston Churchill, complete with cigar.

Native head of the Guidari region was Chief Gabaroun, a gigantic potentate who, we were told, had 87 wives and 132 children. Chief Gabaroun's word was law throughout an area embracing 25 villages and a population of some 25,000.

When this genial autocrat came to call on us, he looked like a rainbow moving along the road. Across his chest glowed a spectrum of French medals, ribbons, and tricolor sash. He wore bright-yellow shoes and Moslem headdress, surmounted by the kepi of the French Foreign Legion. Baggy white trousers and cotton jacket completed his costume.

Gabaroun chatted amiably over refreshments and invited us to a *tamtam*, or native dance. At our request he talked into our tape recorder microphone; then we played his voice back. He was dumfounded.

He summoned his son Michel and said: "These white people are sorcerers. I have never seen this before. My voice is in the box, and I believe it is dangerous."

Michel assured him that his fears were groundless. Gabaroun was unmoved.

"This is not good," he insisted. "I am very frightened."

Next morning, nevertheless, when we went to the village of Donamanga for the *tamtam*, Gabaroun made no objection when we tape-recorded the sounds of the dance: drums, a marimba made of gourds, horns, and hand clapping.

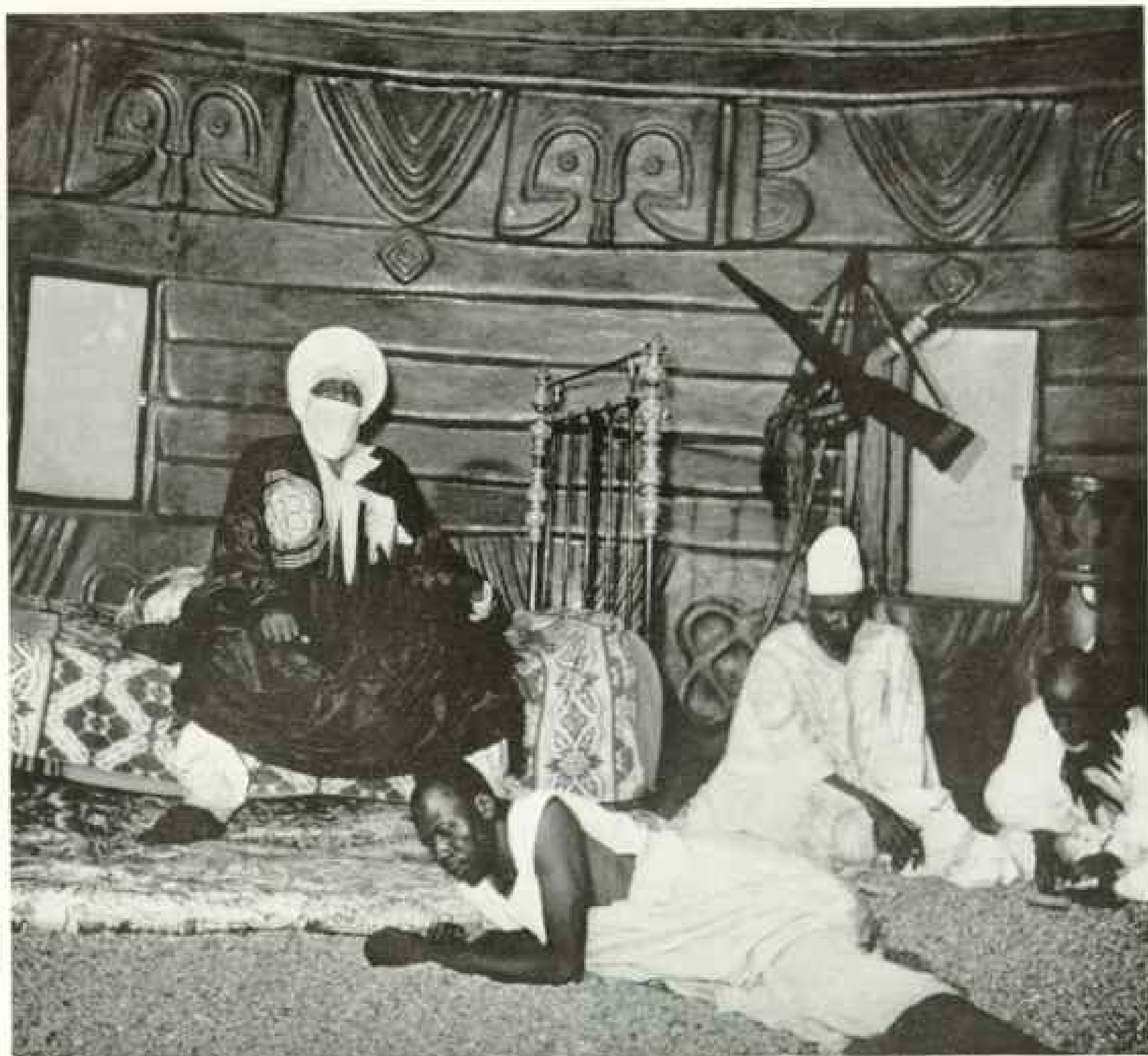
Ebony girls in short skirts of red beads shimmied wildly to this jungle music. Others, including the village elders, clapped a rhythmic beat. Small children danced and swayed

An Expedition Luncheon: Guests Come to Watch

For the American Museum of Natural History and the National Geographic Society, Dr. and Mrs. Carnes Weeks of Medway Plantation, South Carolina, organized this central African bird-and-mammal-collecting expedition.

To villagers on the Barya River the party was a kind of traveling circus. Objects of their rapt attention are Donald Carter of the museum (left), Walter Weber, guide Valette Vaillard, and Mrs. Weeks.

Equipment crossed the river on the dugout canoe ferry.



His Sultanic Majesty, Lamido Reï Bouba, Holds an Audience from a Brass-bed Throne

Yards of white muslin swathe the six-and-a-half-foot Lamido, who not only rules but owns his 36,000 people, their lands, cattle, and crops. Groveling, the interpreter dares not look at his lord's face. Decorated palace walls behind the potentate are of mud.

Lamido Reï Bouba sent horsemen garbed in chain mail to greet expedition members when they entered his Belgium-size domain in the French Cameroons.

energetically in imitation of the grownups.

Chief Gabaroun offered us a suckling pig for lunch. We accepted, and our host boomed out an order. Instantly a dozen youths leaped into a mud puddle in pursuit of a squealing piglet. Several big sows charged the intruders and were beaten off with sticks.

Finally the pig was captured, deftly slaughtered, and spitted over a fire. After an alarmingly brief interval it appeared on our table. It was quite rare, but good.

After lunch Chief Gabaroun had his chair brought out to join ours and gave the order for more tamtam. Again the band played and the girls shimmied.

As the sun's rays diminished and shadows lengthened, Gabaroun's six-horse cavalry galloped into view. The riders, seated on sheep-skin saddles, charged down the baked road to the chief, reined in at the last minute, and saluted with sabers. As a grand climax, Gabaroun had his herd of cattle driven past in a dusty, thunderous display.

Bidding farewell to the chief, we headed toward the mountains of the Cameroons, a trusteeship administered by France. Our goal was Reï Bouba, a domain of some 36,000 people ruled by a potentate known as the Lamido (above).

To ease our way into Reï Bouba, we en-

listed the aid of the Sultan of Garoua, himself a ruler of about 80,000 people. The Sultan was delighted when we showed him a copy of the September, 1938, NATIONAL GEOGRAPHIC containing his photographs made by Lawrence Thaw. He agreed to send a message to the Lamido.

A few days later the messenger returned with a reply: the Lamido would be happy to receive us. We set forth at once in our jeep truck and jeep with trailer, heavily loaded with gifts.

The road ended at the Bénoué River; across the stream lay Reï Bouba territory. Awaiting us was the Lamido's emissary, wearing a red dressing gown and a red fez. With him were 40 porters who carried our gear across the river on their heads, splashing as they went to frighten away crocodiles. We followed, two at a time, in a dugout.

That night we bivouacked in a bamboo compound, and in the morning we started the ride to Reï Bouba on horses sent by the Lamido. After lunch at a clean little resthouse we pressed on through rolling country, with blue mountains looming in the distance.

Suddenly we looked from the edge of a plateau down into a wide valley, and there, a few miles away, lay the village of Reï Bouba. The Lamido's emissary, who had doffed his red dressing gown in favor of a blue homespun shirt, now changed to a white shirt.

The two horsemen who galloped up, bearing the Lamido's greetings, were extraordinary figures to behold in the middle of Africa. Dressed in quilted coats of black and gold, seated on colorful padded trappings, and carrying spears, they saluted as they came to an abrupt stop before us.

The third rider to appear was even more fantastic. A coat of chain-mail armor covered his face and body. He lifted his spear in salute and dashed back to the village.

Ruler Arrives on Golden Throne

Ahead, across fields of rice and corn, we could see people and horses milling outside the village gates. Twelve horsemen in chain mail saluted with spears as we passed. Drums, gourds, and horns sounded a noisy welcome. Dancers in leopard skins pranced about, stamping the ground and waving spears.

Then the Lamido approached on a wheeled throne upholstered in gold brocade and surmounted by a gold parasol. Behind the

throne strode six tall servants dressed in green velvet togas and waving ostrich-feather fans.

A porter brought a wooden step and placed it before the throne. The Lamido, 6 feet 6 inches tall, descended with immense dignity. Yards of spotless white muslin swathed his face and head, Arab fashion.

A secretary-interpreter groveled face down at the ruler's feet, for subjects are forbidden to look up at this personage's face. From this prone position the secretary translated as the Lamido spoke, saying to us in French, "I welcome you to my country."

As we proceeded through the gates and down narrow straw-fenced streets to a resthouse, we were followed by music, the beating of drums, and shouted greetings. Laid out in the courtyard of our mud house were baskets of rice, gourds of milk, chickens, eggs, and an assortment of straw hats.

400 Wives—and Each Has a Hut

Our own gifts for the Lamido we sent off in a basket. They included National Geographic maps, and jewelry for the two dozen favorites among the Lamido's 400 wives.

The Lamido's secretary reported the next day after breakfast and escorted us to the palace, a mud-walled compound containing countless neat dwellings. Each of the Lamido's wives has a separate hut.

Entering the palace grounds, we passed before a troop of lancers wearing coats of mail and plumed helmets. The horses were swathed in bright paddings, and the saddles were rich affairs of brocade and leopard skins.

Camera and tape recorder captured the performance of 40 dancers clad in red coats and leopard skins with long, dangling tails. They gyrated and stomped to music from silver-mounted trumpets made of elephant tusks and waterbuck horns, a xylophonelike instrument composed of various-sized gourds, and six drums, each shouldered by two men and beaten by a third with a leather paddle.

Later the Lamido invited us to his private bungalow, and there I so delighted him with my one-minute camera that he asked me to photograph some of his wives. This I did with flash equipment, and the Lamido pocketed every print, for no other man may look upon his wives or even their pictures.

A few days later we disbanded our expedition in Yaoundé, capital of the Cameroons. Don Carter's article, describing the wildlife we saw and collected, begins on the next page.

Stalking Central Africa's Wildlife

By T. DONALD CARTER

Assistant Curator, Department of Mammals, American Museum of Natural History

With Paintings by National Geographic Artist Walter A. Weber

"AFRICA must have looked like this 25,000 years ago," Walter Weber said in an awe-struck whisper.

The National Geographic staff artist and I stood on the shore of Lake Iro, 90 miles north-east of Fort Archambault in French Equatorial Africa, feasting our eyes upon the kind of scene that seldom rewards the student of nature in these days of encroaching civilization.

On the far rim of the lake a grass fire smoldered, turning the setting sun into a fiery ball behind a curtain of smoke. Hippopotamuses bellowed and splashed near by, and a flock of West African crowned cranes winged toward their roost (page 268).

Ibises Revered as Earthly Gods

Sacred ibises, thought by the ancient Egyptians to be incarnations of the god Thoth, appeared unbelievably homely with their long, curved beaks and naked black heads. But what a transformation as they rose in flight! White wings, delicately edged with black, became translucent, and the flesh of the underside added a delicate tint of pink (page 284).

As we headed back toward camp, a stuttering scream rose from a tree at the forest's edge. Throughout Africa, wherever there is a supply of fish, one is certain to hear the voice of the white-headed fishing eagle. To me his call means Africa as much as the roar of a lion or the cry of a spotted hyena.

In camp it was always fascinating to watch my artist friend at his painting. Working feverishly to record the fleeting orange hue on the wing of a big-eared bat or the bright wattles of a guinea fowl, Walt would record every nuance of color and form with fast, sure strokes.

I doubt whether many artists ever worked under more trying circumstances. Even in the shade of a tent fly the thermometer rose repeatedly to 115° F., and perspiration often fell onto the sketches from Walt's face.

There was no lack of subjects. On our first morning in camp a group of marabou storks had walked up and gravely inspected us. These grotesque birds, together with the vul-

tures and kites, help make up Africa's "clean-up squad" (page 269). Strangely enough, the marabou is a true stork that has forsaken the ways of its relatives and become a carrion eater.

Fine Feathers Grace an Ugly Bird

With its clumsy walk and dangling neck pouch, the marabou would make an impressive contender for the title of "earth's ugliest bird." Yet it carries beneath its tail a handful of feathers so soft and beautiful that the species was seriously reduced a few decades ago to satisfy the whims of fashion.

A trout fly still goes by the name Marabou, but the genuine feathers have long since disappeared from millinery shops. I wonder if milady would have been so keen about her feather bou had she seen the ungainly carrion-eater from which it was plucked. Today game authorities recognize the value of the unattractive creatures and protect them rigidly.

Photographing marabous, we learned later, was a simple matter. A chunk of meat in front of a hastily constructed blind promptly brought the birds within range.

With the marabous, as if from nowhere, appeared a group of African black kites. These hawklike birds cautiously stay out of range of the storks' bills when they dart in to steal a morsel of carrion, then dash away to eat it on the wing.

(Continued on page 273)

Page 265

Grazing Waterbuck Scare Up Lunch → for a Flock of Hungry Bee Eaters

As they feed on parched grasslands near the Salamat River in French Equatorial Africa, **Defassa Waterbuck** send insects scurrying into the air. Sharp-eyed **Carmine Bee Eaters** hoo-ming from their perches to gulp a meal on the wing. Both sexes wear the same gaudy costume.

Rough-coated waterbuck like to stay within grazing distance of a river or swamp. Here three males lead a procession. Among the tamest of African big-game animals, they paid little attention to the artist as he made preliminary sketches.

These 13 paintings by National Geographic artist Walter A. Weber record wildlife he observed in Africa as a member of the Weeks African Expedition.

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WALTER A. WEBER



Baby Riding Pickaback, a Nimble Mother Flies Through the Trees

Furred trapeze artists leap pell-mell through the lianas and umbrella trees of a river-edge forest. These **Green Monkeys** (above and upper right) live on fruits, foliage, and insects, supplemented with food stolen from native granaries and gardens. By the time a new baby arrives, the older offspring has begun to fend for itself.



Earth-loving Red Ground Monkeys Take to the Trees When Danger Threatens

Unlike their cousins of tropical America, African monkeys cannot swing by their tails. **Red Ground Monkeys** live on the plains and savannas, often venturing miles from the forest's safety. Should a leopard appear, however, they frantically seek the protection of trees. Sometimes as many as 50 red monkeys troop together.





♣ **Solemn Storks Guard Their Dinner from a Company of Bold Robbers**

Grotesque **Marabous** fill throat pouches with meat from a wart hog's carcass. **African Black Kites** swoop in ahead of **African White-backed Vultures** to steal morsels, but stay clear of threatening beaks.

← Page 268: Among the first heralds of the dawn are the trumpeting **West African Crowned Cranes**. Except when flying, the yard-high cranes carry straw-colored topknots erect. Below, hippopotamuses feed in Lake Iro.



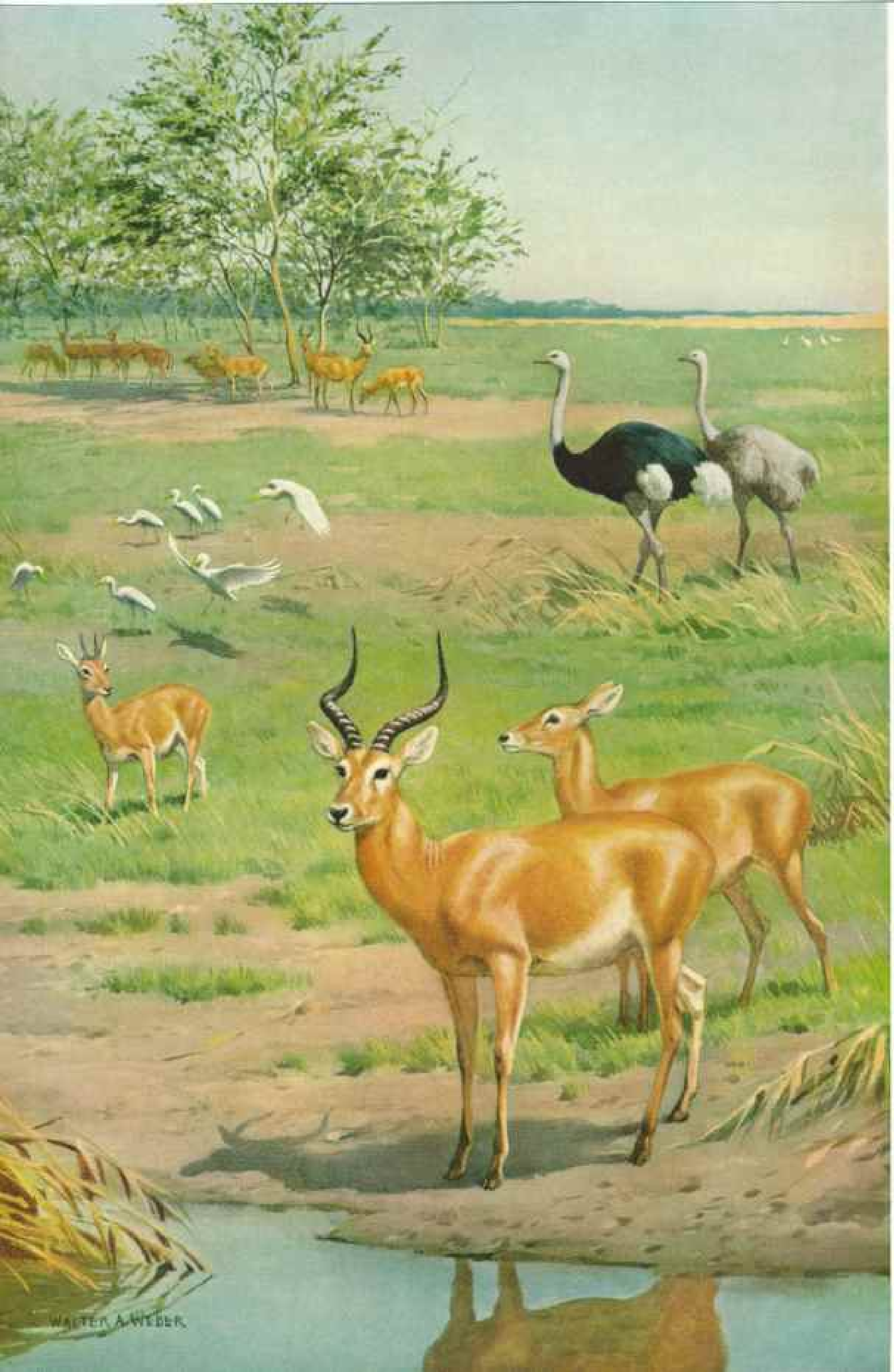
Gabbling Nervously, Polka-dotted Guinea Fowl Flock to a Stream for Water . . .

One of the aims of the Weeks African Expedition was to determine the range of two subspecies of **Helmeted Guinea Fowl**, one of which is the ancestor of the domestic bird. Like weaverbirds (page 277) and Senegal cattle, guinea fowl were probably brought during slavery days to the West Indies, where they still may be found. The barnyard variety, domesticated since Roman times, has red on each wattle.



... While Shy Bushbucks, in Forest-dweller's Stripes, Scent the Wind for Danger

Since Africa's largest predators hunt primarily by sight, camouflage provides vital protection. These woods-haunting **Bushbucks** wear vertical stripes that blend with sun-spangled foliage. Less commonly observed than many other antelopes and largely nocturnal, they are sometimes identified, even when unseen, by their peculiar doglike bark. Artist Weber considers them the most beautiful of African antelopes.



WALTER A. WEBER

On previous trips to Africa I have often amused myself by tossing bits of meat into the air for the fun of watching these bold aerialists snatch them before they reach the ground. Fortunately, central African kites display less aggressiveness than some of the continent's other forms.

Once in Ethiopia I collected a rare genet, one of the small spotted carnivores of Africa, and was seated in front of my tent cleaning the skull. Suddenly I felt a wing touch my cheek and a claw nick my thumb. Before I realized what had happened, a kite winged away across a lake with my genet skull in its talons. The bird soon realized that little or no meat remained on its prize and let it drop into the lake too far away to retrieve.

And so, because of the audacity of a hungry bird, the skin of an Ethiopian genet in the collection of the American Museum of Natural History has the words "Skin only; no skull" on its label.

Natives Flee from King of Beasts

As expedition mammalogist, I had a special interest in lions. We were not on Tanganyika's game-rich Serengeti Plain, where lions recognize the sound of an automobile and seem to pose willingly in return for an easy dinner. Nor was this South Africa's famed Kruger National Park, where the tawny animals sun themselves lazily on roads. In French Equatorial Africa the king of beasts still has an alarming reputation for ferocity.*

Only two years before we came, an ex-

perienced hunter lost his life while guarding a cameraman as he attempted to photograph a lion. In a number of places we saw deserted villages whose inhabitants had fled to escape the beasts' depredations. To our knowledge, the lions of Chad and Ubangi-Shari had never been successfully photographed. Certainly we knew of no one who had managed to record their full-throated roars on tape.

Midget Challenger Outroars Lion

One evening, after many failures, our chance came. A lion roared not far from our camp on the Aouk River. Wentzel and I placed the recorder outside the tent and aimed a microphone toward the beast.

The sound started again, this time even nearer; two prolonged roars vibrated through the night. Wentzel snapped a switch and the reels of the recorder spun to life. We looked at each other happily.

But we were counting our lions before they were recorded. From a near-by clump of grass in front of the microphone came the complacent chirp of a cricket. The insect's cheery good humor remained undampened even when sticks, and finally shoes, were thrown toward the sound. When we finally quieted the unwelcome minstrel, our roaring lion too had subsided for the night.

We played the tape back hopefully, but Leo's mighty voice came through as a barely audible murmur above the deafening song of the little cricket!

We consoled each other. Maybe we would have better luck with photographs.

During an afternoon's drive Weber and I had collected a large lelwel hartebeest. Back at the tents that evening, the animal was skinned for preparation as a scientific specimen. We set the carcass aside as food for our native carriers; it lay beside the truck in the very center of camp. First thing in the morning, we assumed, the boys would cut it up.

At dawn we awoke to an excited clamor. A lion had boldly entered camp during the night and taken our hartebeest. The big cat's trail led across a road and into thick thornbush about 500 yards away, where we found the chewed remains of our specimen.

Lions often return to a kill. Here, we thought, was the opportunity we had been waiting for. A driver backed our truck into an

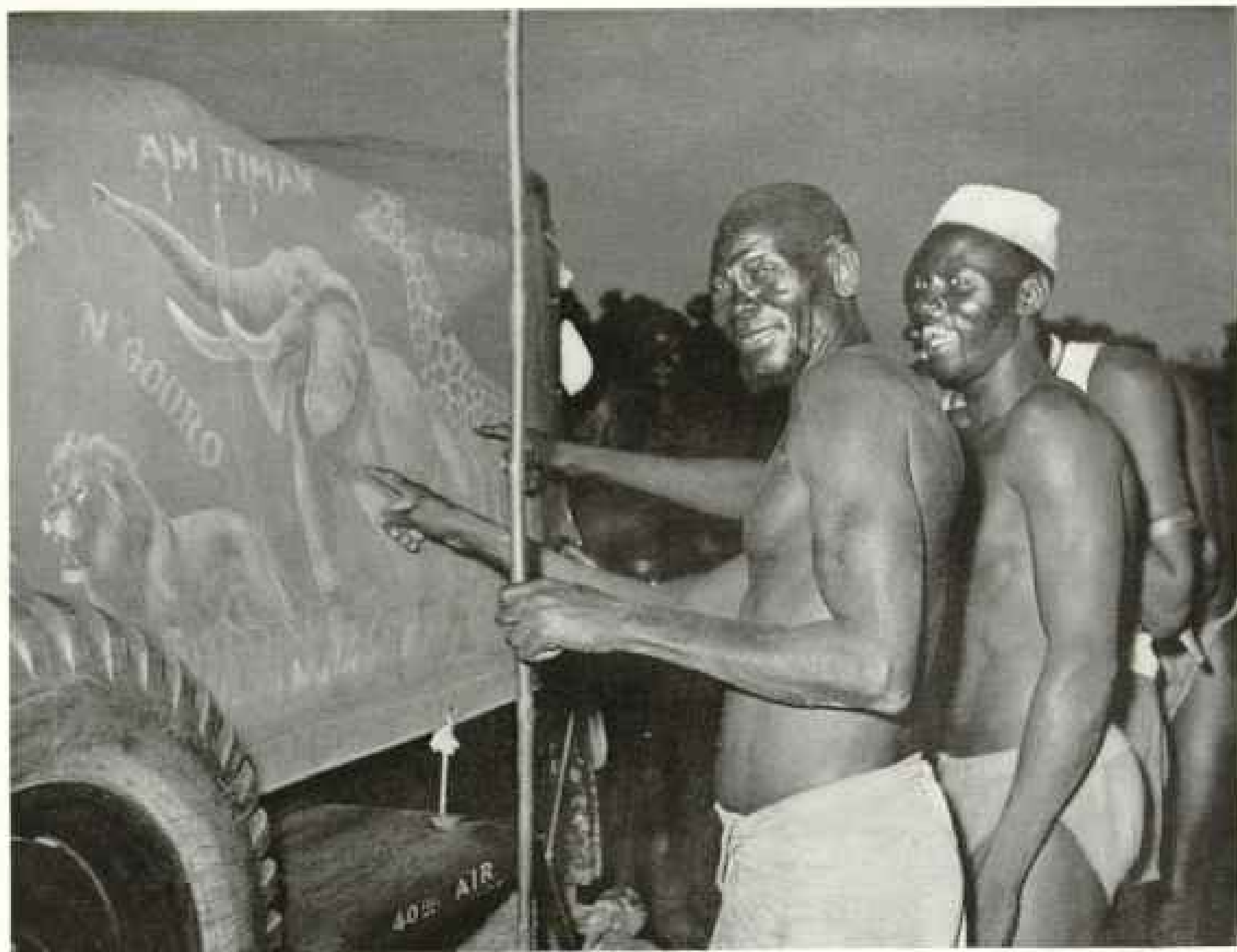
* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Safari Through Changing Africa," by Elsie May Bell Grosvener, August, 1953; and "Roaming Africa's Unfenced Zoos," by W. Robert Moore, March, 1950.

◀ Antelope, Ostrich, and Cattle Egret Forage Amicably Together

Once common, the **North African Ostrich** survives today only in sparsely populated regions. This pair may be half-wild descendants of birds raised as village pets. The male displays billowing white plumes on wings and tail. Natives use these feathers occasionally for dance and ceremonial costumes.

Kob (foreground and under tree), commonest game animals of the region, often graze tamely within sight of villages. Small, spike-horned **Oribi** generally travel singly or in pairs. This adult male weighs only about 32 pounds.

Cattle Egrets follow herds of game, feeding on insects stirred up by the animals' hoofs. Twenty-odd years ago they mysteriously appeared in South America and recently spread to the United States. (See "A New Bird Immigrant Arrives," by Roger Tory Peterson, NATIONAL GEOGRAPHIC MAGAZINE, August, 1954.)



Identifying Animal Portraits, Natives Beam Like Contestants on a TV Quiz Show

On the canvas cover of a jeep truck, expedition artist Walter Weber painted animals and names of places he hoped to see. These Sara hunters, carrying 10-foot spears tipped with iron, enthusiastically named lion, elephant, and giraffe. A zebra likeness, on the opposite side of the truck cover, stumped them; the animal is unknown on French Equatorial Africa's grassy plains.

opening within camera range of the half-eaten animal. In it we set up a battery of motion-picture and still cameras. Wentzel carefully placed lights at strategic points in the trees and arranged the controls so they could be operated at the camera. As a final touch, everything was camouflaged with branches.

Uninvited Guests Wreck a Reception

Even if the camouflage failed, we reasoned, our lion was sure to come back for another meal. The presence of the truck should not disturb him, for he had walked shamelessly up to it the night before when he had entered camp to steal our hartebeest. And the scent of man apparently did not worry him either, for he had come close to us as we slept. Here, we felt, was a lion that would cooperate.

By noon the truck with its cargo of cameras was in readiness. Then, late in the afternoon, we checked again to be sure everything was in order. An appalling sight greeted us. The

outdoor studio was a shambles. Not a camera was left in the truck. Lights and wires had been pulled from the trees, and pieces of equipment were strewn about the ground.

Not a cricket this time, but baboons, had foiled our carefully laid plans. A troop of the mischievous animals had spent a riotous afternoon tearing our "camouflaged" equipment apart.

Two cameras and two tripods were out of commission, but the rest of the gear remained usable. By suppertime we were ready again for our camp-raiding friend.

Space in the truck was limited. Mrs. Weeks and Wentzel, we all agreed, should wait for the lion. Walt and I would take the jeep and go after lesser game.

We had barely left camp when the lights of our car picked up a huge tawny form in the road ahead of us.

"Well," Walt said, "it looks as if our friend is coming for an early supper tonight."

We stopped and watched as the animal approached in the beam of the headlights. It was the largest lion I had ever seen.

As the great beast drew nearer, Walt and I clutched the shotguns at our sides. It was small comfort to remember that we had loaded them with bird shot in anticipation of much smaller game.

The lion came within less than 50 feet of the open jeep. Then he turned and padded noiselessly toward where Wentzel and Mrs. Weeks waited with the cameras.

But once again we were disappointed. Though the big cat crept close to the hartebeest carcass, he did not return to his meal. Following the tracks next morning, we could see where he had made a careful survey and decided things were not to his liking.

Grandstand View of Wildlife

During our stay in Africa we made many interesting stops, but one among them all stands out vividly in my mind. We had been traveling all day through dust and torrid heat. Tired and thirsty, we topped a last hill and saw before us the new, clean rest-house at Gari, on the Barya River. Built on a high bank above the water, the camp commanded a superb view of a plain through which meandered the shimmering stream. We had been sleeping under canvas for many nights, and the thought of a real roof over our heads was heartening indeed. With one accord we settled down for several days.

Gari surprised us with the richness of its wildlife. Here we acquired many specimens, but most entrancing of all was the view. Seated comfortably on the porch of the resthouse, we enjoyed a grandstand view of central Africa's bird and animal life on the plain below.

Sleek buff-colored kob proved to be the region's most plentiful antelope. Slightly smaller than a white-tailed deer but a bit more stocky, and with handsome lyre-shaped horns, the kob found in

the vicinity of Fort Archambault has been described as a distinct subspecies and so was of special interest to me (page 272).

Defassa waterbuck, larger animals with coarse brownish-gray hair, came next in abundance (page 265).

A few reedbuck appeared. These bushy-tailed antelopes resemble white-tailed deer more closely than kob, but their short horns with forward-pointing tips are distinctive.

An occasional buffalo came into sight, and elephant tracks poked the plain, although the big animals never showed themselves.

Birds abounded at Gari. Walt and I spent much time cruising lonely trails or following native footpaths, collecting an occasional



Walter Wentzel, National Geographic Staff

Angling Artist Captures 26 Pounds of Fish for Dinner

The *Capitaine* or Nile Perch attains a weight of 200 pounds, but 20- to 40-pounders make the best eating. Fishing with light tackle and a plug, Walter Weber worked this prize onto a sand bar near Koskobo, then waded in and grasped it by the gills. Tribesmen fashioned the boat from a hollowed log.

specimen to help in his painting or to enrich the museum's collection. But most of the time we observed with glasses.

Brilliantly colored bee eaters of several species dashed from dead limbs in pursuit of insects, then hurled themselves back to the same perch. The carmine bee eater, one of the largest, habitually follows herds of game animals, feeding on insects stirred up by their hoofs (page 265).

Strangely, these vivid birds fearlessly adapt themselves to the presence of visitors. Walt, making his way through high grass one day, counted 36 of them flying about him, attracted by the insects that flew up as he walked.

Rollers (opposite) appeared conspicuously in a burned-over area near camp, where stark trees, blackened and leafless, stood as reminders of a fire. Occasionally, in the taller trees along the river, plantain eaters hopped, vivid one minute with sun-spangled purple and red, and invisible in deep shadow the next (page 283).

Wildlife Hides from Midday Sun

As the thermometer soared, everything took to cover. Antelopes sought the shade of trees or brush patches; even the birds dozed until the brassy sun sank a few degrees toward the horizon.

Exceptions to this rule were the sunbirds. These feathered jewels buzzed about in blossoming flamboyant trees when other living things hid from the heat. Darting about in their restless search for nectar and tiny insects, they take the place in Africa of the New World's hummingbirds (page 278).

Perhaps the most familiar of African birds, the guinea fowl utters a gabbling call that symbolizes the continent for many travelers (page 270). To Americans the same sound carries nostalgic reminders of farmyards back home, for Africa is the domestic bird's ancestral home.

One of the special requests I had received from the museum was to determine if possible where the range of *Numida meleagris major*, a guinea fowl with cobalt-blue wattles and small bristles on its nostrils, the common form in French Equatorial Africa, merged with that of *Numida meleagris galeata*, a bird found in the western Cameroons. The latter wears red on its lower wattles and lacks the hairlike bristles.

We determined to solve the problem if

possible. All the birds seen were carefully observed, and a few specimens were collected for the museum.

A few miles east of Pala a flock of guinea fowl near the road took my eye. I had seen them for only an instant, but felt sure they were different. Walt hurriedly climbed from the truck and with his usual skill brought one down. The bird had red on its wattles and lacked the bristles.

Later we acquired two more so Walt could present them to the U. S. National Museum of the Smithsonian Institution, in Washington, D. C. Just the day before I had collected a blue-wattled bird west of the Logone River; we had established to our satisfaction that the transition occurs between these two points.

Zebra Unknown to Native Hunters

The vast herds of zebras and gnus so prominent in east Africa are missing on the grass-covered plains of French Equatorial Africa. As proof of this, it was interesting to note that the majority of natives we encountered could name all the animals that Weber had painted on our truck cover—elephant, giraffe, antelope, and the rest—with the exception of the zebra, which was a creature unknown to them (page 274).

When we moved deep into the bush, the game picture began to brighten. Defassa waterbuck and kob became plentiful. Reedbuck appeared in the marshes, and we glimpsed handsomely striped bushbuck in the wooded areas (page 271). Roan antelope and, on one occasion, giraffes showed themselves. Two or three black rhinoceroses were

(Continued on page 285)

Page 277

Aerial Acrobatics Give Rollers → Their Popular Name

These jay-sized birds, observed in the northern Cameroons, delight in flying skyward, then pitching toward earth in a characteristic tumbling roll. Rusty-backed **Abyssinian Roller** (upper) inhabits scrub areas of tropical Africa from Atlantic to Indian Ocean. **Blue-bellied Roller** occurs only in west Africa.

Keen-eyed hunters, rollers favor the branches of dead trees from which to swoop after insects. Like the kingbird of North America, the Abyssinians fearlessly attack birds many times their size.

Yellow-and-black **Village Weavers** take their name from elaborately woven nests of palm-leaf strips. Sometimes as many as 100 pairs set up housekeeping inside a native settlement. They seek human companionship and seem to relish the hubbub of village life.





↑ **Royal Poinciana Attracts a Pair of Winged Jewels**

Like the Western Hemisphere's hummingbirds, the **Beautiful Long-tailed Sunbird** (left) and **Scarlet-breasted Sunbird** (center and right) feed on nectar and tiny insects in flowers. Female lacks her mate's gay costume.

↓ **Gray-headed Kingfisher Prefers Dry-land Hunting**

Unlike some of its kind, the **Gray-headed Kingfisher** rarely frequents streams but inhabits dry savanna, where it feeds on insects and small lizards. The female lays eggs at the end of a yard-long tunnel excavated in a bank.

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WALTER A. WEBER

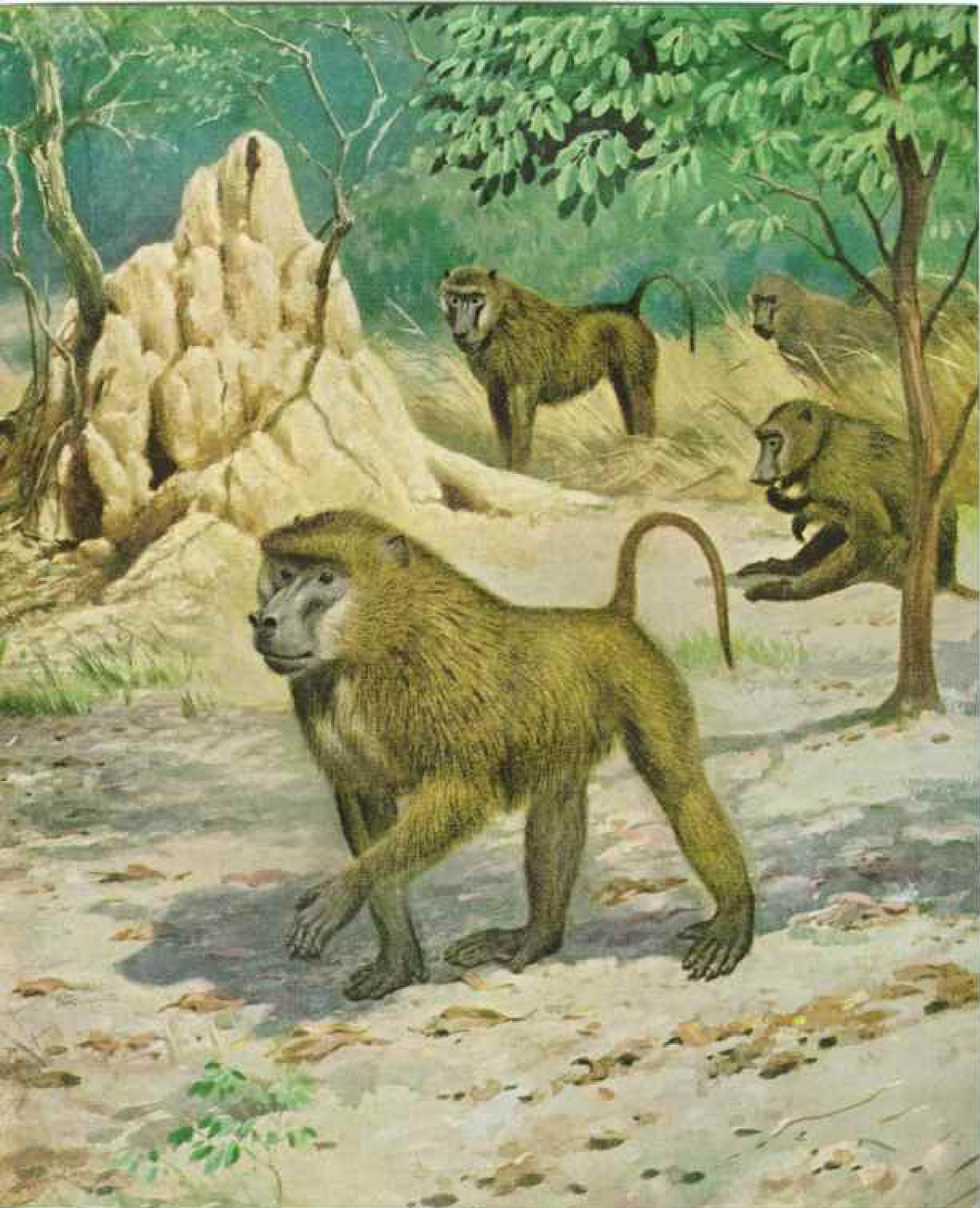


Baboons Leave Few Stones Unturned in Their Tireless Search for Food

Trigger-tempered and crafty, baboons can be formidable antagonists. Experienced hunters say they would rather let their hounds bait a lion than attempt to corner a band of these monkeys. The males have been known to charge hunters in a body. One species, the hamadryas, was sacred to the ancient Egyptians.

Here a family gathering of **Doguera Baboons** hunts for food. One youngster picks at a salmon blood lily. This plant, found occasionally in conservatories in the United States, is a member of the amaryllis family. Another young animal hitchhikes upside down, clinging to its mother's shoulders and waist. Both babies show the huge ears characteristic of infant baboons.

Individuals usually troop together in groups of eight to ten under the leadership of one or two dominant males. When disturbed, the animals utter a loud bark.



Like a Domineering Father, an Old Male Keeps Order in the Troop

Elders wear ruffs about their heavily muscled shoulders. Expedition mammalogist T. Donald Carter recorded the weight of one patriarch as 48 pounds; another weighed in at 40.

An old termite nest, weathered and empty, rises behind the male. The pack has been digging in it, searching for grubs. Baboons will eat almost anything, including beetles, birds' eggs, vegetables, grain, fruit, lizards, spiders, and grasshoppers.

The animals display remarkable social organization. When a troop robs a native garden, scouts take up posts as lookouts, and females and young feed in the center of the troop. Meanwhile, old males guard an escape route. Natives try to protect their crops by stringing tin cans in the wind, hoping the noise will keep the baboons away. Game officials often help by killing enough of a band to drive the rest into another area.

**Father Wears
the Jewelry in
This Parakeet Family**

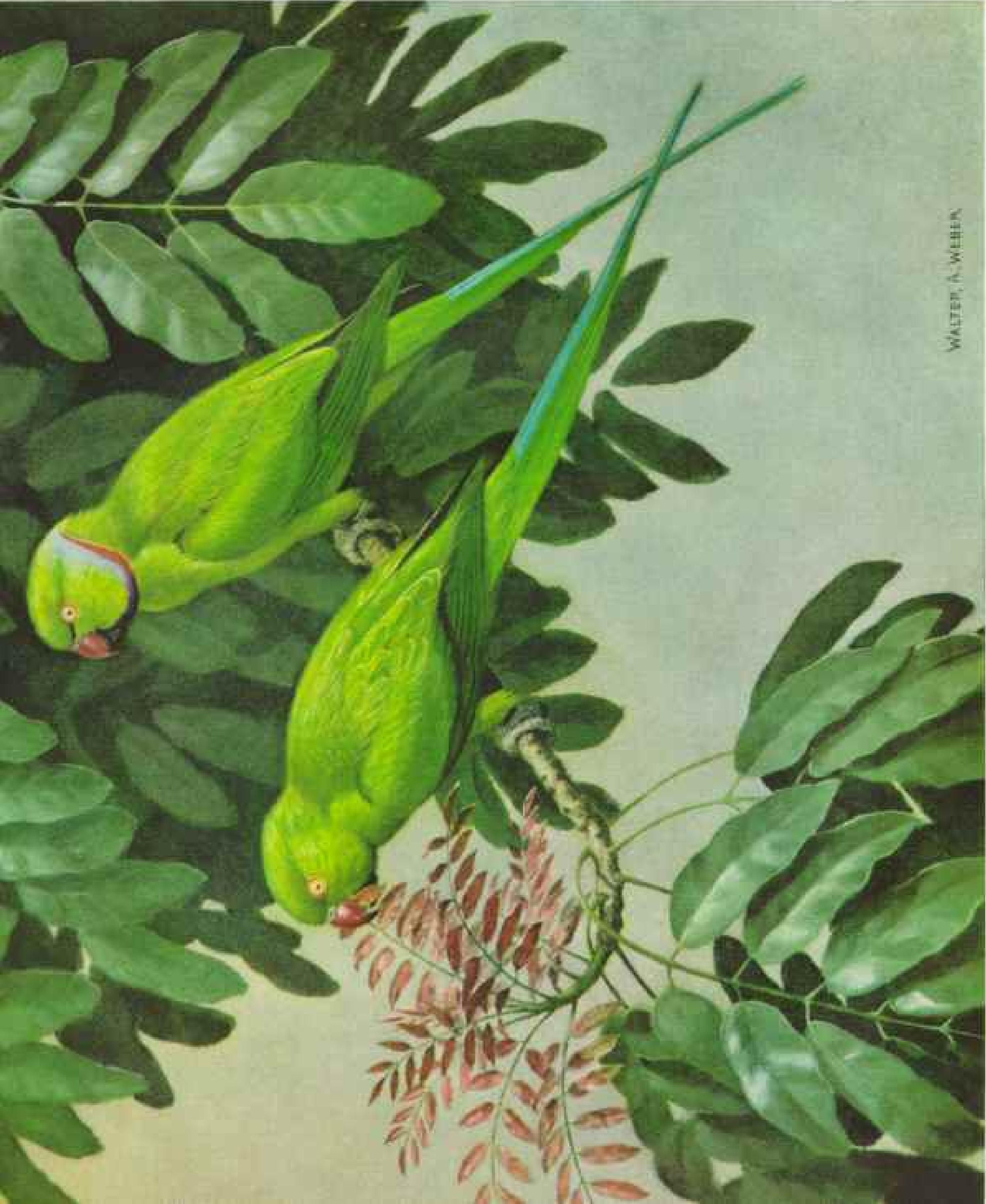
The adult male **Long-tailed Parakeet** boasts a rose-colored collar and black throat. His mate makes do with an all-green warftrobe. During their swift flight the birds scream noisily and spread their tail feathers. The center plumes sometimes exceed 10 inches.

Feeding in flocks, the parakeets often raid native millet and corn patches and steal peanuts laid out to dry in the sun. Except when perching in the open, their leaf-green plumage makes them difficult to see until piercing screams give them away.

Long-tailed parakeets make poor cage birds and are difficult to tame even when taken young from the nest.

Parakeets share with woodpeckers, cuckoos, and parrots the "yoke toes" found in birds that as a rule rarely descend to the ground. These toes are arranged in pairs, two pointing forward and two backward, so the birds can cling to branches in almost any position.

This pair feeds on young leaves of an African mahogany tree.



WALTER A. WEHLEN

Courting Plantain Eaters Vie for a Mate

Stream banks, shady trees, and wooded valleys provide favorite haunts for shy West African Violet Plantain Eaters. About the size of crows, the glossy-feathered birds progress along limbs in a series of agile hops, using their long tails as a combination rudder and balance bar. In flight the crimson primaries show brilliantly against a leafy background. With wings folded, however, the purplish blue blends perfectly into forest shadows.

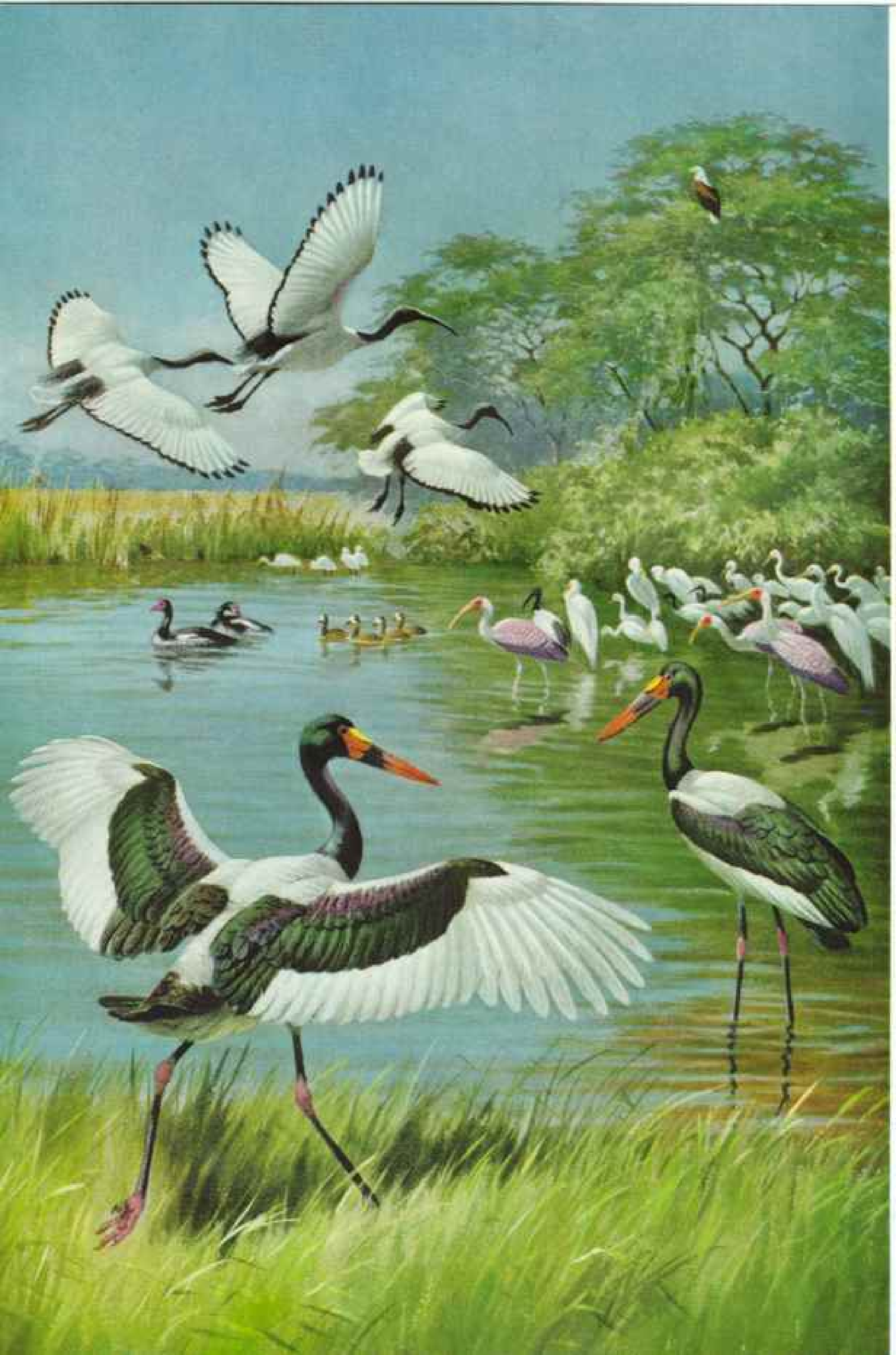
The birds often gather toward evening in a favorite tree, where they set up a loud croaking and gabbling not unlike that of a roosting flock of crows. Another call resembles a gentle cough.

Crimson wing feathers of plantain eaters and related toucans contain a reddish-violet pigment called turacin. It was once believed that the color, containing copper, washed out of the primaries during heavy rains and was then renewed.

Here two males (right) spread wings and bow before an admiring female. Both sexes wear the same plumage. Despite the popular name, the birds do not eat plantains; berries form the bulk of their diet.

© National Geographic Society
Walter A. Weaver





reported to inhabit the area, though we never saw them. Of the lesser bucks, the oribi (page 272) and the gray duiker were most in evidence.

One of the commonest animals about our camps, although we rarely glimpsed it, was the galago. This distant cousin of the monkey, with large ears, enormous eyes, and soft gray fur, roughly matches our red squirrel in size. One of the lemurs, the galago spends its life in trees, seldom if ever coming to the ground. Its piercing birdlike calls are frequently included in the weird symphony of the African night.

Fiery Disks Betray Galago

On evening walks Walt and I usually carried a powerful light, which we played ahead of us in the trees and on the ground. Sooner or later, high in the trees, two big fiery disks would reflect the light back to us. It seemed impossible that these could belong to so tiny an animal. But there was no doubt about it. The reflections would disappear, only to reappear instantly 15 or 20 feet away; no other animal with such eyes, we knew, would be so active.

This was not my first meeting with this little animal. One day while I was camped in Northern Rhodesia a native boy brought me a gourd with a hole in its top, plugged

by a wad of dried grass. Inside, he told me, were four live galagos taken from a nest in a hollow tree.

I tried to transfer the animals to a box, but one slipped past my hand and with an agile leap landed on my table. With only a moment's hesitation the animal sprang to one of the poles supporting the tent, a distance of about six feet, and from there made another jump of at least eight feet to a small tree under which the tent was pitched.

I sent a small boy up the tree to retrieve the animal. When the galago was in my hands again, I noticed that its hind legs had been securely tied together at the ankles with a piece of dried grass. Hampered as it was, the galago had made those jumps easily and gracefully, landing each time exactly where it had planned.

Much later, in the rain forest of the Cameroons, we were introduced to another of the African lemurs. A Frenchman came to speak to us as we sat on the hotel porch after supper. On a stick he carried a strange-looking pet. I recognized it as one of the rarer forms of potto, a short-tailed sluggish animal with brown fur. Everything about it stood out in direct contrast to the galago. Its slow movements, small ears, and dull eyes made it difficult to believe that the two animals were related.

Almost daily baboons foraged about our camps. These large monkeys live on the ground but occasionally climb trees in search of food. However, if disturbed they immediately forsake the trees and escape on foot.

Baboons go about in sizable troops, turning over rocks and tearing rotting logs apart in search of insects, scorpions, and other delicacies. When the animals are suddenly disturbed, they express their displeasure by barking and scurrying about. The males grimace at the intruder, and mothers look frantically for their babies. Very young offspring cling to mother's undersides, while older ones jump on her back or shoulders and ride to safety (page 280).

Mother Baboon to the Rescue

One day as Wentzel and Weber drove along a trail, they inadvertently separated a troop of baboons. One group scampered to safety, but the others, with the jeep between them and their mates, found their escape cut off. At what sounded like a barked command from the old male in charge of the troop, the strag-

Page 284

← Woe Betide the Minnow That Meets This Gallery of Feathered Fishermen

In a backwater of the Aouk River, promise of abundant food has attracted a mixed flock of waders and swimmers. Gatherings like this are commonly seen along African streams.

Handsome **Saddle-bills** (foreground) take their name from a flat protuberance saddling the upper mandible. Tallest of the storks, they stand four feet high and boast a wingspread equaled among their kind only by the carrion-eating marabou (page 269). Beyond, a trio of **Sacred Ibises** spread black-edged wings. The wrapped and mummified bodies of these graceful birds, once revered by the Egyptians, have been found by the thousands in ancient cemeteries along the Nile.

Curved bills and pinkish backs identify three **Wood Ibises**. Behind them stand **African Great White Egrets** and smaller **Cattle Egrets** (page 272). On the river's quiet surface a pair of **Spur-winged Geese** paddle contentedly, followed by a family of **White-faced Tree Ducks**.

Above them all, a **White-headed Fishing Eagle** looks down from its riverside perch. Related to North America's bald eagle, it differs in its reddish-brown body and reddish patches on its shoulders.

glers began a frantic end run to swing ahead of the jeep and rejoin the pack.

Suddenly a female paused as if she had lost something. Changing direction, she rushed back to pick up a forgotten infant. The young baboon clamped its arms around the mother's shoulders and clung for dear life as she galloped around the jeep and rejoined the troop.

Sleep Foils Baby Baboon's Plans

Adult baboons are among the most savage of African mammals, and attempts to keep them as pets have rarely been successful. But for a time the expedition numbered among its members an infant, with the huge ears and the appealing old man's face of so many baby simians. "Dopey" would have been a first-rate camp nuisance if he could have stayed awake. A dozen times a day he would raid Wentzel's camera case, get into the kitchen supplies, or try to make off with some of Walt's paints. But invariably fatigue would get the better of him, and he would nod and fall asleep before any damage was done.

Africa boasts a rich monkey fauna. Most of the forms live in or near forests and seldom if ever go far from a tree.*

One species, however, provides the inevitable exception. Africa's red ground monkey has changed its mode of life, over the millenniums, and, unlike its tree-loving relatives, spends most of the time hunting food on the ground. Like the baboons, red monkeys often venture far out onto the plains, where they must rely on agility and fleetness of foot to save themselves from predators. Occasionally, however, if the opportunity presents itself, they will take to the trees to foil a hungry leopard or other enemy (page 267).

At Madecongo, one of our first camps after leaving Fort Archambault, Mrs. Weeks adopted a baby red monkey. The little fellow stayed with us throughout the trip and eventually went home with her to the United States.

Monkey Faces Peer from Trees

Most of the monkeys of Africa belong to a group called the guenons. These medium-sized, long-tailed animals generally live in forests and seldom if ever go far from the protection of trees. This group includes some of the most beautifully colored of all primates. The most common guenons are green monkeys, widely distributed throughout Africa

(page 266). The north African grivet, the south African vervet, and the west African true green monkey are all members of this group.

Intensely curious, green monkeys will scatter and disappear if disturbed. But in areas where they have not been shot at, one has only to sit quietly beneath the tree. Sooner or later a face will peer down from a mass of foliage, and then another and another. The little animals, relying on their amazing ability to disappear like acrobats into the treetops, cannot resist coming back for a second look at anyone who disturbs them.

As one tours through Africa, these are the monkeys that most often troop across roads in front of cars. Often they become quite tame and confiding and will even beg food from passers-by.

Despite the fact that these monkeys, when fully grown, become difficult to manage, Walt acquired a young female green monkey and brought it home to his farm in Virginia. For a summer Bouba reveled in the life, romping with Walt's dogs and perching on his daughters' shoulders as they took her on walks through the woods.

Bouba Remembers an Old Friend

But Bouba's heritage eventually asserted itself. She threw things and bit a delivery man. In self-defense Walt presented her to the National Zoological Park. Hopefully, assistant zoo director Ernest P. Walker assigned Bouba a place in a big-group cage, where 26 other monkeys played happily together. Little Bouba promptly picked fights with every inmate of the big enclosure.

Bouba ended, lonely and defiant, in the solitary confinement of a private cage. But she still recognizes the man who brought her from central Africa to Washington, D. C. Now, when Walt visits the monkey house and stands before her, Bouba peers quizzically at him, as if not quite sure who has come to see her. Then Walt whispers her name softly, and the little monkey springs to the bars and gently extends an arm.

"This is what it was like at home," she seems to be saying, as Walt fondles her hand. "This is the way it was when we were in Africa together."

*See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Portraits of My Monkey Friends," by Ernest P. Walker, January, 1956; and "Monkey Folk," by William M. Mann, May, 1948.



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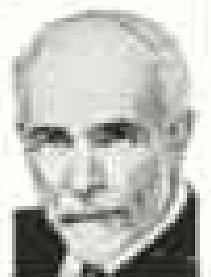
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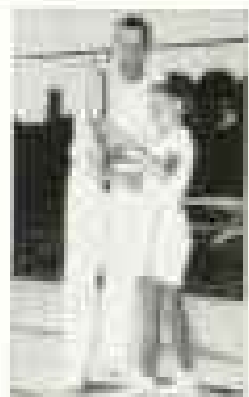
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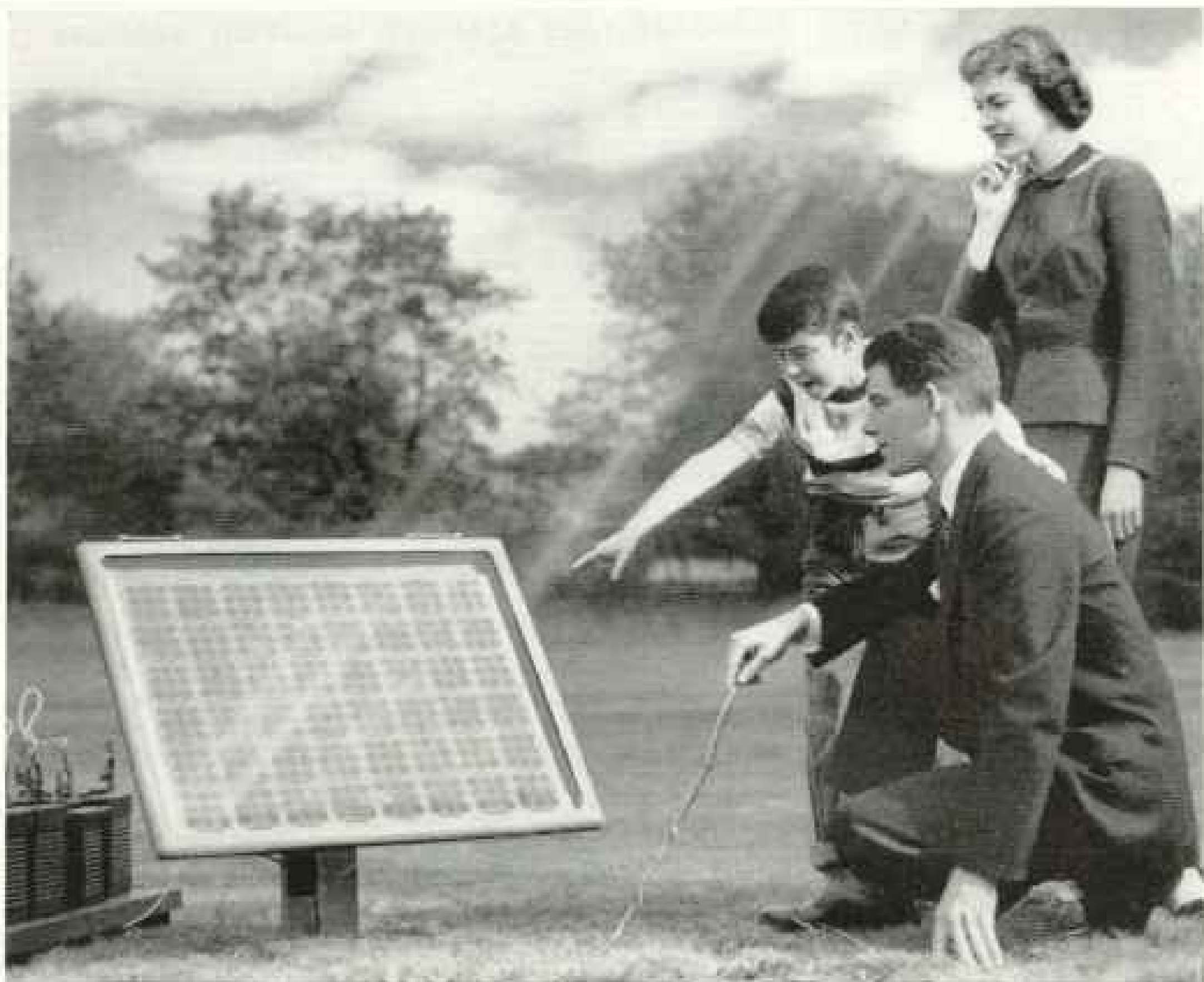
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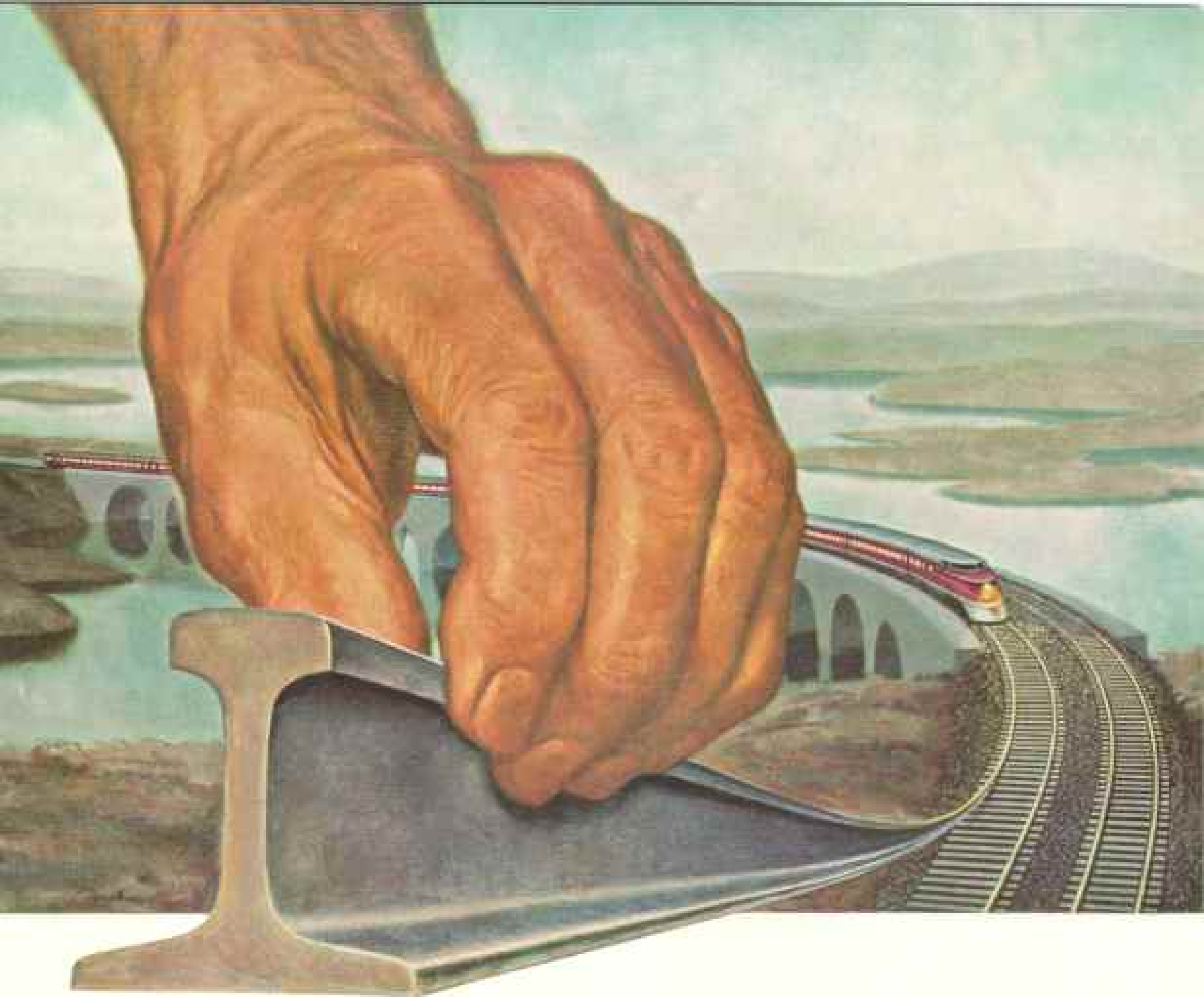
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