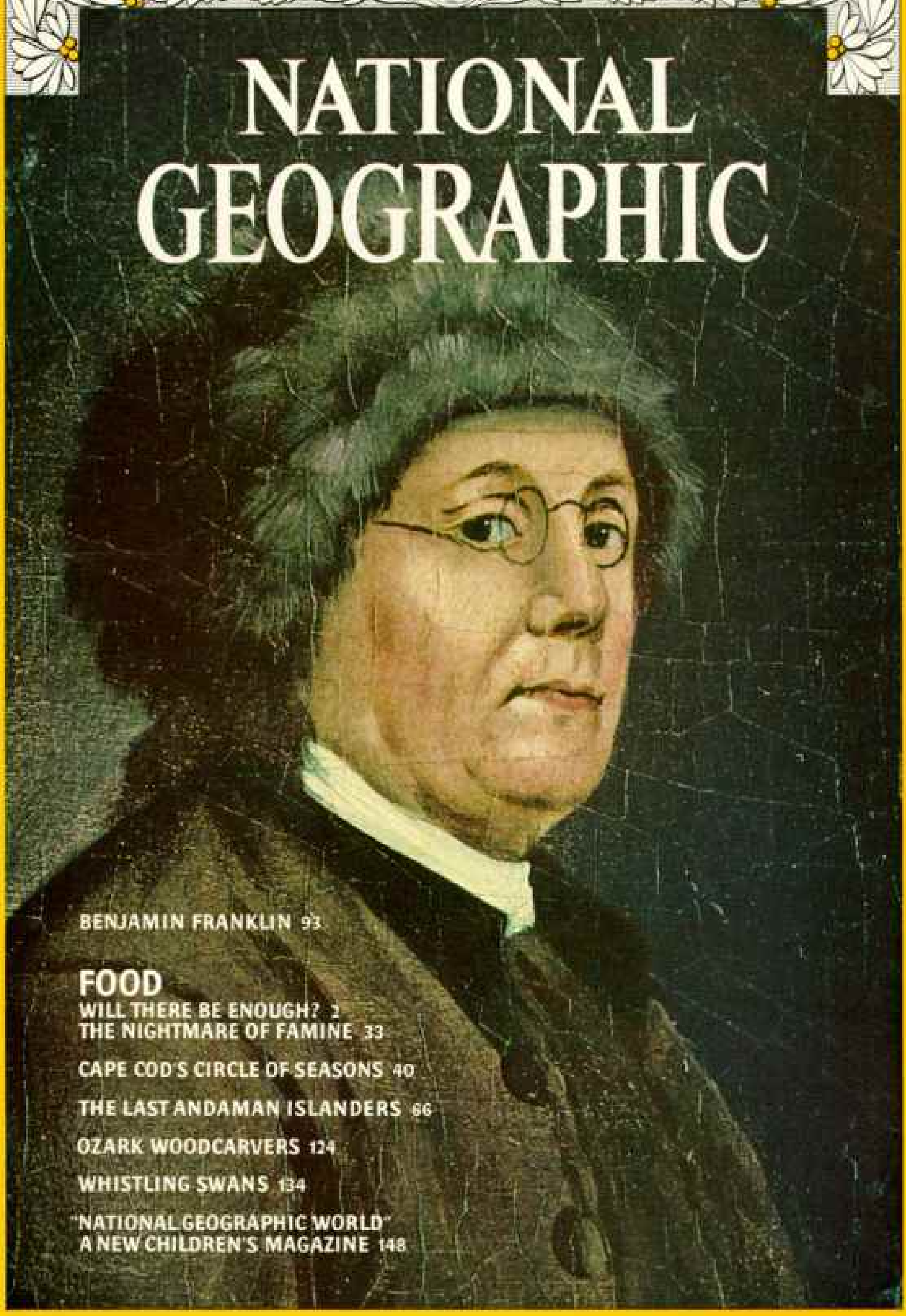
"CLOSE-UP: U.S.A." — WESTERN NEW ENGLAND

VOL. 148, NO. 1 JULY 1975

NATIONAL GEOGRAPHIC



OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

"MANY MEN are inclined . . . to predict that the day has at last come when the human race must cease to expand its numbers, or else face inevitable hunger."

Familiar words? They were published 59 years ago, when NATIONAL GEOGRAPHIC devoted the entire January 1916 magazine to one subject: "How the World Is Fed." Now, six decades later, we revisit the question.

If there are amazing similarities in the two eras, there are also profound differences. In the midst of epidemics and battlefield casualties in the year 1916, NATIONAL GEOGRAPHIC reported the earth's population as about 1.7 billion. "If they were all set down at a banquet," we reported, "it would require sixteen tables reaching around the globe to seat them." Today—largely as the result of Western medicine's staggering impact upon the death rate—the planet has 3.9 billion people, and demographers expect that figure to double in just 36 years. No one would dream of a world banquet today, even as a figure of speech.

Were it not for an equally impressive advance in agricultural technology, hunger would be stalking far more of the world. Even so, as many as 1.5 *billion* people may suffer some degree of malnutrition. Most of the world's poorer peoples live in the equatorial "hunger belt"; they constitute two-thirds of the planet's population but produce only a fifth of its food. In contrast, a United Nations report notes that "The . . . grain used annually for livestock feed in [high-income] countries . . . is greater than the total human consumption of cereals in China and India together." Small wonder that, in times of drought and famine, food becomes one of the world's most emotional issues.

So too with population. Recent international conferences on both population and food have reminded the world that the people of poorer nations may view with suspicion programs to limit human numbers. Children there are often regarded as the only economic security for a parent's old age, and population programs unaccompanied by offers of massive wealth-sharing may seem simply a means for the "haves" to keep their unequal share of things. Also, in many places religious proscriptions limit modern methods of population control.

And we must consider the weather. Some climatologists fear the world's monsoon belt may be shifting—with the result that there may be catastrophic new droughts in heavily populated areas.

Readers of the GEOGRAPHIC have long followed this planetary suspense story. Major articles on the weather, on famines, and on the technological revolution in agriculture have kept members abreast of the changes. Our present report may be considered the latest "update" on the endless race between human fertility and that of the soil that sustains us—and on the hope offered by such things as high-protein corn, the humble sweet potato, the riches of Antarctic seas, and the drought warnings that satellites can give.

"Truly," noted our 1916 article, "the man who dines well ought to be a deep student of geography. . . ." Today that man's grandchildren must delve deeper still, having in mind those millions who hardly dine at all.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 148, NO. 1
COPYRIGHT © 1975 BY NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C. INTERNATIONAL COPYRIGHT SECURED

July 1975

COVER: *"Figure . . . an old Man, with grey Hair Appearing under a Martin Fur Cap, among the Powder'd Heads of Paris." Thus Benjamin Franklin described himself in 1777 (pages 93-123). Painting by John Trumbull, Yale University Art Gallery, John Hill Morgan Fund.*

Can the World Feed Its People?

By THOMAS Y. CANBY

Photographs by STEVE RAYMER

BOTH NATIONAL GEOGRAPHIC STAFF

Child of catastrophe, a Bengali girl waits for relief food during a famine that wracked Bangladesh last autumn. Her beleaguered nation, one of the most densely populated on earth, lives in the shadow of chronic hunger, which, many experts fear, may threaten the entire world.

THE STRUGGLE—the ceaseless war against hunger—is as old as man himself, and never across the face of our planet has the outcome been more in doubt.

Recent battles have been costly, as in famine-plagued Bangladesh (right, and pages 32-39). To head off future disasters, scientists are working feverishly to develop new weapons against starvation—some commonplace, some almost bizarre. Consider:

• Livestock breeders transplant embryos from prize cows to "substitute mothers." The inferior cattle then gestate and bear high-quality calves. Thus a single blue-ribbon cow can contribute a herd of valuable offspring every year.

• A new variety of corn packs beef-quality protein, promising a nutritional revolution in many corn-dependent countries.

• SCP—single-cell protein—can be grown as a fortifier for human and livestock food by "planting" yeast in a mixture containing a petroleum derivative. A 250-acre plant devoted to such "food from crude" could yield as much protein as a million acres of soybeans.

• In Antarctic waters Soviet and Japanese vessels experimentally harvest krill—abundant planktonic crustaceans—to be converted into animal and human food. The Soviets speak of an annual haul of a hundred million tons, more than the total sea catch today.

Can such measures stave off mass starvation when each dawn finds 203,000 additional mouths to feed? Or is it already too late? In search of answers, I recently traveled more than 58,000 miles around the globe. From the world's food experts I heard words of warning, and of hope. And in many lands I saw the pinched, bleak face of hunger.

Malnutrition Gets a Foothold

A pestilence lay on the Indian village of Itaunja, lay with a malignance that was slowly sapping its life.

It showed itself in strange symptoms. Little heaps of rice, wheat, and beans dotted Itaunja's market, all for sale. Yet the hungry-looking who thronged the marketplace took away little, as if unable to eat.

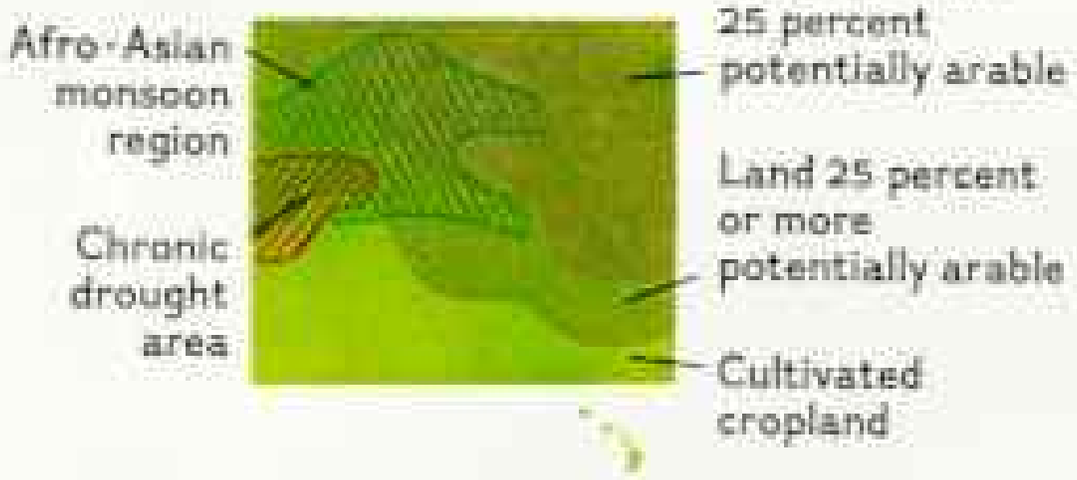
A frail woman named Bhagana, holding a small cotton bag of wheat in one hand and clinging to her wizened child with the other, told me how the scourge of inflation had afflicted her family. "A year ago," she related, "we could buy twice as much wheat, and we ate two meals a day, often three. Now we usually eat only a single meal."

I asked what this meal consists of.

"Chapaties and salt," she answered, referring to India's unleavened tortilla-type bread. "Sometimes with a vegetable, but usually just chapaties."

Certainly here was no famine in the classic sense of starved bodies and exhausted foodstocks; photographer Steve Raymer and I would see those elsewhere as we

Mounting pressures on a finite earth



TODAY 3.9 BILLION MOUTHS to feed; in 24 hours, an additional 203,000; next year, 74 million more. Relentlessly human numbers grow, demanding ever more food from soil and sea. Moreover, as living standards rise in many nations, appetites for meats and dairy products drastically expand; people of the United States, for instance, place four times as much demand on the food supply as do those in the poorest nations. Between the two pressures—population and affluence—mankind runs a desperate race with hunger.

Until recently we met expanding needs by pushing back the farm frontier. But today almost all the world's land economical to cultivate—some 3.6 billion acres—is already being used.

Meanwhile, climatologists warn, changing weather patterns could bring disastrous droughts to the most populous regions.

OCEANS COVER 71 percent of the planet's surface, yet produce a mere one percent of man's food.

pursued our study of the world's food problem. In Itaunja, hunger took a far more prevalent form, that of insidious malnutrition. Striking at the poorest of the poor, it drags them down until they fall prey to disease.

Famine in both forms threatens a globe-girdling tropical zone that has been called the "hunger belt" (map, above). Until three years ago the lot of those people at the bottom of the world's economic ladder had seemed to be getting better. Wondrous new seeds had been developed in a so-called Green Revolution; with these, and the alchemy of fertilizers, tired lands had miraculously shown promise of greater fertility than the people they nourished. And if drought or flood brought sporadic hardship, stricken governments could rely on the seemingly inexhaustible grain reserves of distant North America.

Those were times, observes Senior Economist Robert C. Tetro of the United Nations Food and Agriculture Organization, "when

people tended to forget that the most important event on earth each year is the harvest."

1972 Marked a Grim Turning Point

With shattering suddenness a cross fire of forces converged in 1972 to disrupt the world's food supplies—disrupt them so profoundly as to revive the warnings of the English clergyman-economist Thomas Malthus, who nearly 180 years ago wrote, "The power of population is so superior to the power of the earth to provide subsistence" that man will succumb to "gigantic inevitable famine."

And if, indeed, such a prospect looms today, how bad might it be? Some experts have chosen figures that chill the blood: Famine, they say, could claim from 50 to 200 million lives around the globe within a decade.

Adverse weather played a key role in the upheaval of 1972. Drought and frost reduced grain yields in eastern Europe and the Soviet Union; dry weather withered crops in India,

Tapping the bounty of the United States heartland, a Europe-bound tanker on the Mississippi River in Louisiana takes on 80,000 tons of corn. Twenty percent of all farm exports—including half of all grain in international trade—flows from the U.S., giving it unchallenged dominance in the world food market.

America's food role took a crucial turn in 1972, when demands created by a worldwide spate of crop failures and huge grain sales to the Soviet Union and China depleted reserves. Removal of this historic buffer against world famine also fueled global

inflation. Almost simultaneously, world fertilizer use outpaced production, and soaring oil prices idled tractors and irrigation pumps in the neediest nations. Suddenly and ominously, mankind found itself living hand to mouth, and world food reserves precariously low.

Loser in a gamble with weather, a Texas farmer plows under 1,200 acres of wheat that withered during the 1974 drought. Earphones soothe him with music in the enclosed cab of his tractor.

With such machines, abundant use of fertilizer, and the wonders wrought by agricultural research, U. S. farmers—less than one percent of the world total—in a normal year raise 15 percent of all food. An automobile bumper sticker (**top**) reflects a consciousness of their role.

Australia, Argentina, and Africa. Typhoons and drought slashed harvests in the Philippines, and excessive rains bogged down United States corn and soybean crops.

Peru's fish catch, traditionally the world's largest, drastically declined—and with it, a major source of poultry and livestock feed. Ominously, the world's need for fertilizer, increasing each year by leaps and bounds, shot past manufacturing capacity.

Meanwhile the grain-short U.S.S.R., reversing a practice of belt tightening during times of poor harvests, quietly entered world markets and bought up a staggering 28 million tons of grain, most of it from the U.S.

Comforting Surplus Suddenly Vanishes

"The U.S. surpluses," notes economist Tetro, "had cushioned the world against food shortages and price fluctuations for two decades." With these all but gone, needy nations scrambled for what was left. Prices soared, and food switched roles from an anchor against inflation to a leader in the spiral. A year later the energy crisis struck, hitting hardest those poorer nations lacking both oil and fertilizer, and the money to buy them.

From a position of almost unwanted abundance, the world in a few short years had seen its food reserves drawn down to only a few weeks' supply. The international cupboard was nearly bare.

By May 1974 the United Nations Economic and Social Council had concluded that, though "history records more acute shortages in individual countries . . . it is doubtful whether such a critical food situation has ever been so worldwide."

At a campuslike research center outside Mexico City, where he carries on his crusade to help the world help itself, Dr. Norman E. Borlaug (page 23) sketched the dimensions of the problem for me.

"Two-thirds of the human population of 3.9 billion," he explained, "live in the poorest countries—those least able to supply their peoples' needs. They also have the highest birthrates; of the 74 million people added to our population each year, four of five will be born in a have-not country."

Dr. Borlaug, a geneticist, won world renown (and a Nobel Peace Prize) for his development in the 1950's of "miracle" strains of wheat that launched the Green Revolution in many countries. In his early experiments in Mexico, for lack of enough assistants and

Treating with disease instead of a cure (**above**), a pathologist injects fungus spores into corn at a research center in Mexico. Traits of those plants showing resistance to diseases are bred into high-yielding strains.

Ravaged by searing winds during last year's drought, this ear of Nebraska corn (**facing page**) produced but two lonely kernels. Slashing the nation's corn crop by a fourth, bad weather drove a few farmers to publicly slaughter their calves in an effort to dramatize the high costs of feeding livestock. Today, as in ancient times, drought and crop disease can be harbingers of famine.

Plague in beauty's plumage; queleas take flight over a Kenya field. Marauding by the tens of millions across parts of Africa, the sparrow-size birds annually destroy thousands of tons of wheat, rice, sorghum, and millet. With chemical sprays and explosives,

officials kill millions at a time, yet make little dent in their numbers.

In tropical countries, where ravaging birds, rats, and other pests are most destructive, a farmer may lose half his crop before it reaches the table.

machinery, he sometimes yoked himself to a plow to till a test plot. He is no less dedicated and energetic today as the director of the wheat program of the International Maize and Wheat Improvement Center, known as CIMMYT, its Spanish acronym.

"When we talk about world food production," Dr. Borlaug said, "our best index is grain. Cereal grains are basic to the diets of peoples everywhere, whether they eat them directly, as in the poorer nations, or indirectly, as dairy products or grain-fed beef, pork, and chicken. Each year the world consumes a total of 1.2 billion metric tons of grain.

"This is equivalent to a highway 55 feet wide and six feet thick, built entirely of grain and stretching around the earth at the Equator. Each year it is eaten in its entirety and must be replaced. And expanding demand for food adds 625 miles more each year."

Technology Gives U. S. the Edge

To fill its empty storehouses, the world must turn largely to the United States and Canada, whose dominance of global grain trade rivals the dominance of the Middle East nations over petroleum.

On his roaring tractor or combine, the U. S. farmer presents a Bunyanesque figure. Where his Soviet counterpart feeds six besides himself, the American supports 46; where an Asian or African spends five days in the field to produce a hundred pounds of grain, the American spends only five minutes. In 1974 his crops—with soybeans, wheat, and corn at the top of the list—brought in 20 billion dollars from abroad, enough to pay for four-fifths of the country's oil imports.

At the other end of the food scale, the United Nations identifies 33 countries that are seriously threatened by major food shortages (map, pages 4-5).

No country, however, has lived more intimately with the specter of famine than China. During 1876-79 alone, drought claimed an estimated 13 million victims.

Today that land of 822 million appears to have the upper hand over hunger, according to a group of ten U. S. plant scientists. During a visit last year they saw widespread irrigation works and high-yielding rice varieties bred by Chinese geneticists, and learned of crash programs to build fertilizer plants.

"Even China's population must be coming under control," says Rockefeller Foundation Vice-President Sterling Wortman, who led the delegation. "Marriages are delayed until the man is 28, the woman 25. The Chinese are ingenious in directing social and economic pressures toward smaller families."

The visitors heard repeated references to Chairman Mao's dictum, "Store grain everywhere." Households and communes are urged to store stocks of grain to guard against a bad year.

"They are still a poor people," says Dr. Wortman, "but I came away feeling I need not worry about China feeding her people, as long as she is not disrupted by war."

Today this worry shifts south to the soft

PHOTO BY EARL PURCELL, U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT

Hope in his hands, an Ethiopian relief worker stirs powdered milk from the United States. Food shortages in drought-stricken Ethiopia helped undermine the government of Emperor Haile Selassie.

Sea of sacks laps a mountain of U. S. sorghum on a dock at Dakar, Senegal. The food is destined for the Sahel, where famine has claimed perhaps 100,000 lives.

underbelly of Asia, the Indian subcontinent.

Some 760 million people crowd the nations of India, Bangladesh, and Pakistan—more than live on the continents of Africa and South America combined. This population almost certainly will double within three decades unless curbed by climbing death rates—a rise some demographers believe may be inevitable in India and Bangladesh. Indeed, many fear that the 74 million people of Bangladesh have already started the slide into the Malthusian abyss.

Self-sufficiency Eludes India

To the traveler arriving from Bangladesh, India seems almost underpopulated. But one person of every six on earth lives and dies in India, and at the current growth rate the nation has some 15 million additional mouths to feed annually—more than the entire population of Australia. Yet before the roof caved in in 1972, the bountiful seeds of the Green Revolution had brought India tantalizingly close to self-sufficiency.

In 1963 she and neighboring Pakistan invited Norman Borlaug to attempt the introduction of the high-yielding "wonder" wheats he had developed in Mexico. In research sponsored by Mexico and the Rockefeller Foundation, scientists had tackled a stubborn barrier to higher yields: When farmers fertilized their wheat, it responded not with more grain but by simply growing taller.

In wind or rain these tall plants toppled, reducing productivity. Patiently, Borlaug bred dwarfing genes into disease-resistant plants. Instead of growing taller when fertilized, they grew larger heads of grain that increased yields by 50, even 100 percent.

"Equally important," Borlaug explained to me, "was the development of a crop-production strategy. This meant determining the best techniques for growing the new varieties, assuring the farmer a fair price for his grain, providing the necessary inputs—seed, fertilizer, insecticides, weed killers, machines—and, vitally important, extending the credit with which to buy them."

Meanwhile research by the International Rice Research Institute in the Philippines brought forth dwarf rice strains comparable to Borlaug's wheats. Beginning its spread through Asia, the new rice found wide acceptance in India.

The Green Revolution took root; by 1968 harvests, particularly of wheat, had begun to climb. Soon India's wheat glutted markets. Officials commandeered schools and stadiums

for storing grain, and India amassed reserves that eventually totaled 9.5 million tons.

"As a result, by 1971 we were able to feed our own growing population with few imports," Dr. M. S. Swaminathan, a key strategist of India's agricultural spurt, told me. "We also helped sustain the nearly ten million Bangladesh refugees who fled here during their war of independence.

"Then came the drought of '72. Before we recovered from that, we were jolted by the energy crisis—higher prices for fuel, fertilizer, pesticides—everything! The greatest tragedy," Dr. Swaminathan continued intensely, "is that this occurred just when our forward momentum was at a peak. I think our agriculture still is ready to move—our farmers are really great. We are used to obstacles. But when they become Himalayas. . . ."

Himalayas they are. With many farmers lacking fertilizer and fuel for irrigation pumps, India's harvests have yet to rebound to the 1971 peak. Last year she had to buy 600 million dollars' worth of grain.

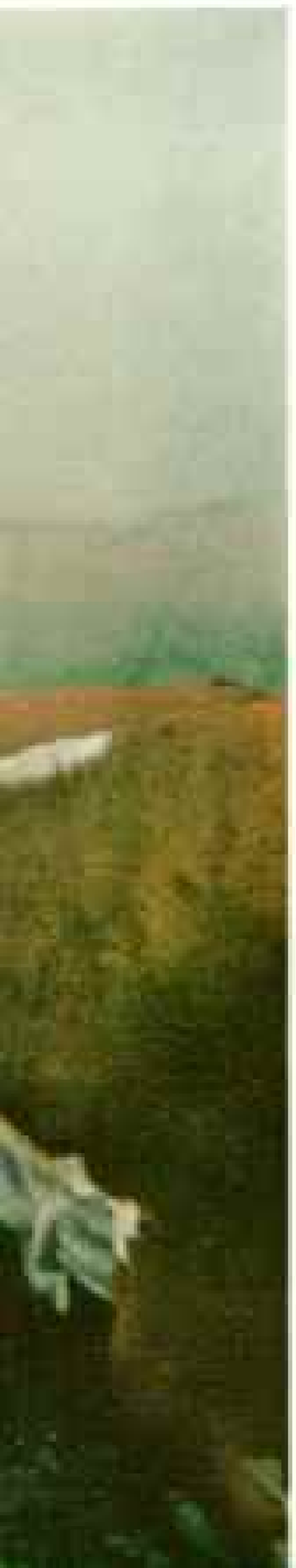
In New Delhi I found Western economists worrying about backfiring government policies designed to feed the urban poor. "Government shops in the cities sell wheat and rice far below the market price," I was told. "To stock the shops, laws require farmers to sell part of their crop to the government. Because this price is set too low, the farmers hoard or sell on the black market, and many of the urban poor go hungry."

Cattle Droppings Assume New Role

India, nonetheless, possesses the capacity to feed herself, many experts agree. Her cropland area approaches that of the United States, even though she harvests only 110 million tons of grain a year compared with America's 250 million. India also is fortunate in the area known as "infrastructure"—she has good roads, vigorous universities, the ability to plan, and most important, a strong agricultural-research arm.

"Our research is fast developing a strategy for the fertilizer shortage," declared Director A. B. Joshi as I toured the mammoth Indian Agricultural Research Institute in New Delhi. He described progress of its 1,500 scientists in tailoring fertilizer applications to the exact need of soils, in breeding algae that fix nitrogen in the soil—even in utilizing India's omnipresent cows.

"Now we simply burn cattle dung for fuel. But with simple home methane tanks we can pipe off combustible gas for cooking; the



West goes East on a cattle ranch tucked in mist-wreathed mountains north of Tokyo. This cowboy works a herd of Herefords, which show special adaptability to Japan's extensive highlands—the only land available for ranches in a nation where every arable acre is intensively farmed.

Meat production constitutes the least efficient use of cereal grains, yet the escalating affluence of Japan has generated an explosive demand for it. Fattening domestic livestock with massive grain imports, and purchasing more meat from abroad, the Japanese have so dramatically enriched their diets that teenagers often tower over parents, and schools must discard old desks for larger new ones.

Preeminent among food favorites stands the hamburger. A milk shake washes one down (**right**) at a Tokyo carry-out restaurant.

leftover slurry still makes good fertilizer."

Grave as it is, the fertilizer crisis pales before another potential disaster: failure of the summer monsoon—a failure that even now could be impending.

In the best of times, brief deviations of these rain-bearing winds threaten famine for parts of the subcontinent. Now, however, the monsoon may be growing spottier, and some climatologists believe they understand why. Coinciding with a cooling trend in the northern latitudes (map, pages 4-5), the entire monsoon belt may be shifting away from vast areas of the subcontinent.

One of the world's foremost climatologists, Dr. Reid Bryson of the University of Wisconsin, believes that "such a shift in South Asia could be catastrophic," particularly if coupled with depleted grain reserves.

Weather Trend Ravages the Sahel

It was a southward shift in wind patterns, Dr. Bryson believes, that produced the recent devastating drought in the African Sahel, a 3,000-mile sweep of sub-Sahara savanna stretching from Senegal into Sudan.

For decades the Sahel's human and animal populations had been increasing rapidly. Farmers expanded their millet and sorghum patches on ever more marginal acreage; herds denuded land of vegetation already precariously balanced with the harsh environment.

With the land thus overtaxed, the drought struck in the late 1960's; devegetation increased at an alarming rate, and in places the savanna yielded to desert. When news stories shocked the world into action in 1973, the human toll already stood at an estimated 100,000, the livestock loss in millions.*

Thirty nations responded with a herculean relief effort, administered by the stricken nations, FAO, and the U. S. Agency for International Development. In a year and a half 1.2 million tons of food, 46 percent of it from the United States, found its way to the Sahel's beleaguered towns and relief camps. AID experts estimate that some six million lives were saved by the outpouring of assistance.

Rains—rains hard and frequent—had magically transformed the Sahel when photographer Steve Raymer and I visited stricken Niger. Sparse grass grew again amid rocks and sand and bleaching animal bones. As our Land-Rover bounded along a desert trail from Agadez toward I-n-Gall, Tuareg and Fulani nomads once more were drifting like mirages across the desert steppe with their remnant herds. We pulled up at a sprawling relief camp near I-n-Gall.

"I lost all my camels," recounted Tuareg Mohammed Nakou as we crowded into his mat-covered hut with his wife, mother, ten children, and two chickens. "I lost my 12 cows. I lost my goats—all except one." He made a loud clicking in his throat, and up pranced a black-and-white billy.

No, Mohammed said, he had no plans to leave the camp; indeed, what could he do with his single goat? But I knew the Niger Government was already breaking up the camps, in part for fear that the once-independent nomads were growing too willing to accept the dole, and also to curb the epidemics that raged among the refugees.

We saw the haunting shapes of malnutrition—the nursing mother who herself was skin and bones, the listless child with shriveled limbs and hair discolored by lack of protein. "Measles is the children's worst enemy," said Bea Hulet-Dorne, a Belgian nurse working through the World Council of Churches. "Viruses invade their bodies. Those who escape often succumb to colds and bronchitis aggravated by the cold desert nights."

Plight Takes Political Toll

Governments, too, were succumbing to the famine. A coup overturned the Niger regime, accused of fraud and inefficiency in distributing aid. Drought also contributed to the fall of Haile Selassie in Ethiopia, and to the assassination of President Ngarta Tombalbaye in Chad.

In villages all across the savanna we saw volunteers from Europe and North America helping local farmers take advantage of the rains by showing them how to grow vegetables, build low dams for capturing runoff, and plant trees that would restore the Sahel to what many believe it once was—a wooded realm in which man and game flourished.

Can the Sahel be saved? Many scientists fear that drought and overgrazing have tipped the balance irreversibly.

Others, such as Dr. N. H. MacLeod of the American University in Washington, D. C., have hope. They point to a satellite picture that shows a hexagonal island of green in the great tan sea of the Sahel. Inspection revealed it to be a quarter-million-acre modern ranch,

*See "Drought Threatens the Tuareg World," by Victor Englebert, NATIONAL GEOGRAPHIC, April 1974.

fenced off with barbed wire from the surrounding desert. Inside, other fences divide the ranch into five sectors, with cattle grazing a single sector at a time.

Though the ranch has been in operation only seven years, the rotational grazing has made the difference between pasture and desert. Therein, feels Dr. MacLeod, lies one chance for the battered Sahel.

How Near to the Limits of Population?

No "maximum-load" sign on the spaceship earth spells out its population capacity. But questions of what earth's limit may be, and what to do about it, obviously go to the heart of the food problem.

"It took the world a million years to achieve its present population of nearly four billion," notes Dr. J. George Harrar, President Emeritus of the Rockefeller Foundation. "In less than 40 years it will double at the present rate of increase." Each second, two more humans populate the earth.

Malthus expounded that population tends to increase up to the limits of the means of subsistence.

Here, happily, he has proved wrong. "Populations do not inevitably rise to absorb the resources available to them," observes British economist Barbara Ward. "At a certain level of health, wealth, and literacy their numbers cease to grow and they begin to approach stability or 'zero population growth.'"

The United States, most European nations, and Japan are nearing ZPG, with Luxembourg and East Germany almost there. Few demographers doubt that the rising population curve must eventually level off, even in developing lands. They differ over how this will come about. Through lower birthrates? Or higher death rates?

Last August experts and political leaders from 135 governments gathered in Bucharest, Romania, to grapple with the population problem. Debate, often acrimonious, reflected the sensitiveness of an issue that bears directly on national aspirations, religious convictions, resource allocation, survival itself.

They adopted the World Population Plan of Action recommending, among other things, that all countries "Respect and ensure . . . the right of persons to determine, in a free, informed and responsible manner, the number and spacing of their children."

Many believe government possesses no right to such a role; others believe the plan recommends too little too late. Yet, in one form or another, many nations already have programs to reduce their birthrates—a trend that began in India.

"In 1952 India adopted the world's first nationwide population-control policy," explained an official at the Department of Family Planning in New Delhi. "With a massive budget, our program mobilized the media—radio, billboards, press, films—all supporting the idea of small families. We gave away free contraceptives. And our vasectomy campaign! Offering hundred-rupee bounties for voluntary sterilizations, we

Food, but for a price: Sacks of wheat pile up behind a middleman at a grain market in India's Punjab. Burdened by a ballooning population, India finds shortages aggravated by self-defeating policies. To provide cheap food for the urban poor, farmers must sell part of each crop to the government at below-market prices. Result: Sales shift to the black market, where prices soar beyond the reach of the needy.

The world's major foods

COMBINE SEEDS, SOIL, AND WATER with shafts of sunlight, and the miracle of photosynthesis produces plants—the basic food of all animal life. Each year the world devours 1.2 billion metric tons of cereal grains. People of poorer nations, eating cereals directly, consume about 400 pounds a year each, while the most affluent consume nearly a ton in the converted form of meat, eggs, and dairy products. Legumes, such as soybeans, are rich in protein; roots and tubers yield vital calories.

CORN, OR MAIZE The only important cereal of American origin, this grain is eaten directly in many lands but fed primarily to livestock in the U. S. Hybrids make it the most productive of grains.

SORGHUM Introduced to America as food for slaves, this versatile African grass provides human food, feed grain, molasses, pasturage, and broom straw.

WHEAT Monarch of cereals and the basic grain of world trade, wheat edges out corn as man's premier crop. The U. S. ranks second to the Soviet Union in production, but harvests substantially more per acre.

MILLET Millions of the world's poorest peoples — inhabitants of semiarid tropics in Asia and Africa — rely for survival on millet and its equally hardy sister cereal, sorghum.

BARLEY Easily adapted to varied growing seasons, rainfall, and temperatures, barley flourishes in temperate climes. Animal feed and beverage malt absorb most of the yield; geneticists perfect a high-protein strain.

RICE "Food" and "rice" are nearly synonymous to many Asians. And one person of every three on earth depends on it for survival. The grass does best in fields flooded to retard weed growth.

RYE The stuff of whiskey, livestock feed, and bread, rye adapts easily to dry and poor soils. Crossed with wheat, it produces triticale, a new cereal richer in protein than either parent.

OATS This favorite food of breakfast eaters and horses is rich in protein and carbohydrates. Susceptibility to disease and difficulties in milling limit cultivation.

SWEET POTATO Member of the morning-glory family, the tropical sweet potato holds promise of genetic improvement in yield and protein content that could vastly reduce malnutrition in the hunger belt.

SOYBEANS With uses ranging from hamburger extender to ingredient of linoleum, this protein-rich bean has become a leading U. S. export. The nation's farmers plant the legume on one acre of every six.

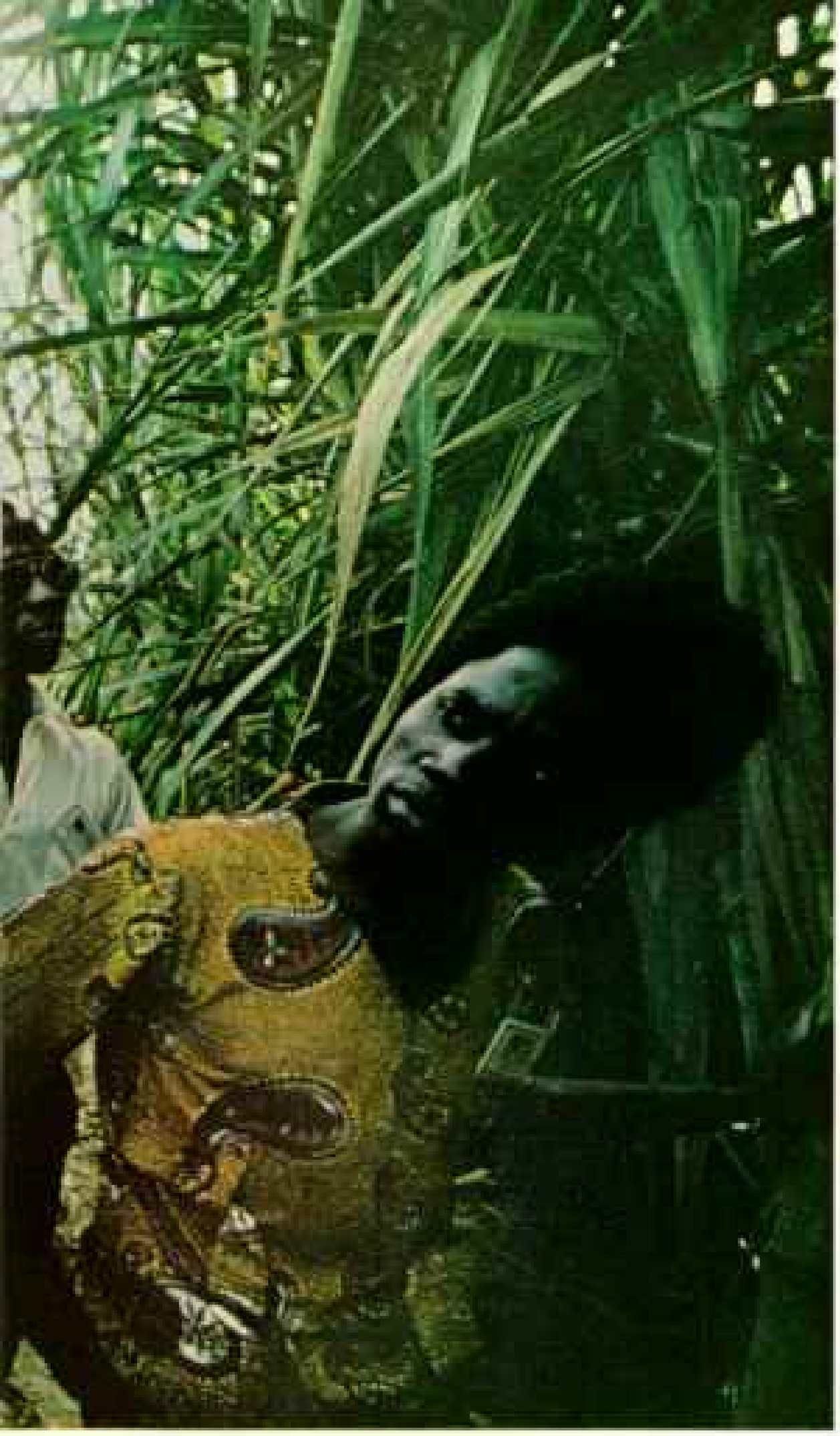
POTATO Irishmen consumed 7 1/2 pounds of potatoes a day each before blight brought the famine of the 1840's, claiming perhaps a million victims. Native to the Andes, it reigns as the most important vegetable.

CASSAVA Brazilian Indians long ago learned to remove poisonous hydrocyanic acid from this root, known also as manioc and yuca. Source of tapioca, it forms a low-protein staple in humid tropics around the world.

Asia helps Africa in a sugarcane field on Taiwan. Seeking ways to improve their sugar industry, trainees from Liberia take lessons from an island that has become a classic example of agricultural efficiency.

In rich and poor countries alike, scientists are accelerating the pace of agricultural research, focusing on the needs of the tropical hunger belt. A similar massive effort launched the Green Revolution of high-yielding wheat and rice varieties in the 1950's and 1960's.

Beneath a canopy of monsoon clouds (**right**), villagers in Thailand transplant seedlings of the "miracle" rice that helps make their nation a grain exporter. But the worldwide shortage of fertilizer—upon which new varieties depend—has dealt a severe blow to the Green Revolution.



organized mobile camps, one of which performed 100,000 vasectomies in 40 days! In a single year, 2.6 million were carried out.

"In the early '70's came war, drought, and budget cuts. We stopped to take stock. To our dismay, we found that during our campaign India's population had increased 50 percent, with the highest growth rate ever.

"Now we understand that our program had been irrelevant to the villager's needs. His main, often his sole, concern is obtaining three meals a day. His children can help him get those meals. They become to him what Social Security is to you Americans.

"In India," he summed up, "children are looked upon not as units of consumption but as units of production. Break the cycle of poverty, and the villager will respond with fewer children, just as happened in the West."

How to escape this vicious cycle? Regions such as the Indian Punjab, suddenly prospering under the Green Revolution, show a new acceptance of small families. And, in the south a tiny beacon of hope shines from one of India's smallest states, Kerala.

There, officials report a portentous drop of nearly a fifth in the birthrate. They credit improved health care, and a rising level of literacy—at 61 percent the highest in India.

Spiraling Numbers—and the Brakes

In Kenya I found the family-planning director grappling with a population that is exploding at a near-record rate of 3.5 percent a year. "Until recently, tribal traditions assured the spacing of children," he explained. "Now these are fading, with no new restraints to take their place."

In Egypt, where 37.5 million crowd the thread of land along the Nile, I found refreshing optimism. "I am certain we will win the race between population and food," asserted Dr. Zeinab El Sobky, who directs family planning in Egypt's Central Committee.

"A quarter of our families are still polygamous," she declared, "and a man can divorce a wife simply by walking out of the house. To protect her marriage, the woman quickly bears as many children as possible, hoping her husband will not have the heart to abandon her. We hope to remedy this with a law allowing divorce only by court decree, and another abolishing polygamy.

"Another tool is education. If a woman can read, she is easier to reach with family planning. Also, if children must attend

schools, then the father cannot hire them out to a neighboring farmer to earn 50 piastres a day. They become an expense instead of an asset, a fact families quickly catch on to."

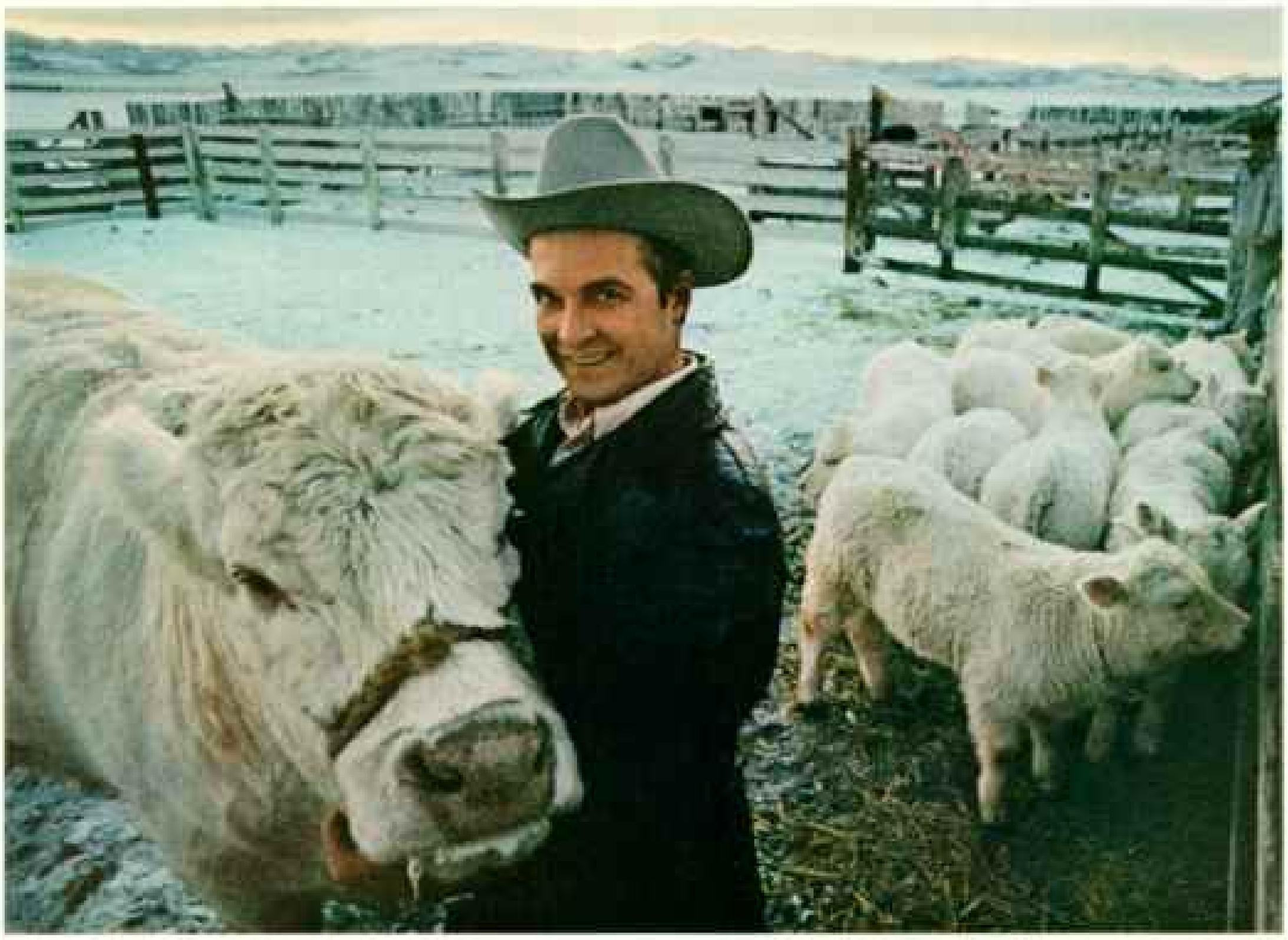
While population growth still accounts for the major part of rising food demand, a ravenous new rival has emerged: affluence, reflected by the industrial world's consumption of meat. This glorification of steak and hamburger now extends from North America across Europe and the U.S.S.R. to Japan. As a result, one pound of grain in three goes into animal feed. "The livestock of the rich world," claims Dr. Georg Borgstrom of Michigan State University, "is in direct competition with the humans of the poor world."

Malnutrition Knows No Borders

Malnourishment caused by calorie deficiencies and by too little protein and other nutrients afflicts an estimated 400 million to 1.5 billion of the world's poor. Even in the affluent U. S., poverty spells undernourishment for an estimated ten to twenty million. Hardest hit are children, whose growing bodies demand 2½ times more protein, pound for pound, than those of adults. Nutrition experts estimate that 70 percent of the children in low-income countries are affected.

In Colombia, where one can find a cross section of the food problems besetting much of Latin America, nutrition-related diseases claim two of every five children who die before the age of 6. At a hospital in Bogotá, I saw rows of cribs holding pathetically shrunken figures, each 35 or 40 percent under normal size, suffering from edema and pellagra, and blotched with body sores. These were victims of chronic malnutrition. To stem the scourge, the government was launching an energetic nutrition campaign in cooperation with CARE, whose workers fight hunger around the world.

In the town of Leiva, I found 32 Peace Corps members meeting and comparing notes on their struggle with the phantom killer. "Because the average *campesino* is poor and doesn't understand nutrition," said



Mother of an instant herd, this Charolais in one year produced the ten calves milling behind Canadian David Dyrholm, whose firm transplants embryos from prize cows into proxy mothers. The result: A superior cow, normally limited to one calf a year, can produce a host of genetically desirable offspring, thus quickly upgrading herds.

one of them, Elizabeth Shipley of California, "they often eat only carbohydrates—rice, potatoes, corn, cassava, plantains—which supply calories but have little nutritional value." Children's stomachs cannot hold enough of the bulky diet to sustain them, and intestinal parasites compete for what they eat. Teach about vegetables, teach about gardens—these were bywords of the conference.

Many experts contend that a major cause of malnutrition is the recent widespread abandonment of breast feeding. "Mother's milk is the best and safest of all foods," states Alan Berg of the World Bank. "Buying enough formula or cow's milk to replace it could consume a quarter to half of a laborer's wages in the needy nations. Aside from the cost in lives, forgoing available mother's milk represents an economic loss likely to be in the billions of dollars annually."

Why the decline? "Partly because the bottle has become a status symbol," Berg concludes, particularly among urban migrants.

A Compendium of Problems

At a time when demands on them are increasing at the fastest rate in history, the farmers, herdsmen, and fishermen who feed us are suddenly finding their tasks more difficult. Some of the problems besetting them:

• **Weather's new uncertainties.** Meeting last year in Bonn, West Germany, 21 scientists of many disciplines agreed unanimously that the cooling trend "can be ignored only at the risk of great suffering and mass starvation." They point out shortened growing seasons in Canada and Iceland. Recent droughts in the U. S. Midwest may also be related. "A benevolent climate can no longer be taken for granted," warns climatologist Dr. Stephen H. Schneider of the National Center for Atmospheric Research in Colorado.

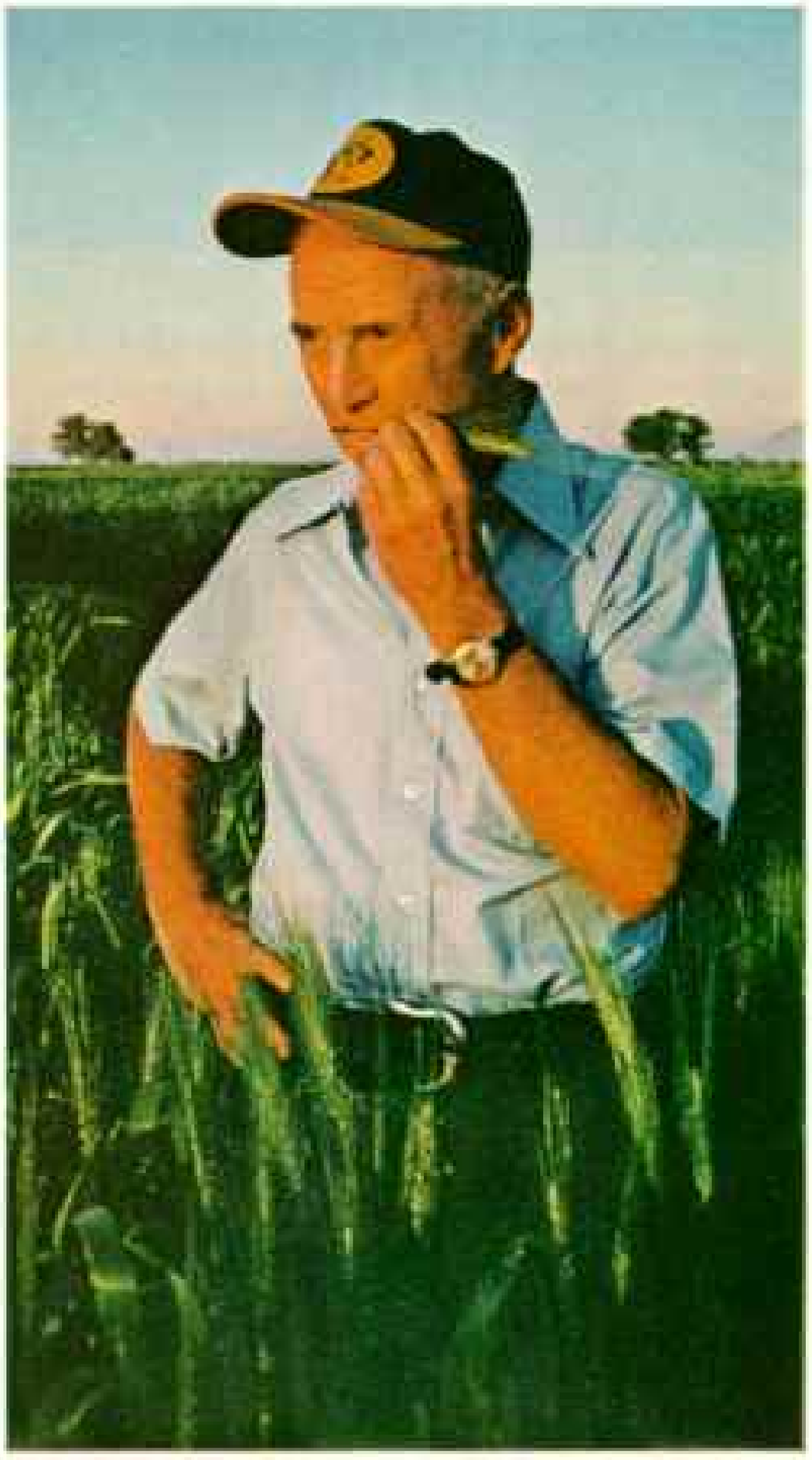
• **Persisting fertilizer scarcity.** Some experts question whether output will ever catch up with demand. One reason is the colossal size of the capital investment needed to build the necessary plants—eight to ten billion dollars each year. Another bottleneck lies in the limited pool of skilled personnel; building these enormously complex facilities has been compared to putting a man on the moon.

Ironically, enough gas is still uselessly flared off in the principal oil-exporting countries to produce twice as much nitrogen fertilizer as the world now uses.

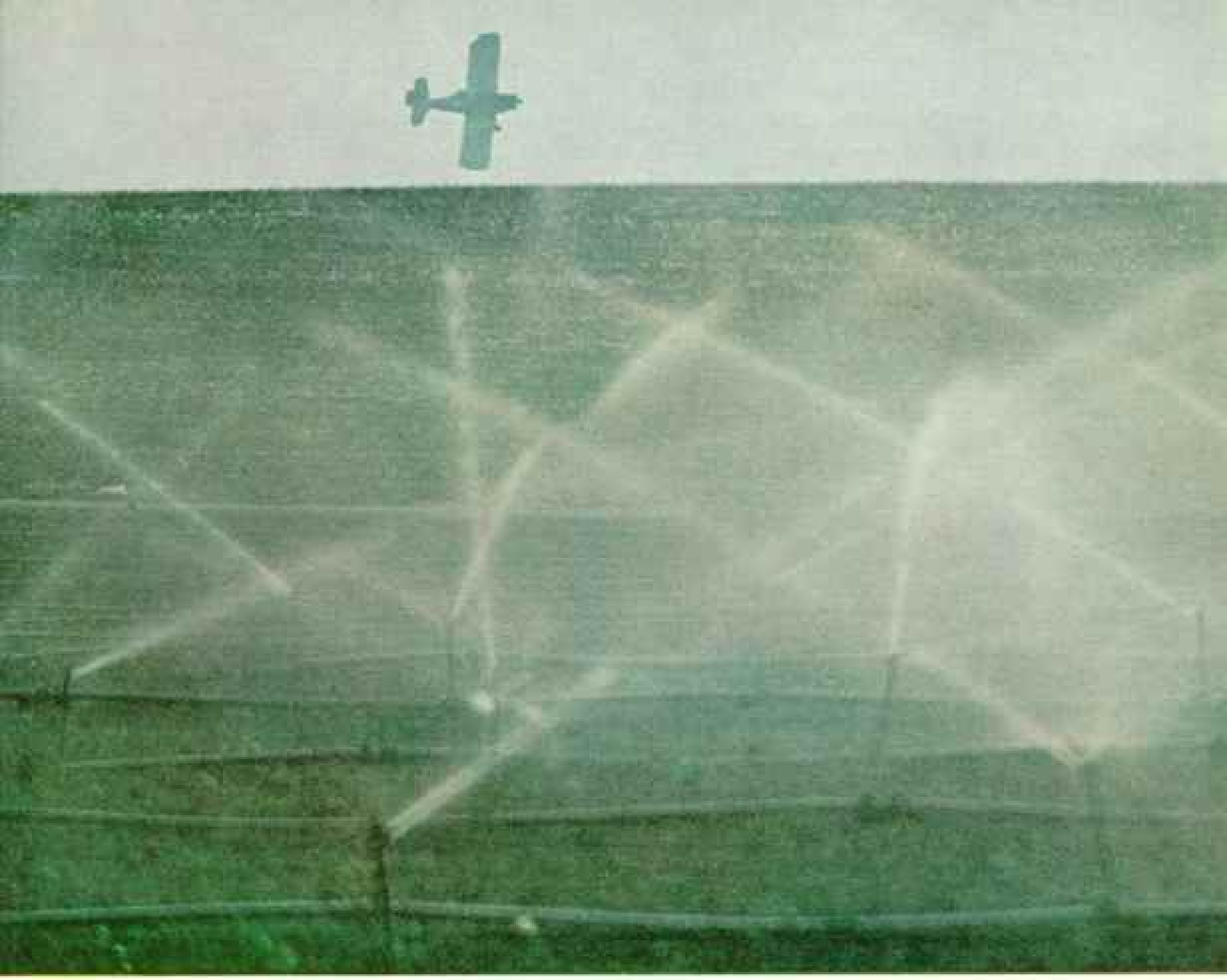
As long as the shortage continues, it will inflict hunger and hardship, particularly in the poorer nations. A tribal farmer I talked with in Kenya typifies the problem. After having sold one of his 12 cattle to buy fertilizer, he still was able to grow only half as much wheat as last year. Nearby, a wealthy cattleman posted an armed guard outside his storage shed. "Fertilizer is like gold here," his wife told me.

• **The limitation on land.** Until two decades ago, earth's burgeoning population met most of its food needs by breaking new land to the hoe and plow. Today the world's 3.6 billion farm acres have pushed cultivation to the outer edges of economically usable land.

Farmlands in many industrial nations are shrinking alarmingly—in the United States about 1¼ million acres are removed from production each year. The new Interstate



Hunger fighter Dr. Norman E. Borlaug, a U. S. geneticist working in Mexico, won the 1970 Nobel Peace Prize for his early role in developing high-yield wheats.



Highway System alone, when completed, will have swallowed a land area larger than the State of Delaware. Encroaching suburbs devoured my father's farm in Maryland, and by the year 2000 half the state's remaining farmland could be taken out of production.

Agricultural frontiers still exist, largely in Africa and South America. But they must be fought for. The tsetse fly and its plague of sleeping sickness bar herdsmen and farmers from 2.8 million square miles of Africa—five times the area now farmed in the United States. Leaching, toxicity, and high temperatures of soil impede the cultivation of 2¼ million square miles of llanos and tropical rain forests in Latin America, primarily in the Orinoco and Amazon River Basins.

• **Shortages of water.** The production of a single hen egg, traced back through its creation, requires about 120 gallons of water, calculates Georg Borgstrom of Michigan State. A loaf of bread requires 300 gallons; a pound of beef, 3,500. And these demands are but a drop in the bucket compared to irrigating a single acre of desert farmland.

We already have dammed most of our more accessible rivers. Those remaining tend to be located where the need is least; about a third of the planet's river water flows through South America, which embraces only an eighth of the land.

The meaning of this, many hydrologists believe, is that shortages of water, more than land, threaten our food future. Alternative sources, such as desalting ocean water, pose enormous costs.

• **The dependence on energy.** When the U. S. farmer traded in his 22 million horses and mules for today's 4.4 million tractors, he severed bonds that in India still tie two-thirds of the people to the land. But in so doing, he became totally dependent on the petroleum that drives his machines.

The equivalent of 80 gallons of fuel is used to produce a single acre of corn. Because of corn's high yield, it returns about four calories of food for each calorie of energy used to produce it. Sugar beets give back only

1.2 calories for each one they require, and low-energy tomatoes create an actual deficit.

"Even with his reliance on fossil energy, the U. S. farmer consumes only about 5 percent of the nation's fuel budget," calculates Dr. David Pimentel of Cornell University. "Twice as much—some 10 percent—goes into food processing, distribution, and marketing." And in the final step, a consumer may drive a two-ton auto to the supermarket for 30 pounds of groceries.

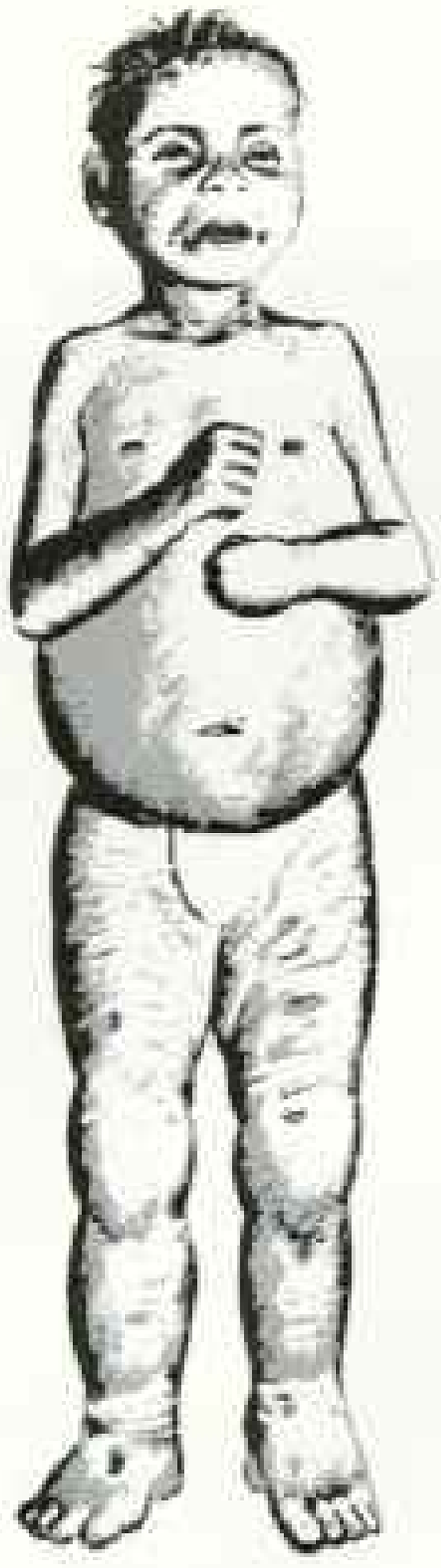
• **Threatened ecosystems.** "Granary of Rome" . . . "Fertile Crescent" . . . these names tell of the abundance that once blessed the North African coast and an arc of land stretching from the Mediterranean to the Persian Gulf. Today, blighted by deforestation and overgrazing, they have become part of a semi-desert extending from Gibraltar to India.

This same scenario now unfolds on the Indian subcontinent, says Lester R. Brown, President of Worldwatch Institute, a private agency that focuses on emerging global problems. There, rampant deforestation strips the

Fish from the desert fill a net in an Israeli carp pond. To wrest food from their parched land, Israeli aquiculturists exploit the ability of fish to convert feed into human fare far more efficiently than do hogs or cattle. A one-acre pond can produce 5,000 pounds of protein-rich carp a year.

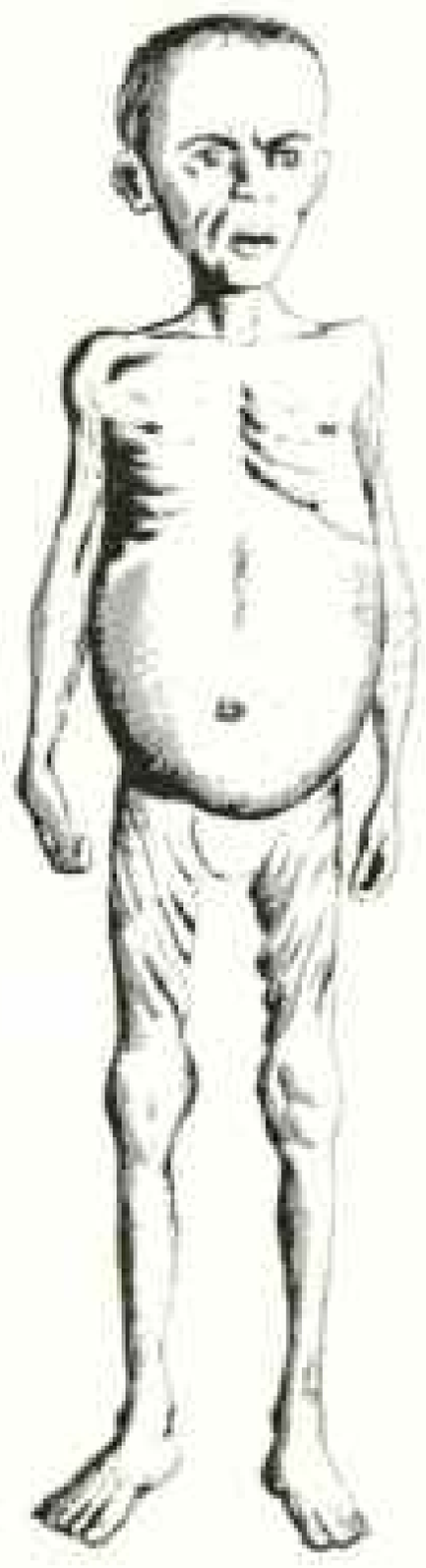
Chinese and central European aquiculturists also raise carp, while Americans specialize in trout and catfish. Scots and Norwegians fence off estuaries to raise seagoing salmon. Despite high yields, production costs probably limit such aquiculture.

Beyond a barrage of irrigation sprinklers, a crop duster sprays sugar beets. A pipe nine feet in diameter brings water from the Sea of Galilee for the computerized irrigation that makes farms bloom in Israel's desert.



Misshapen bodies tell the tragic story of malnutrition, a condition affecting perhaps as many as 1.5 billion people. Medical science identifies two major types, which usually occur in combination.

Kwashiorkor is typified by the bloated look so incongruous with starvation. Accumulated fluids pushing against wasted muscles account for the plumpness of hands, feet, belly, and face. Emaciated shoulders reveal true thinness. Caused by an acute lack of protein, kwashiorkor (a West African word) can bring brain damage, anemia, diarrhea, irritability, apathy, and loss of appetite.



Marasmus
Stick limbs, bloated belly, wide eyes, and the stretched-skin face of an old person mark victims of marasmus, a word taken from the Greek "to waste away." Lacking calories as well as protein, sufferers may weigh only half as much as normal. With fat gone, the skin hangs in wrinkles or draws tight over bones. With marasmus comes anemia, diarrhea, dehydration, and a ravenous appetite.

Children, whose growing bodies require large amounts of protein, are afflicted in greatest numbers, but perhaps only 3 percent of all child victims suffer the extreme stages illustrated.

NATIONAL GEOGRAPHIC ART DIVISION

foothills of the Himalayas, birthplace of the region's great river systems. "With trees no longer holding the soil, erosion is rapidly silting up reservoirs on which Pakistan depends for irrigation water. The denudation also probably aggravated the recent flooding in India, Bangladesh, and Pakistan."

• **A leveling of productivity.** With the passing of the farm frontier, our expanding needs must be met through larger yields per acre. Until recently, the mechanized farmer, aided by fertilizers, obliged with an upward spiral of productivity. Now this promising upsurge may be slowing, not only in the United States, but throughout the Western World.

"I believe we're reaching a yield plateau that only new breakthroughs in research can surmount," says University of California agronomist Dr. Milton D. Miller. "Use of fertilizer is reaching a point of diminishing returns, and the yields of many of our standby crops—corn, for example—appear to be nearing their biological ceilings."

Hunger Belt Holds Potential

Food strategists mapping the ongoing war against hunger realize that their battlefield must be the tropics and semitropics, where two-thirds of the planet's people scrimp on a mere one-fifth of its food. But here, too, lies the greatest potential: most of the available new land, abundant sunlight, and a year-round growing season.

I saw some of this promise for myself on a visit to the Asian Vegetable Research and Development Center on Taiwan. "Our mission is to supplement the use of rice in Asia," said Robert F. Chandler, Jr., director of the newly established center. Here technicians are testing and developing new strains of tomatoes, potatoes, mung beans, soybeans, and Chinese cabbage.

"But the front-runner," Dr. Chandler told me, "is the unlikely sweet potato. We feel confident we can bring its protein content up to that of rice and at the same time assure the Asian farmer twice rice's yield—with an added bonus of abundant vitamin A."

Throughout the world's hunger belt, I visited other such institutions where dedicated scientists are deeply committed to the fight for food. Leading the assault is an international network of ten research programs supported by 29 governments and organizations under chairmanship of the World Bank.

At CIMMYT, near Mexico City, where Dr.

Probing hunger's insidious impact, Dr. Joaquin Cravioto tests a malnourished child's mental responses in a Mexico City hospital. Striking at a critical time in the learning process, malnutrition-caused brain damage stunts the mental development of millions.

Norman Borlaug still leads the experimental wheat program, I saw scientists perfecting a wheat-rye cross known as triticale, a high-protein barley, and a protein-rich corn called opaque-2 that could revolutionize nutrition in many countries.

Experiments Promise Tougher Rice

In Colombia and Nigeria, sister institutions seek ways to tame vast llanos and tropical rain forests. A center in Peru is improving the yield of the indigenous potato; two African facilities focus on the needs of herdsmen. Another in India reexamines ancient methods of collecting and "harvesting" precious rainwater in the world's semiarid tropics.

In the Philippines geneticists of the International Rice Research Institute are building a second generation of improved rice strains on the foundations of the Green Revolution. Their techniques typify those that prevail in most of the international centers.

"We're aware that our earlier high-yielding rices demand a lot of the small farmer—pesticides, herbicides, fertilizer, know-how—often more than he can deliver," explained Director Nyle C. Brady. "Our tactic now is to breed this technology into the seed itself—pack it with resistance to diseases and insects, tolerance to drought and toxic soils, even to deep water and cold weather. We think we can do it; the genetic variability of the rice plant is incredible."

I saw short-season rices that allow two and even three crops a year; rices that resist the ravages of insects; a versatile rice that could withstand both drought and flood; varieties whose stems can elongate as much as 20 feet to keep their heads above high water.

A refrigerated building held the germ-

Refugees from rampaging inflation, retirees in St. Petersburg, Florida, take advantage of 85-cent lunches. With much of Pinellas County's large elderly population trapped between fixed incomes and vaulting food prices, the school board has set up 23 feeding centers to provide low-cost meals. Experts estimate that ten to twenty million Americans go to bed hungry every night.

plasm bank, some 30,000 strains of rice. These provide seeds for genetic experiments—and represent an insurance policy for the future. With new varieties fast displacing nature's originals, local strains possessing vital resistances to pests or diseases could be erased forever unless preserved in the bank.

"We've developed strains with a fifth more protein," said Dr. Brady. "That's important, because rice provides 80 percent of some Asians' protein." So far, though, yield has dropped when more protein is bred in.

High priority goes to solving the fertilizer problem. "Our best bet for the long haul," said agricultural economist Randolph Barker, "lies in finding rice plants whose roots will serve as hosts to nitrogen-fixing bacteria, just as those of soybeans do. This way they would provide much of their own nutrient." At research centers around the world I heard echoes of Dr. Barker's belief that development of nitrogen-fixing grasses—including not only rice but also wheat, corn, and pasture varieties—offers great opportunities for dramatic improvement in world agriculture.

Is Doomsday in the Offing?

Ultimately, all of my inquiries pointed to a single question: What are the prospects of feeding ourselves on our ever-more-crowded planet?

"The race between population growth and food production has already been lost," maintains biologist Paul R. Ehrlich of Stanford University. "Before 1985 the world will undergo vast famines—hundreds of millions of people are going to starve to death . . . unless plague, thermonuclear war, or some other agent kills them first."

Among some this pessimism has led even further, into the realm of how the "have" nations should react when massive famine strikes the "have nots." One such scenario is called the "lifeboat ethic." It prescribes that the self-sufficient nations must, at some point, refuse help to those who are stricken, lest the added burden swamp the survivors' lifeboat, dragging all to the bottom.

At the other end of the scale, Harvard population and resource specialist Roger Revelle computes that the earth's arable land area, if properly developed, could produce "edible plant material . . . for between 38 and 48 billion people"—ten times today's population.

Most experts with whom I talked take a position somewhere between Dr. Ehrlich's pessimism and Dr. Revelle's theoretical extreme. In large measure they share the conditional optimism of Dr. Don Paarlberg, Director of Agricultural Economics for the U. S. Department of Agriculture.

"Barring disasters caused by bad weather," he believes, "food production can stay half a step ahead of demand for a few decades. After that, unless population comes under control, it may be hopeless."

Heading the list of hopeful auguries is the accelerated pace of worldwide agricultural research, particularly the new emphasis on the tropical hunger belt. But other elements also support this guarded optimism:

• **A new will to win.** "For the first time," says Dr. Wortman of the Rockefeller Foundation, "the nations of the world may possess the will to concentrate on raising agricultural productivity. When leaders of developing countries could depend on food gifts or imports, they tended to ignore their own agricultural sector in favor of industrial schemes. But they know they can't stay in power with a lot of hungry people on their hands. Raising more food has become a matter not only of human, but of political, survival."

• **Nowhere to go but up.** "It may sound paradoxical, but the low level of productivity in most needy lands represents one of their brightest future hopes," asserts Dr. Chandler of the vegetable center. "The rice farmer of India or Bangladesh could readily double his yield of 1,500 pounds an acre with better varieties and techniques." Dr. S. R. Sen, an executive director of the World Bank, believes that India and Bangladesh can increase their productivity threefold. Others believe world food production can be doubled.

• **Crop monitoring by satellite.** Beginning this year U. S. satellites are surveying the growth and health of part of the U. S. wheat crop. If this succeeds, the monitoring eventually will cover wheat plantings worldwide, and perhaps other crops. With accurate and timely warning of crop scarcity, the world could respond *before* disaster strikes.

• **Growing emphasis on small farmers.** "Because of the attention they give their holdings," observes James P. Grant, President of the Overseas Development Council, "small farmers more than pull their own weight. An Indian farmer with five acres produces half again as much per acre as does one with ten times as much land. We tend to overlook the fact that per-acre yields in the U. S. are

surpassed by farmers in Japan, Egypt, and Taiwan, and equaled by Korea's."

• **The example of Taiwan.** This Switzerland-size island of 16 million people has written an Asian success story that provides a possible pattern for other developing nations. "And they did it largely with ingenuity and hard work," notes Dr. Chandler, whose vegetable center is on the island.

Burdened in the 1950's by soaring population and demand for food, the Taiwanese turned their economy around so dramatically that by 1965 U. S. aid was no longer needed, and the population was being stabilized.

They attribute their miracle to a blend of elements: drastic land reform that harnessed the incentive of private ownership; universal education, including a vigorous family-planning program; farm cooperatives to provide credit, fertilizers, and marketing; balanced industrial growth.

The farming I saw on Taiwan is a precision process: rows of young plants intercropped between others now ripening; four and five crops from the same land in a single year; yields among the highest in the world.

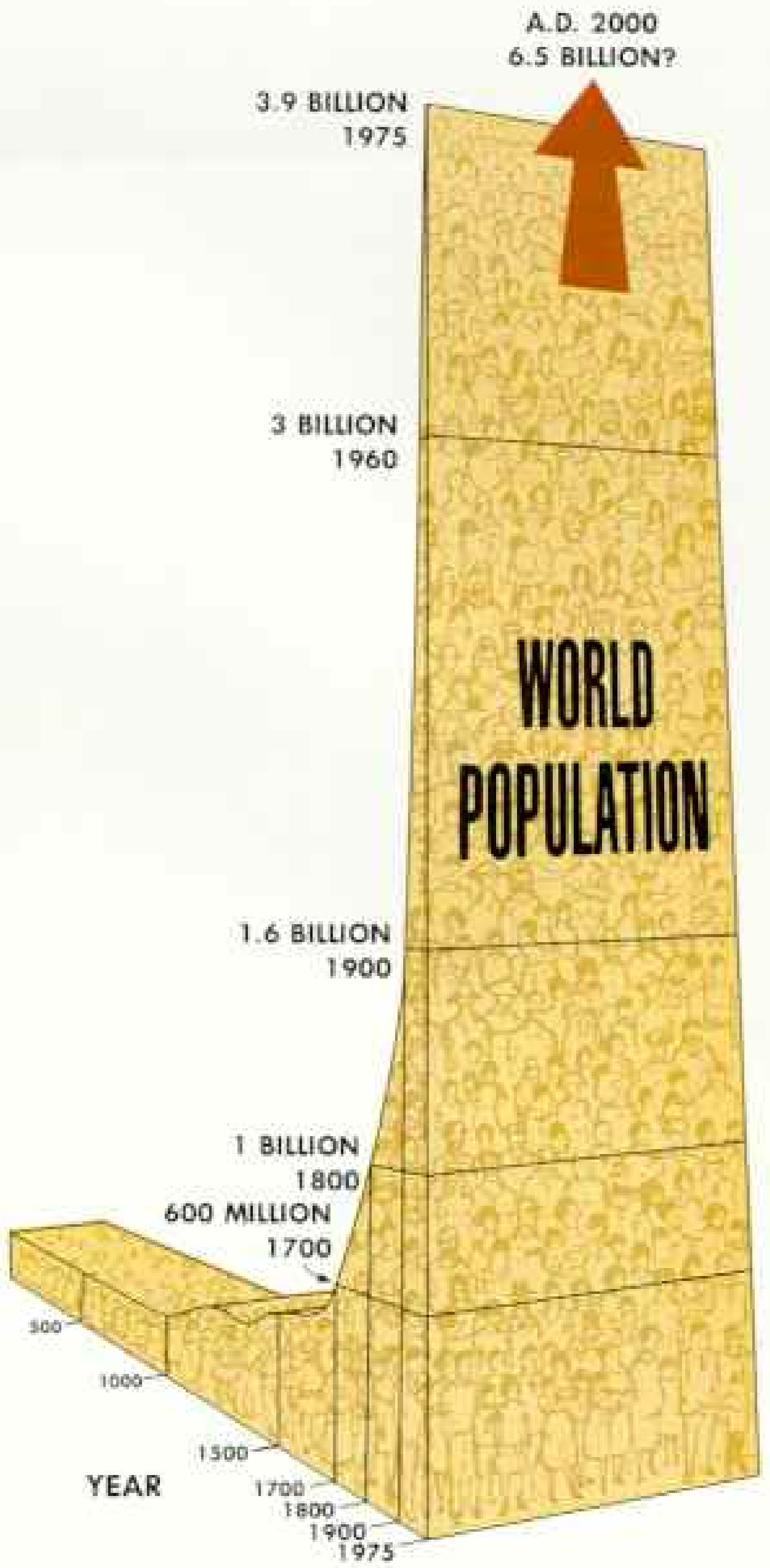
• **Building emergency food reserves.** "And let them gather all the food of those good years that come . . ." said Joseph unto Pharaoh, "and that food shall be for store . . . against the seven years of famine. . . ." Just such a "Genesis strategy" came out of the U.N. World Food Conference that met last year in Rome. As a result, international machinery is being put in motion to organize emergency stockpiles to help needy nations.

No one underestimates the thorny political questions involved. Who contributes to the stockpiles? How much? Where should they be located? Who controls access, decrees how much shall be withdrawn, and when?

Despite such obstacles, experts concur on the need for continuing action. "Unless the food problem is dealt with, and rather promptly," warns Sterling Wortman, "nation after nation will be shaken by political turmoil." Similarly, Dr. Borlaug foresees famine-torn nations "disintegrating into chaos," with Bangladesh, India, Egypt, and Indonesia possibly succumbing "by the end of the present decade."

Perhaps FAO economist Robert Tetro offers the best response to the challenge of feeding humankind:

"It *shall* be done," he believes, "because it *must* be done." □



Stirrings of new life pulse in the ear of a UNICEF nurse (**facing page**) attending an Indian woman near Lucknow. Three children—survivors of six prior pregnancies—watch from the doorway.

Already faced with 613 million mouths to feed, India could see her population double in 30 years—a rate paralleled by most of the poorer nations. Many food experts believe the world has only two or three decades in which to bring population growth (**above**) under control before it hopelessly exceeds the limits of food production.

BANGLADESH

The Nightmare of Famine

A PICTURE STORY BY
STEVE RAYMER
NATIONAL GEOGRAPHIC PHOTOGRAPHER

THE SCENE is chilling, horrifying. Several thousand starving Bengalis wait patiently, it seems, to die in a refugee camp in Rangpur, one of the remotest districts in the poor, desperate land of Bangladesh.

There is only enough food on hand from the United States and Canada to provide each with a daily cup of flour, but no powdered milk. Many are too weak to eat, or to swat at the flies swarming around the kitchen.

I see a child—a naked skeleton—waiting for his meager ration (**left**); his withered body bears the telltale signs of advanced malnutrition. Others like him sit almost lifeless in their filth. A woman clad in rags clutches an infant so thin his ribs look like a birdcage beneath his peeling skin. I see a tear in the mother's eye.

This is the face of famine as I saw it last fall in Bangladesh, where 74 million people crowd a watery nation the size of Wisconsin.

Like a hungry army, Bengalis pour into this and similar camps in search of nourishment. Most are disappointed. The nation is always short of food during this between-crop period known as the "hunger months." But in 1974 floodwaters inundated nearly half the nation, destroying stored grain and damaging the standing crop. Result: no jobs for farm laborers.

Despite loss of foodstuffs, however, there is an estimated four million tons of rice in Bangladesh during the famine—enough to feed the entire nation for a third of the year. But the vast majority of people, subsisting at poverty level in the best of times and now also victimized by the flooding, are too poor to buy it.

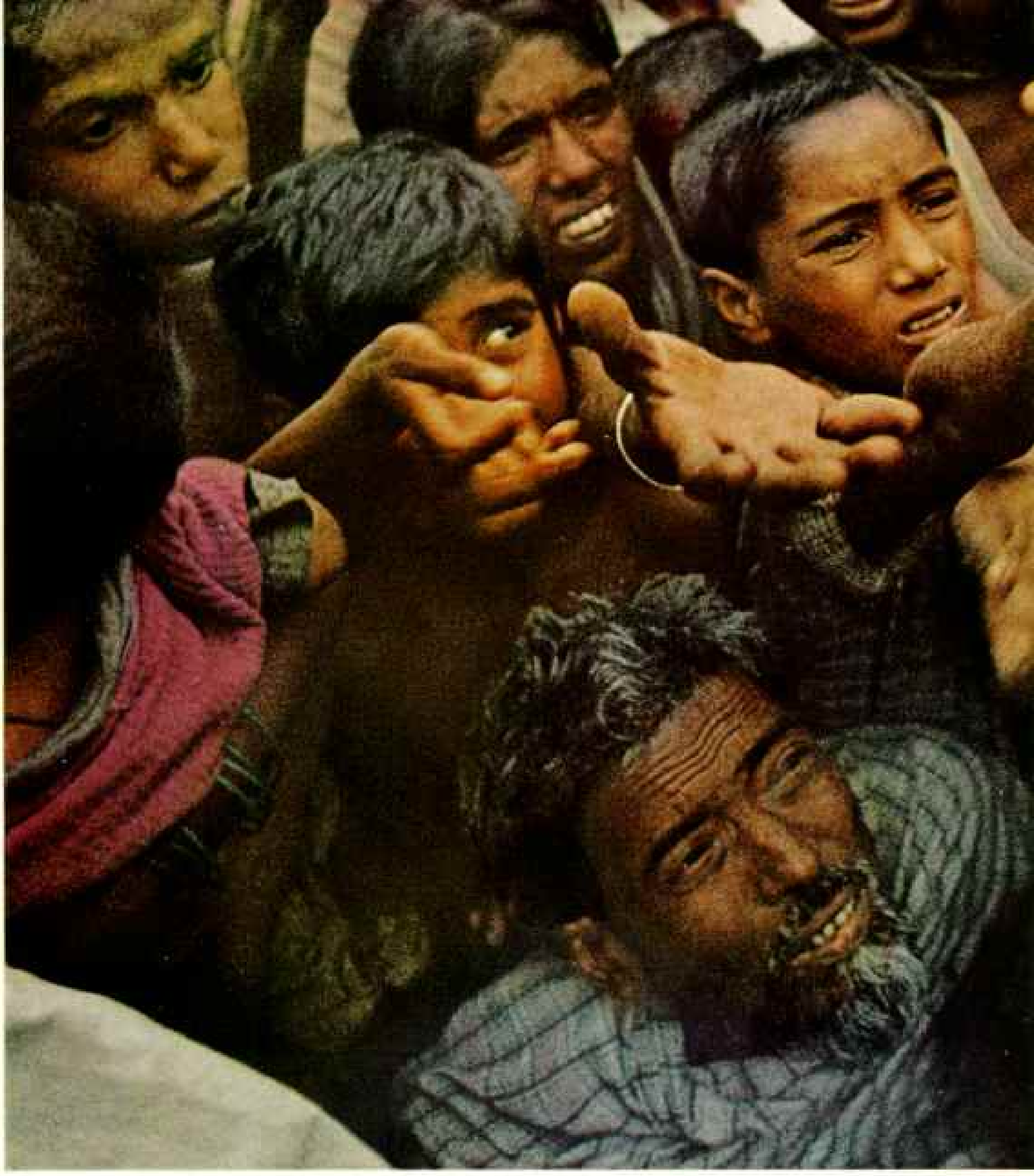
Relief officials tell of widespread smuggling of rice into neighboring India, where it sells for up to twice as much. Hoarders at home drive rice beyond 50 cents a pound in a country with a per capita income of $70 a year, among the world's lowest.

Taking command, inflation triggers price jumps of from 200 to 500 percent in other food. The black market thrives, but at prices hopelessly beyond the means of the hungry.

A reeling Bangladesh Government, unable to stockpile food to stave off disaster, depends on massive international handouts, but too little reaches those who need it, especially in rural areas. Aid from the granaries of North America, India, Australia, and Europe only trickles to the feeding kitchens. Much is siphoned off by corrupt officials, who sometimes demand bribes before issuing food cards. I saw it happen.

Battered by an angry climate, undermined by corruption, and staggered by poverty, Bangladesh remains today a frightening example of what can happen to the weakest, most vulnerable nations when everything goes wrong at once.

For Bangladesh that dread specter, starvation, stalks the land, and thousands of Bengalis die—most of them preventable deaths in what has been called a "man-made famine."

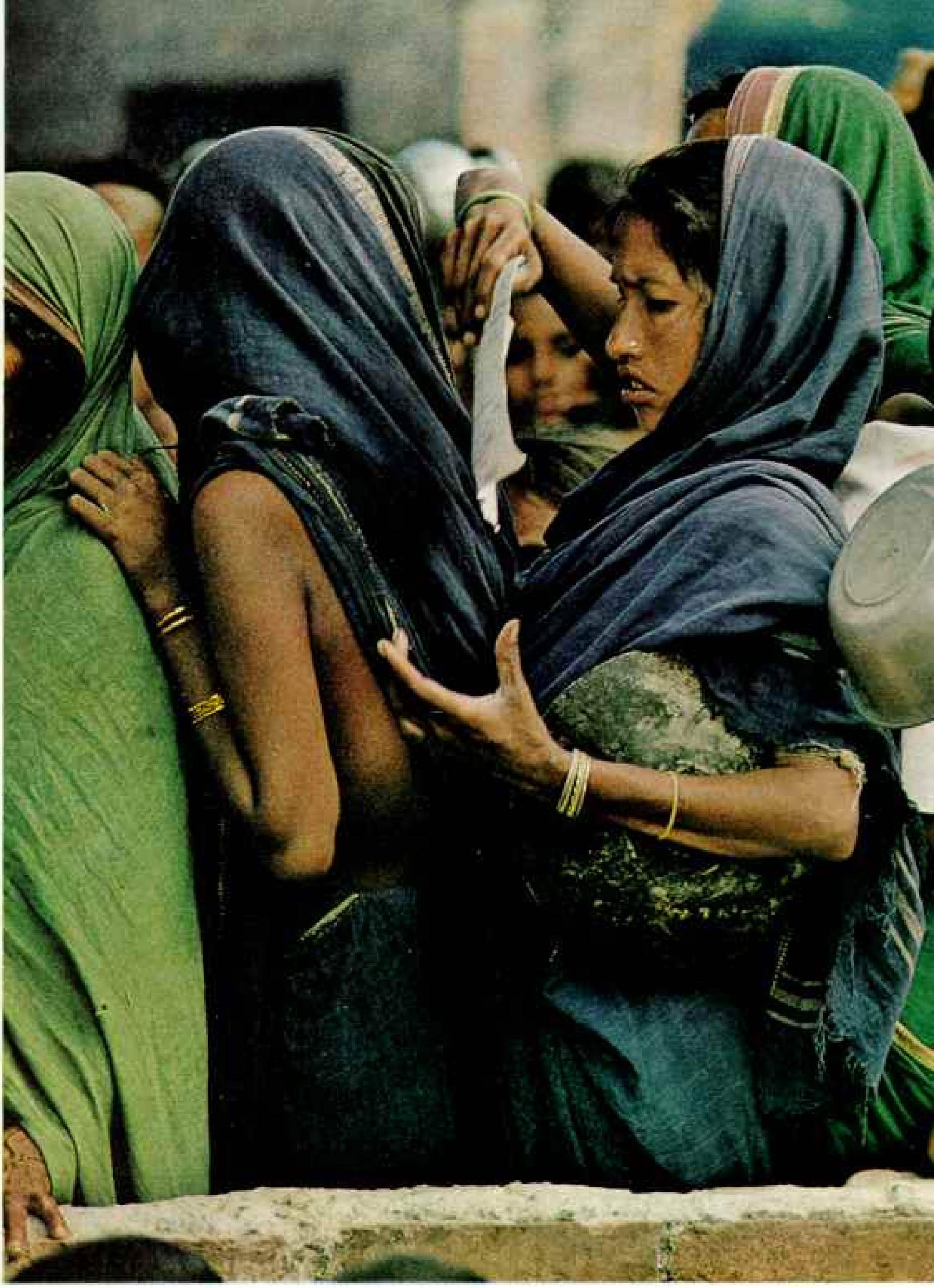


Agony of survival: Hungry hands reach for the unleavened pancakes called chapaties at a local Red Cross feeding kitchen in Dacca. At the city's Kamalapur railway station, I talk with an up-country man who has sold everything—his bullocks, his wife's jewelry, his pots and pans, his not-yet-harvested crop, finally his tin roof—to buy food for his starving family. In the end, they have ridden to Dacca on the roof of a train (**right**), hoping to find more to eat.

Armed patrols regularly truck the most destitute off to refugee camps at the city's outskirts. The remaining rail-station squatters beg in the choked streets, their anger sometimes boiling into riots, while they wait for a mobile Red Cross feeding kitchen to arrive.

Another tired train cranks to a stop. Amidst the thousands of defeated, emaciated refugees, a woman lies on the station platform and gives birth. Several other women come to her aid. One finds a rusty sickle near the tracks and cuts the umbilical cord. Another, seeing the mother is too weak and shriveled to nurse, dabs the infant's lips with coarse table sugar. Burning with fever, the helpless mother watches.

Bangladesh has another mouth to feed.



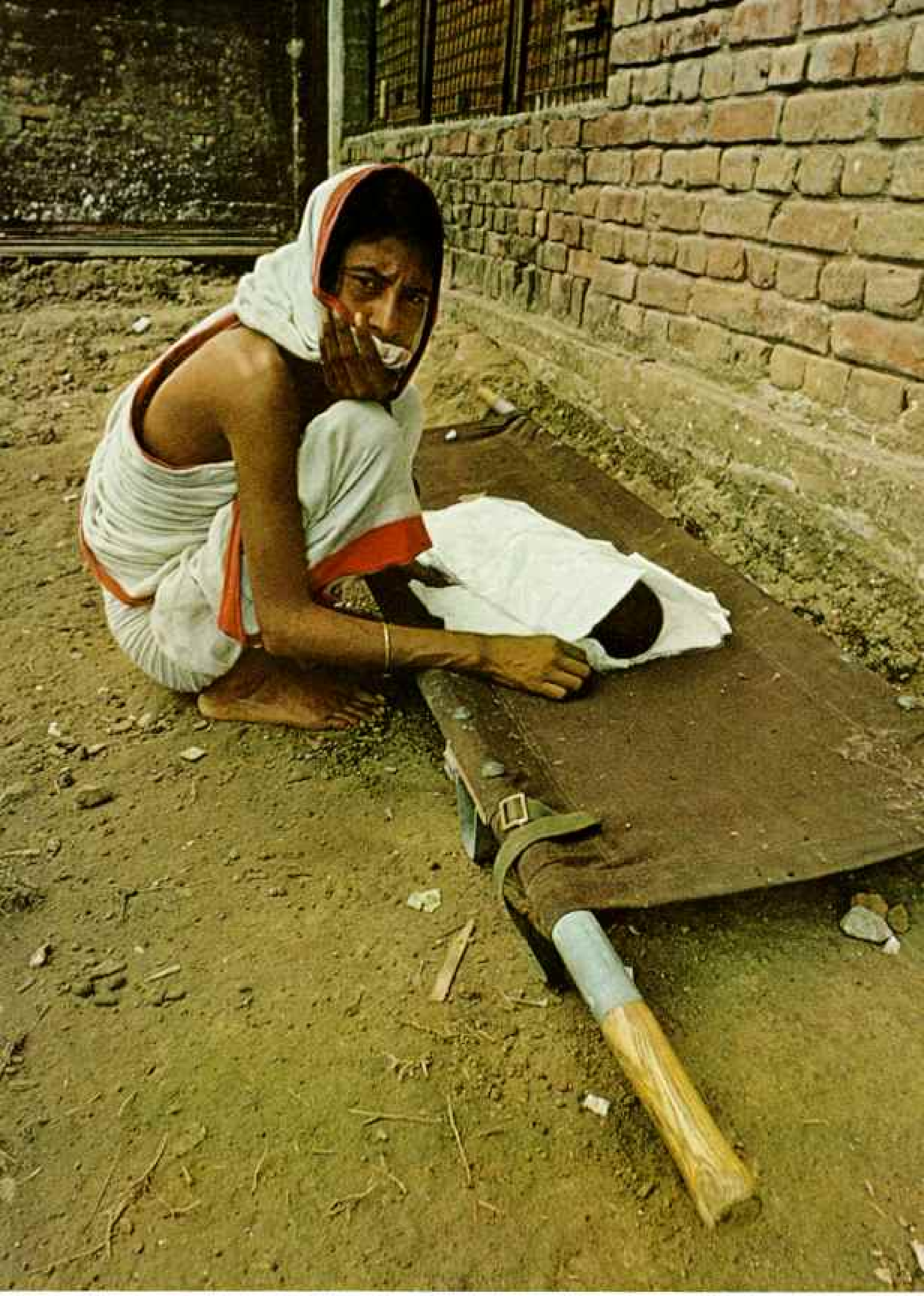
Food cards in hand, refugees press for powdered milk from the United States and Canada, dispensed by the Dutch Red Cross. They also receive cholera and smallpox shots.

Nearly three billion dollars in foreign aid has been spent to assist Bangladesh since it broke

from Pakistan in 1971 after a nine-month struggle for independence. But far from recovering from the deadly ravages of war, flood, and famine, little Bangladesh each year slides further into poverty and despair.

The United States alone has contributed some 800 million dollars in aid, including food. Governments aside, about a hundred private organizations—probably the greatest concentration for any country—have extended a helping hand.

"We are a nation," says a Bengali economist, "that must beg to survive."



Guns and grain: One must protect the other in Bangladesh. A soldier of the Rakkhi Bahini, a paramilitary government force, guards grain sacks as a food convoy moves through Dacca. Responding to violence and corruption, often triggered by food shortages, the nation's leader, Sheik Mujibur Rahman, assumed dictatorial powers last January.

Stricken by grief, a mother in a Dacca refugee camp mourns her dead baby (**left**). But life goes on. In Bangladesh—with 1,300 persons per square mile, one of earth's most densely populated nations—seven babies are born every minute. Sadly, millions of parents are so poor that children, grown up and working, offer the only security they will ever know. □

Cape Cod's Circle of Seasons

By TOM MELHAM

Photographs by JAMES P. BLAIR

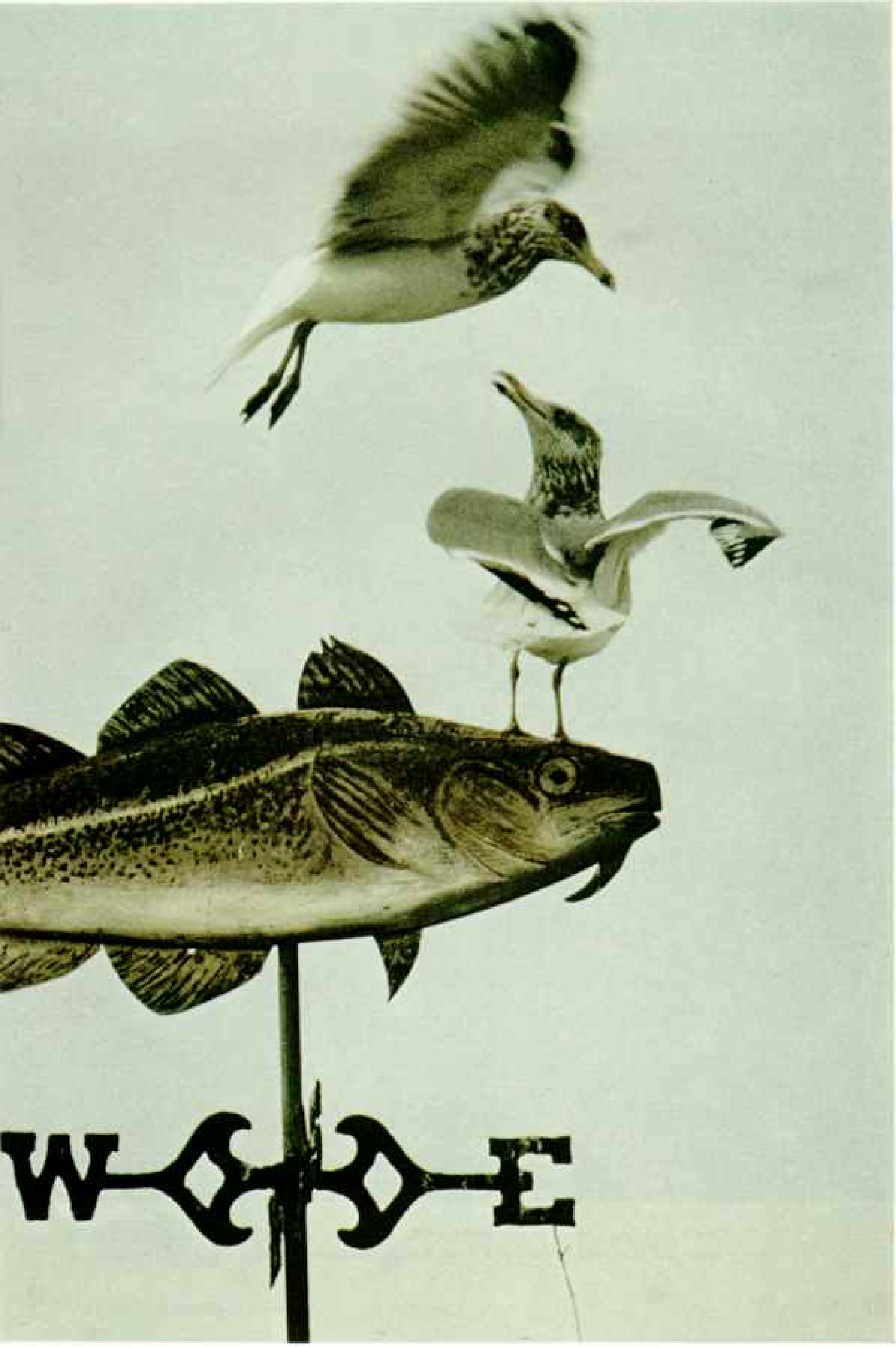
BOTH NATIONAL GEOGRAPHIC STAFF

THE WINDS WERE UP EARLY, tearing at my too-light windbreaker as I paced Nauset Beach just after dawn on a chill winter day. Seaweed and chunks of salt ice littered the sand where, a few months before, I had squeezed my way through eddies and whorls of summer vacationists. Now, except for the gulls chorusing overhead, the beach was deserted. As elsewhere on Cape Cod, shops were shuttered, guesthouses empty. The summer glut of tourists and street vendors, clambakes and beach parties had melted into memory.

Heading south, I neared a "ghost town" of weathered wood shacks set like an Andrew Wyeth painting amid low, sculptured dunes fringed with sun-coppered beach grass. The sea, sand, and salt air merged in a haunting panorama of elemental beauty. This, to me, is the real Cape, the off-season Cape stripped of summer varnish.

Born of glaciers, shaped at the whim of wind and wave, on the map it seems a thorn in Neptune's side as it juts crookedly into the Atlantic from mainland Massachusetts.

Feathered fishermen joust for space atop a cod-shaped weathervane in Chatham. Whirled by wild northeasters in winter, barely nudged by summer's salt-laced breezes, the vane spins out a tapestry of seasons hardly guessed at by vacationing "summer people."


W
E

Tide's out, fun's in for youngsters carrying specimen nets on a nature-study walk along Cape Cod Bay near Brewster. A tame herring gull, raised at the Cape Cod Museum of

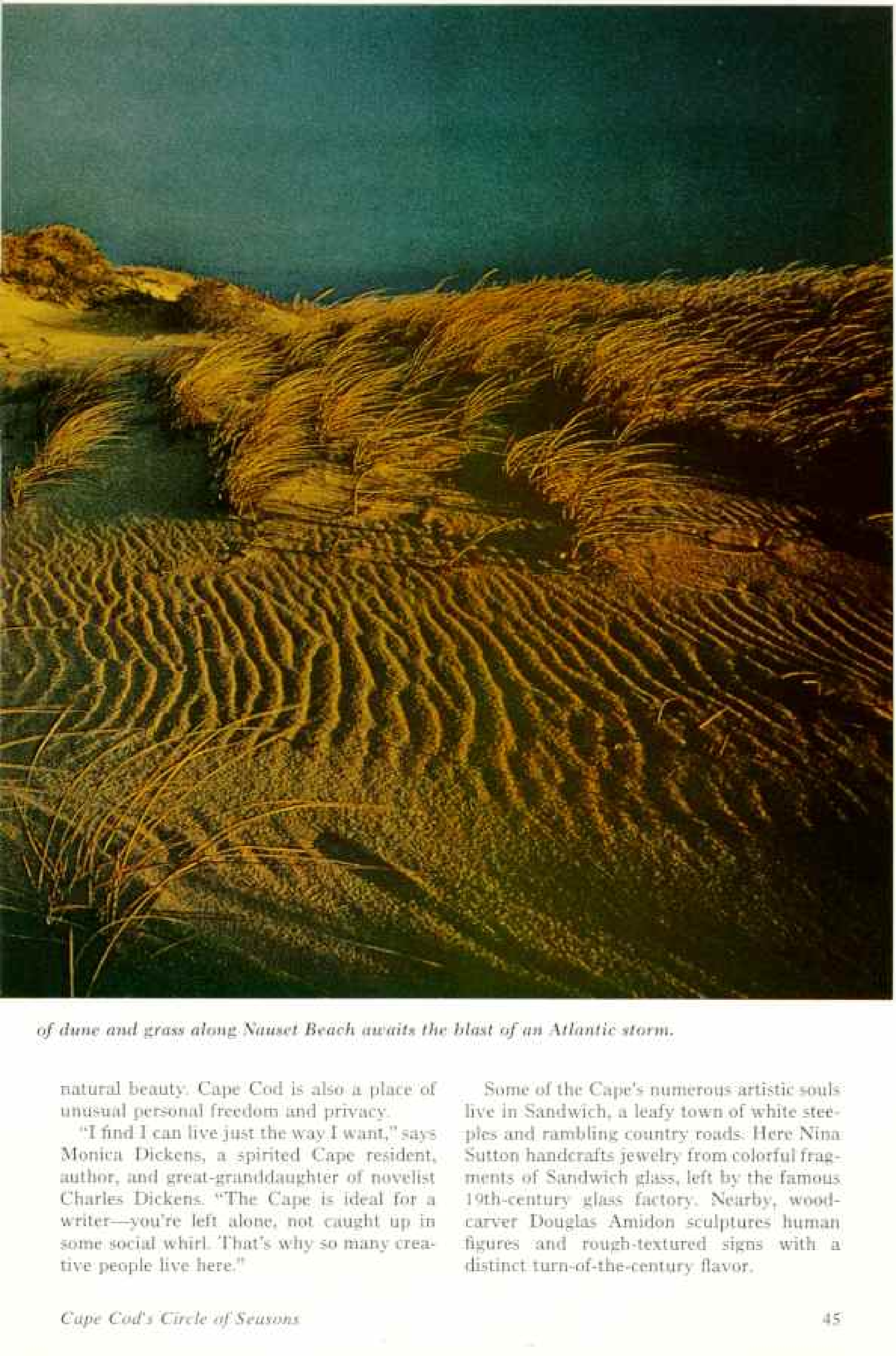
Natural History, paces the group. Hikeways braiding the peninsula's sandy 70-mile length guide other off-the-beaten-pathers to moor and marsh, cliff and dune, beach and tidal flat.

Etched by the sea wind, bronzed by the late November sun, a lonely stretch

Its first segment—the upper Cape—runs eastward 35 miles from the Cape Cod Canal to Chatham (map, page 51, and "**Close-Up: U.S.A.**"—**Western New England**, a supplement to this issue). It is a hilly, pond-pocked realm of harbors, cranberry bogs, and sea captains' houses. Here, too, is the world-renowned scientific community of Woods Hole, and the resort of Hyannis Port, where the Kennedy clan has summered since 1926.

At Chatham the land swerves abruptly north and runs 35 miles more, before ending in Provincetown's shifting shoals. This lower Cape is a sandspit world of beaches, sea cliffs, and dunes clothed in bayberry and heath.

Nowhere on the Cape is the sea more than six miles away, continually exerting its power and making this land one of exceptional



of dune and grass along Nauset Beach awaits the blast of an Atlantic storm.

natural beauty. Cape Cod is also a place of unusual personal freedom and privacy.

"I find I can live just the way I want," says Monica Dickens, a spirited Cape resident, author, and great-granddaughter of novelist Charles Dickens. "The Cape is ideal for a writer—you're left alone, not caught up in some social whirl. That's why so many creative people live here."

Some of the Cape's numerous artistic souls live in Sandwich, a leafy town of white steeples and rambling country roads. Here Nina Sutton handcrafts jewelry from colorful fragments of Sandwich glass, left by the famous 19th-century glass factory. Nearby, woodcarver Douglas Amidon sculptures human figures and rough-textured signs with a distinct turn-of-the-century flavor.

Sandwich resident Al White—gun engraver, silversmith, and artisan in almost any medium—escaped to the Cape 15 years ago when his former home, Attleboro, Massachusetts, grew too fast and too big for him. "It's not so hectic here," he says. "I need the mental and physical freedom of the place. I can't create when I'm crowded in."

Judging from his output, Al hasn't been crowded for a long time. Painstakingly engraved scrimshaw and other carvings grace his home. On his workbench a brooch fuses gold, tourmalines, and diamonds into a lifelike cicada poised on a currant leaf. A bronze timber wolf, one leg held fast in a trap, snarls savagely in a powerful portrayal of nature at odds with man.

Nature plays strongly in Al's work, as it does throughout Cape Cod. Call it "rural seaside charm" or "getting away from it all," it is what entices most people. Few steady jobs await newcomers, for the Cape lacks factories and industry.

Woods Hole Ships Explore the Seas

One noted employer is the Woods Hole Oceanographic Institution, where researchers delve into a wide range of fields, from aquiculture to the study of currents, from life in a salt marsh to maps of the sea bottom.

Five research vessels set out regularly from Woods Hole to roam the world, collecting scientific data. One of the most unusual and effective vessels is *Alvin*, a three-man deep-sea submersible. I asked Dr. Robert D. Ballard, one of the men who conducts research in *Alvin*, if I might try a dive.

"It'll cost you about $10,000," came the wry reply. "*Alvin* is expensive, but for our work, it's indispensable."

Bob's research concerns the ocean bottom, in particular the Mid-Atlantic Ridge, a tortuous scar running down the center of the Atlantic Ocean floor.* Through *Alvin*'s view ports he has also studied the floor of the Gulf of Maine, where—unlike most of coastal America—the earth's granite crust lies exposed. He looks forward to years of research in the Atlantic. But like any other Cape Codder, he also looks forward to a quiet garden and an orchard.

"I enjoy the idea of working daily at a great oceanographic institution and then going home to a farm," the tall blond scientist said.

The Cape's rural spirit is evident even along busy roads like 6A, the Cranberry Highway that parallels Cape Cod Bay as it picks up small towns like beads on a string. Winding over and around gentle slopes, this woodland-bordered thoroughfare passes shingled homes, salt marshes, country stores, and inns steeped in New England heritage. Its side roads harbor some old Cape traditions as well.

Herring Hunt: a Rite of Spring

One April day I ventured off 6A to West Brewster and Lower Mill Pond, a pine-girt pool that turns a gristmill as it feeds Stony Brook. But on that day cars clogged the usually serene roadside. Dozens of Tom Sawyers and Becky Thatchers frolicked in shoeless abandon, pants rolled to the knees, dip nets thrashing Stony Brook for fish. Spring, I learned, is the time when millions of instinct-driven alewives, a kind of herring, leave the sea to struggle upstream and spawn in the freshwater ponds where they began life.

"I got one! I got one!" screamed a freckled and utterly delighted 6-year-old as he snared a herring with bare hands.

Slipping down the bank, another young fisherman fell headlong into the creek, emerged unhurt, and found two writhing fish in his net! Parents shucked their shoes and joined in. Two gray-haired dowagers approached the brook and recaptured a bit of their youth as they witnessed again—doubtless as they had for decades—Cape Cod's watery rite of spring.

The herring, salted and dried, once provided a windfall food source to economically depressed Cape Codders. Even in this century, children on 6A hawked "sticks" of a dozen fish for a dime. Today town law still grants each Brewster citizen the right to harvest a bushel of alewives a week, but few take advantage of that privilege.

"They're trash fish," one old-timer told me with disgust. "So full of bones I'd as soon eat a whiskbroom."

No matter. The Cape has plenty of tasty alternatives within easy reach: oysters, bay scallops, lobsters, and clams. Offshore, toward the vast submarine shelf of Georges Bank, lurk schools of herring, haddock, and the cod from which the Cape takes its name. For nearly four centuries these fish have filled the holds of vessels from many nations. But now the great catches dwindle; locals lay the blame

*A two-part article describing Project FAMOUS, by Dr. James R. Heirtzler and Dr. Robert D. Ballard, appeared in the May 1975 GEOGRAPHIC.

on the foreign ships, especially the Soviets'.

"Cape Codders use hooks or large-mesh nets," Chatham fisherman Fred Horton told me. "Using hook and line never hurts the fish population; a small fish won't go for a big hook. But the Russian trawlers net everything, big and small. They come in for herring—that's our bait, what the cod feed on. If we don't have herring, our way of life dies."

I met Fred in the Chatham Squire, favorite pub of the boisterous younger fishermen. Walk in on these shaggy-maned, burly men and it's easy to assume they appreciate only beer and roughhousing. But in truth they—like Chatham's more conservative fishermen—harbor a huge, unabashed love for the sea.

"The ocean's the most powerful thing in the world," one of them told me. "It changes every day. It's primeval; it's the great mother. Man, there's *nothing* other than fishing!"

Out to Sea on a Line Trawler

Fishing is one of the Cape's few industries and one of its oldest, dating from its earlier inhabitants, the peaceable Wampanoag Indians. Eager to try my hand, I arranged to go out after cod on a commercial fishing boat.

I tugged my body out of bed long before dawn, then staggered into the blustery darkness mantling the Chatham Fish Pier. Small-craft warnings were flying high, but a few dogged seamen made ready anyway—including 33-year-old Bob Ryder, skipper of the 40-foot fishing boat *Destiny*. As its throbbing diesel took us past the channel lights, I asked Bob, a hulking six-footer, why he went out day after day, good weather or bad.

"For the money," he replied with a grin. "And freedom—it's better than being stuck behind a desk."

One of forty-odd boats in Chatham's fleet, *Destiny* is a line trawler. Thousands of hooks, on short lines spaced about six feet apart, hang from the main ground line, which is fed overboard and anchored along the seafloor. A chunk of herring on each hook lures the bottom-feeding cod, haddock, and halibut.

With Bob at the helm, mate Steve Fitz swiftly baited up, coiling the line like so much spaghetti in several wooden tubs. Ten miles from shore, the heavy seas promised to get worse, and Bob decided to fish here rather than go the usual 20 miles out. At his signal, Steve cast over a buoy and ground-line anchor. As the boat eased forward, each hook flipped out singly, the "spaghetti" unwinding without a snag and disappearing below.

Astern, Chatham's lights seemed to bob and wink as *Destiny* rose and fell on the black, oily waves. Off our bow the sun began to emerge from the ocean, piercing the gray horizon with a pink keyhole. As the last of the line payed out, Steve paused to admire the new day—and open a beer.

Close to the ocean all his life, 24-year-old Steve tried college but "just didn't feel good inside. I felt wasted; I thirsted to go out in a boat. Why fishing? Maybe for this—" he said, pointing to the streaky dawn sky. "And it's clean, natural work. You feel like you've done something at the end of the day."

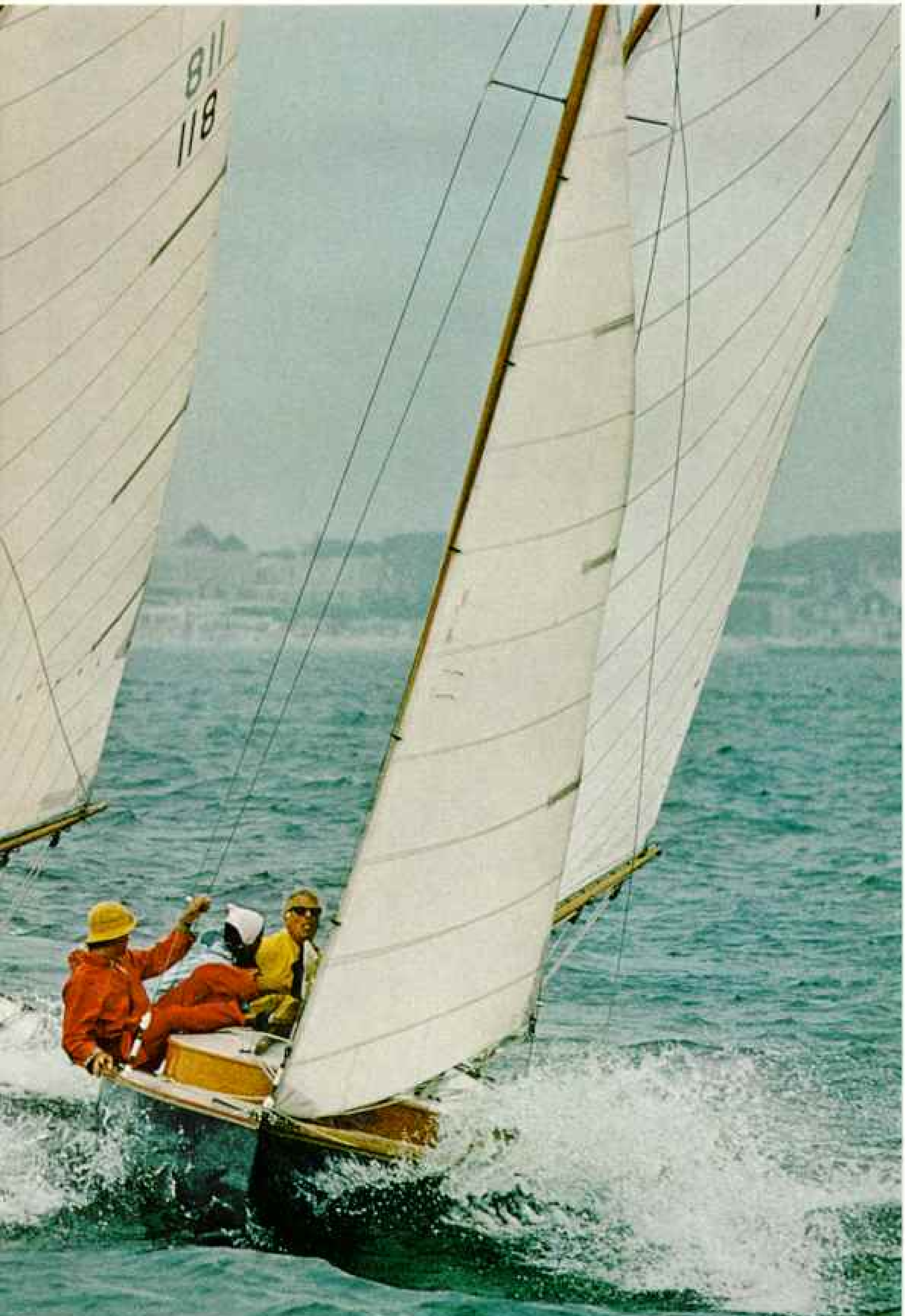
Indeed you do. A day of codfishing can last 16 hours or longer, from baiting and setting lines to hauling, gaffing, and cleaning scores of fish, some of which may weigh 60 pounds or more. All this while the sea pitches you about; it's enough to wear down anyone's stamina. These men earn every nickel they get, even when an exceptional catch brings them a thousand dollars.

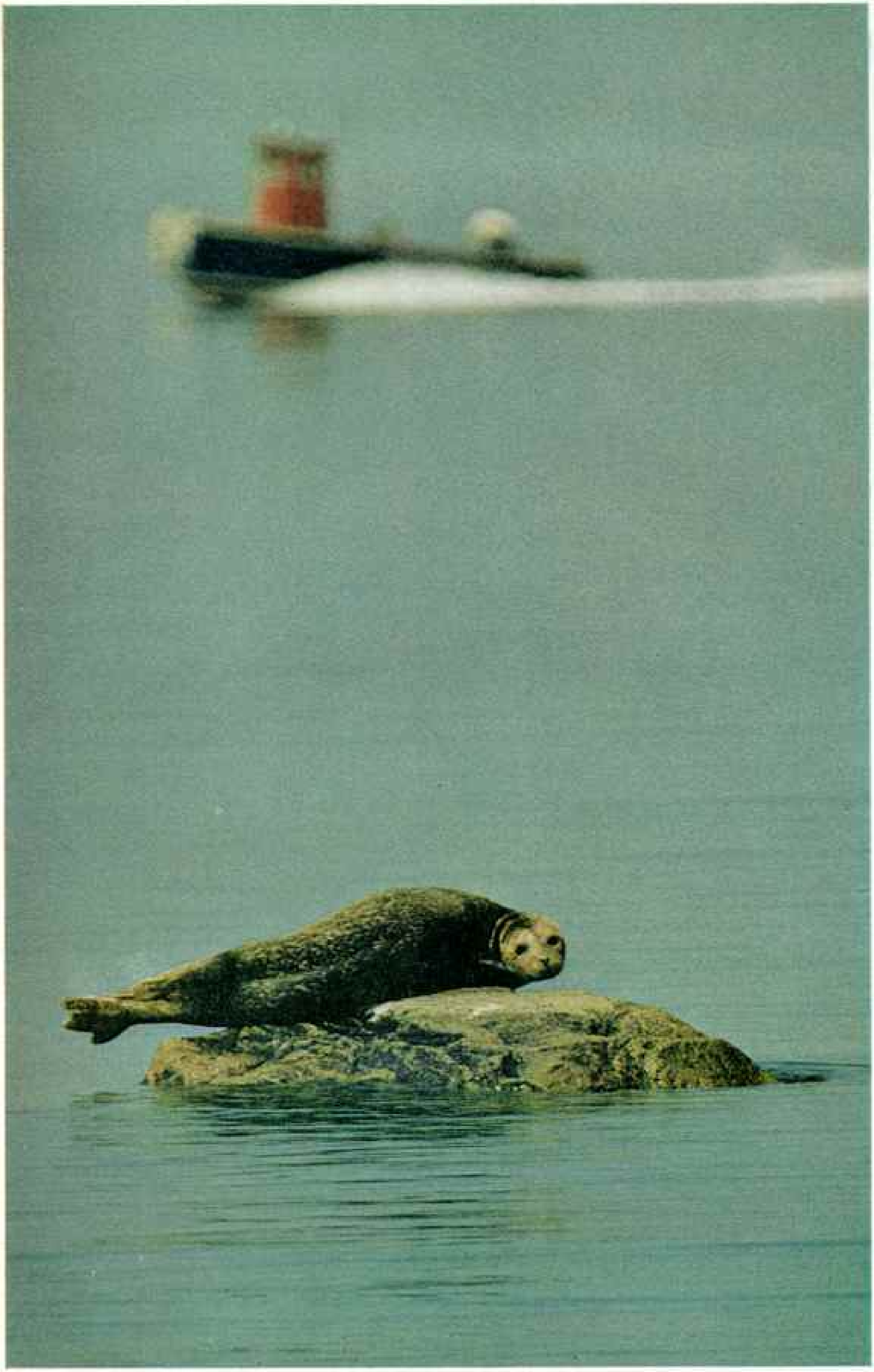
"It sure doesn't average out that way," Bob roared over the engine's hammering rhythm. Bottom snags, he explained, can cost a fisherman his whole trawl. Worse, he risks his boat—and life—each time he goes out. The seaward edge of the Cape from Monomoy Island north to Provincetown, the treacherous "backside," is the graveyard of more than 2,000 ships and countless men.

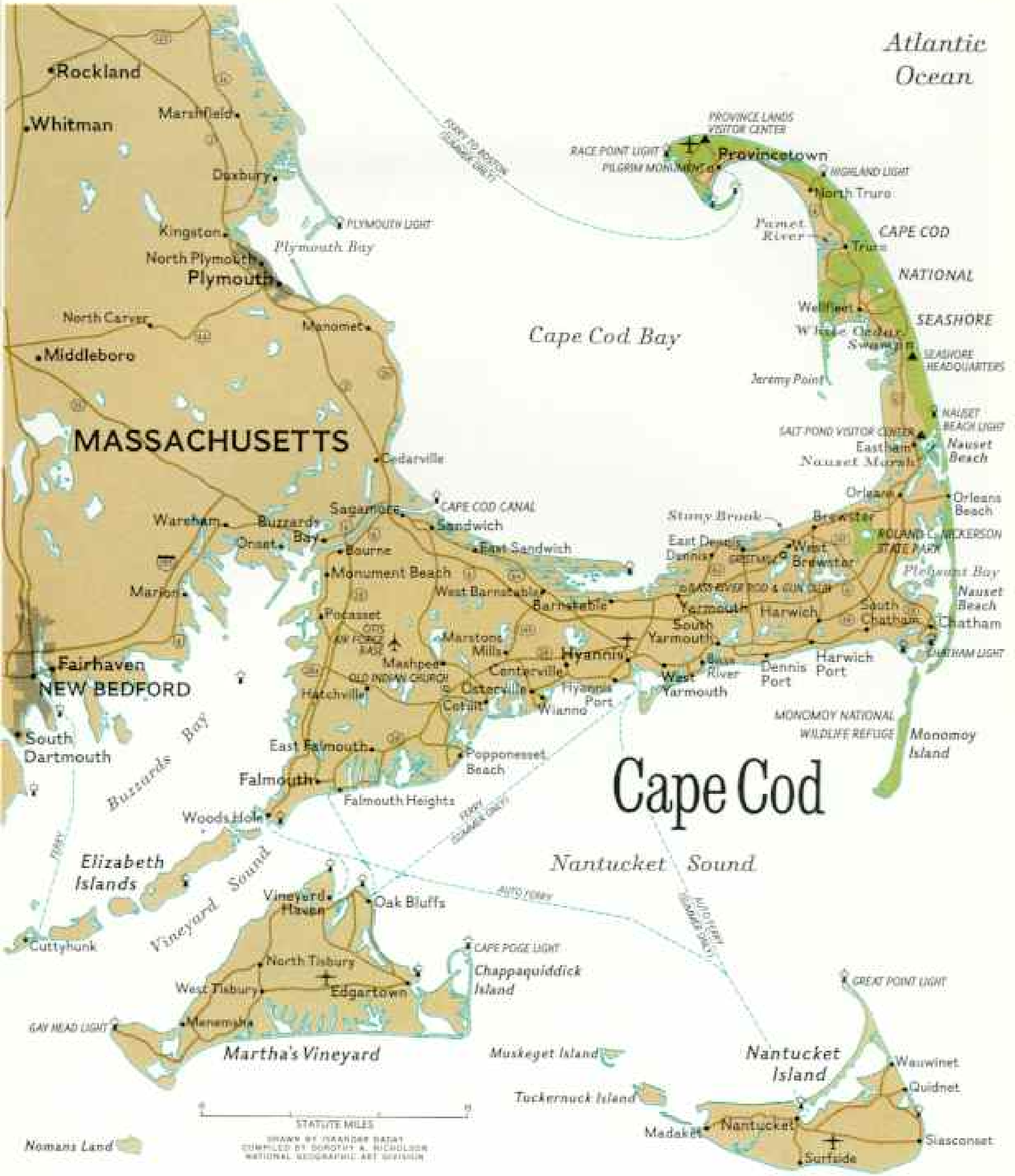
By now Bob was hauling in the line as Steve coiled it into the tubs. It was a bad day for cod. Hook after empty hook emerged from the dark waters. Then our luck turned even worse—dogfish and skates, worthless weeds to a fisherman, showed up. Bob knocked them off the hooks.

At last a few cod appeared, and Bob deftly gaffed them into the stern. But he was still turning up more trash fish than keepers. Then a whine of the pulley and taut line told him something big was on a lower hook. "You just never know what *(Continued on page 53)*

Shipping a bit of the briny, racing sloops vie on a summer Sunday off Harwich Port (**following pages**), echoing the age of sail when Cape Codders manned the helm of many a California-bound clipper. Beyond the shelter of Monomoy Island lies danger; shoal-fanged seaward Cape waters have swallowed more than 2,000 ships.


811
118





"STRONG RIGHT ARM of Massachusetts," Cape Cod elbows into the Atlantic from the Cape Cod Canal, which saves ships a hazardous passage around outlying shoals. Those same shoals in 1620 drove back a Virginia-bound vessel named *Mayflower*, which made its first New World landfall near present-day Provincetown. After signing the Mayflower Compact—first written agreement on self-government in America—the Pilgrims crossed the bay to found Plimoth Plantation.

Today millions of latter-day pilgrims make vacation landfalls on the Cape's spacious beaches, vying with 124,000 year-rounders for parking spaces and elbow room. Bemused by it all, a stray seal (**left**) parks on an offshore rock in Cape Cod Bay.

House that tradition built: Styled as a Cape Cod home of the 1600's, a modern "salt-box" in East Dennis turns a long, sloping back roof to winter's northeasters. In bygone

days; additions like these were often tacked on as the family—or its fortune—grew.

you're going to pull up—*anything* can be down there," Bob murmured. What was it? Tuna? A shark? "Halibut!" Bob's happy yell filled the air. "Forty-five pounds, easy. At a dollar-ten a pound, I'll take all I can get!"

Accustomed to prepackaged halibut steaks, I could only gape in awe as that 45-pounder flopped and bashed its head on the bottom of the boat. But Bob has caught much bigger ones, as large as 200 pounds dressed out.

"Halibut's a slow-growing fish, and there aren't many left here," he said. "This one's probably 10 years old. At the going price, it'll pay my expenses; the cod'll be all profit."

Then reaching to untangle a line, Bob inadvertently ripped his oilskins with a gaff hook. "There go the expenses," he muttered.

And so the day went, a mix of good luck and bad, as two Chatham fishermen reaped a living from the sea. By early afternoon the boat's wallow and diesel fumes had filled me with green waves of nausea. Worsening winds persuaded Bob to call it a day. As we churned back to Chatham, Steve cleaned the catch, lopping off the heads and tossing the entrails to the flock of following gulls.

Back in the harbor the fish were unloaded, crated in ice, and trucked to Boston and New York City's Fulton Street, where "fresh Chatham cod and haddock" would draw retailers and housewives the next morning.

Heavy Seas Mold the Cape's Coastline

Leaving Chatham, I headed north along the Cape's backside. Violent northeasters relentlessly buffet this unprotected coastline, eating away its midsection while they feed shoals at Provincetown and Monomoy Island, a wildlife refuge south of Chatham. The shore near North Truro takes the worst battering, where Highland Light stares out to sea less than a hundred feet from the edge of an ever-retreating bluff.

"We just lost a piece 40 feet long and about 70 feet wide," lightkeeper Thomas Branco said as we stood on the landslide-prone cliff. Below us waves lapped at gigantic hunks of clay that only weeks before had been part of his lawn. A few miles south, the ocean intrudes toward the headwaters of the Pamet River, almost severing the lower Cape.

"I don't think I'll ever see it, but someday Provincetown might be an island," Branco said, smiling wanly. "And there's nothing you can do about it. You can't stop the ocean."

Unable to tame *(Continued on page 58)*

Tart-'n'-saucy rubies are whisked by conveyor belt to waiting trucks of the A. D. Makepeace Company, world's largest grower of cranberries. Bogs like this one near

Marstons Mills are flooded at harvest so the buoyant berries can be easily gathered by wooden booms. Much of Massachusetts' million-barrel-a-year crop comes from the Cape.

Summer horseplay: During the Barnstable County Fair in July (**above**), harness-straining teams of Belgian and Percheron workhorses haul sleds weighted with 10,000 pounds and more—urged on by teamsters' cries of "Hut! Hut!" and tourists' squeals of "Hi-ho, Silver, away-y-y!"

Horsing around without steeds, merrymakers at Chatham's annual Fourth of July parade (**left**) douse passersby and onlookers with bucketsful of seawater scooped from a fisherman's dory. Following the silly with the serious, a home-made banner urges the extension of coastal fishing control from 12 miles to 200 for foreign vessels, which are blamed for dwindling local catches.

From Sandwich to Provincetown, summer's mood continues unabated for three hectic months. Native Cape Codders may grouse about the onslaught of summer people, but many still hang out a room-for-rent shingle.

nature's fury, man is challenged by another threat to the Cape—growth. A boom in both summer and year-round homes made Cape Cod's Barnstable County the fastest growing county in Massachusetts. Its population rose 37.5 percent between 1960 and 1970. Today the Cape's permanent inhabitants number more than 124,000.

In Hyannis—named for an Indian sachem—older residents recall when the modest streets were paved with oystershell. But today a generation that courts tourism has made the Cape's largest village a circus of shopping centers, motels, and billboards—part resort, part suburban sprawl. Falmouth is close behind, with large motel complexes. Chatham retains its countrified isolation, but it, too, has begun to subdivide and build. Provincetown, swelled by summer boarders, must buy water from neighboring Truro.

Even in rural Sandwich, a housewife complains: "When we came here, you could see cows out back. Now it's a parking lot. So many people come here they destroy what they came to see. They cut down the trees and spread asphalt over the grass."

Most residents dislike the changes wrought by developers and newcomers. But Cape Codders traditionally respect the rights of the individual, and many are loathe to set rules for land they don't own.

Norman Cook, former head of the Cape Cod Planning and Economic Development Commission, argues for a construction slowdown and for cluster zoning that would set aside village greens for each subdivision.

"Today the Cape has about 100,000 acres of open land left," he says. "It will be full in ten years if things go along as they have. We don't have the water or land to support many more people, but they just won't believe our resources are finite."

National Seashore Buffers Growth

Whether or not the Cape restricts its growth, part of it will always remain—the 28,000 acres along the lower Cape that comprise Cape Cod National Seashore, administered by the National Park Service.

"Preservation and use—that's the Park Service in a nutshell," Seashore Superintendent Leslie Arnberger told me. Created in 1961, the seashore was "about 300 years too late for wilderness, but happily we've been able to save some open space."

Much of the open space is beach, although numerous trails lace other natural areas, such as the White Cedar Swamp, Salt Pond, and Nauset Marsh, affording glimpses of ecological evolution, from marsh to swamp to forest.

Several million people visited the seashore last year, and the numbers are swelling, Mr. Arnberger said. "Traffic's the main problem. Once they get on the beaches, there's room enough." He added that the Park Service plans to expand its bicycle trails from Provincetown to Eastham, through the dunes of the lower Cape.

Sailors Doomed by Witch's Spells

One summer dusk I crossed those brooding dunes while winds whispered through the stubble of poverty grass. No wonder 18th-century Cape Codders feared this desolate stretch as the home of witch Goody Hallett!

I tried to picture the legendary "little old woman of Nauset Sea" dancing the nights away in scarlet shoes, wailing like the wind as she heaped ill fortune on wayfarers who dared intrude into her barren domain.

For nearly a century, according to the tales, Goody reigned over Eastham and the Cape's deadly shoals. She whipped up hurricanes and lured ships to disaster with a lantern hung from a whale's tail. Stoked with hot rum, the witch frolicked in the leviathan's stomach, dicing with the Devil for souls of doomed sailors.

Legend says the Devil eventually strangled his wicked consort, and years later, a pair of red shoes found in a dead whale's belly confirmed Goody's demise. But if Goody Hallett were alive today, I know just where she'd live—Provincetown.

"P'town," as some call it, is summertime haven for the occult, the gay, and the artistic, the serious and the sham. Many Cape Codders, Provincetowners included, label the town a "summer sideshow." Its central attraction is Commercial Street, crammed with wall-to-wall souvenir and craft shops, portrait studios, hot-dog stands, and waterfront apartments.

Sidewalks and doorways overflow with the varied profile of tourist America—shaggy youths, sprightly old folks, and camera-toting families dressed in Cape Cod T-shirts. People, people everywhere! They come to watch fudge being made, to poke at lobsters in tanks, to sit for sidewalk caricaturists. Awash in this summer flood, it's easy to overlook Provincetown's other faces.

A few yards from Commercial Street's crush stretches peaceful Cape Cod Bay, where sandpipers scatter before cartwheeling children, and yoga enthusiasts pretzel themselves in early-morning exercises. Here, more than 350 years ago, the Pilgrims made their first landfall in the New World before founding Plimoth Plantation, drafted the Mayflower Compact, and lay at anchor more than a month. A 252-foot-tall tower, the Pilgrim Monument, commemorates the events.

Here, too, whalers once berthed, as did playwright Eugene O'Neill, novelist John Dos Passos, and a number of modern artists. Today Provincetown is part art colony, part fishing village, part mecca for youth.

"It's very free here," explains Nancy Francke, an engaging young motel manager who left comfortable but routine New York suburbs for the charms of Provincetown.

"You don't have to be someone you're not . . . you can paint, sculpt, write, or just look at the water. Some may call that a cop-out, but when it makes you happy and life's so short, why not?"

Free-living to the hilt, P'town may delight or offend, but it cannot be ignored. It grasps at all who come here, asserting gaudiness and serenity, creative independence and a passion for the inane.

Stepping down from Commercial Street, I entered the Rainbow Shop to find myself walking on clouds (they're painted on the sky-blue floor). Rainbow colors filled the store.

"The rainbow is a big, wonderful symbol of hope and the unity of man," Thom Klika beamed as he painted a wall-size rainbow streaming from a cottony cloud. A tiny rainbow decal sparkled on one of his front teeth.

Rainbows are Thom's main motif, taking shape in watercolors, pillows, even jigsaw puzzles and stained glass. Rainbow greeting cards brighten dark days with such messages as "The soul would have no rainbows had the eyes no tears."

"Have a rainbow," Thom offered, handing me a colorful miniature, one of some 350,000 calling cards for happiness he has made and sent to people as far away as Europe and Japan. "Even if I wanted to stop making them, I couldn't—kids keep writing to me, asking for them. If I don't follow through, they'll think there's no Rainbow Man."

Leaving Thom to his joy-breeding work, I explored Provincetown's more relaxed west end, where a slim, gray-haired man labored in his terraced herb and flower garden.

"It *was* something of a challenge to build it out of sand," he allowed modestly. Better known for verse than vegetables, this casually dressed gardener is Stanley Kunitz, Pulitzer Prize-winning poet who spends his summers in Provincetown.

"Why Provincetown?" I asked.

"It's one of the best working places I've ever encountered," he replied, pointing out the isolation of Provincetown's east and west ends from its cotton-candy center. "In the west end, you have few distractions. People respect the artist's privacy here."

In the similarly artistic east end lives Robert Motherwell, creator of bold, exciting collages and oils. Both he and Kunitz help support the Provincetown Fine Arts Work Center, a "congregation of talents." Here 20 young artists and writers spend October to May in work, discussion, and informal criticism. Talented resident poets and artists advise, with the help of guests such as writer John Cheever and poet Robert Lowell.

"It's a unique situation," Motherwell says. "Here the teachers pay the students." Young artists and writers get about $150 a month.

Needy or otherwise, artists continue to seek out Provincetown. Motherwell explains: "It has the most beautiful light in America; the sea reflects all around. And it's always been a Bohemian place. I've summered in France, Italy, other places, but I always come back here in the end."

Fall Brings the Cranberry Harvest

As Provincetown's summer laughter faded into the solitude of autumn, I returned to Brewster to sample the Cape's major fall event—the cranberry harvest. Massachusetts raises nearly a million hundred-pound barrels of berries each year, and much of that crop comes from the Cape's sandy bogs.

One sparkling October day I accompanied a harvesting crew from the A. D. Makepeace Company, world's largest cranberry grower. Workers had already flooded the bog with about a foot of water, first step in harvesting.

Submerged, the deep-red berries shone among the leafy vines like millions of sunken rubies on green plush. Men waded ahead of me, pushing motorized harvesters that threshed the vines. The fruit bobbed to the surface in a vast red wake.

Other workers corralled the buoyant berries within a hinged *(Continued on page 64)*

Thumping "oompah" strains toot from Chatham's gazebo (**above**) during Friday evening band concerts through July and August. Before an enthusiastic lawn-chair-and-blanket audience that often exceeds 5,000, the band reels out a repertoire of Sousa marches, Strauss waltzes, and beer-garden schmaltz—often punctuated by the rhythmic popping of children's helium-filled balloons.

Aromatic steam makes the air itself mouth-watering at the annual August clambake of Yarmouth's Bass River Rod and Gun Club (**right**). Fresh from the bake pit, blushing red lobsters and clams have been steamed to perfection with sausages, ears of corn, onions, and potatoes over hot rocks and seaweed. The abundant Cape Cod delicacies are swiftly annihilated by hundreds of salt-air-whetted appetites.

Beached for eternity, ghost ships ride out a snowstorm in a marsh at Wellfleet. The shades of many a long-dead seaman still haunt these windswept shores. And many a

spine has shuddered at tales of ghostly Goody Hallet, a Cape Cod witch who, local legend avers, liked to lure ships to perdition with a lantern hung from the tail of a whale.

Savoring the serenity of Cape Cod in autumn, a lone boatman cuts a

wooden boom (pages 54-55). A conveyor belt loaded the harvest into a waiting truck. As one truck filled, another—summoned by radio—took its place.

"The cranberries deteriorate fast after they're knocked off the vine," Lewis Flint, a harvester for 48 years, told me. "So we want to process them within 24 hours." That means long, hectic working days throughout September, October, and often into November. But like Chatham fishermen, cranberry pickers reap the scenic benefits of outdoor work, and harvest a sense of accomplishment.

"Today you can see what the whole year was for," said Chris Makepeace, the 26-year-old assistant foreman, as he raked in more berries. Chris may be the boss's son, but during harvest he still works in the bogs 14 hours a day, seven days a week. Lewis explained:

"It's like working on a farm. You've got to start at the bottom to learn. If Chris hadn't done that, no one would listen to him."

That seemed like a hint, so I slipped on a pair of waders and joined those raking in the crop. It would have been monotonous work were it not for the camaraderie of the crew. All day long they shrugged off fatigue with jokes and songs, and laughed at the frogs that hopped like self-propelled checkers across the dense cranberry sea.

Autumn Glows With Quiet Beauty

Happily, I was not indentured to the harvesters' seven-day workweek, and could explore the whole sweep of autumn on the Cape, considered the best season by many residents. Here fall colors rarely blaze with fire, and the land lacks the craggy magnificence of, say, California's Big Sur. What emerges instead is a quiet, subtle beauty, often as desolate as it is fragile.

You can find it in Mashpee, where the Old Indian Church rises square and solid atop hand-hewn timbers, tawny and seamed as an old Indian's face. The autumn sun barely warms the aging shingles silvered by the

solitary wake along mirror-smooth Pleasant Bay near the peninsula's "elbow."

briny air. Nearby, tired gravestones lean beneath the weight of many years. To me, one tablet's message memorialized the passing of summer as well as of human life:

THE ONCE-LOVED FORM, NOW COLD AND DEAD
EACH MOURNFUL THOUGHT EMPLOYS:
AND NATURE WEEPS HER COMFORTS FLED,
AND WITHERED ALL HER JOYS

Down the Cape from Mashpee, Hyannis Port lures lovers and beachcombers to its surf-flecked shores. They come to savor the salt air, to walk amid dunes rippling with beach grass, to share in the nostalgia of autumn on Cape Cod. They also come for a glimpse of three white-shingled, dark-shuttered homes overlooking Nantucket Sound—the "Kennedy compound."

For nearly fifty summers the Kennedys have romped and rested here, leaving their indelible mark on the Cape. Residents of nearby Hyannis recall seeing Rose Kennedy's young children, barefoot and dungareed, lining up for double dips of homemade ice cream after the downtown movies. July Fourth always meant a boisterous weekend of parties and softball on the broad Kennedy lawn; touch football games used to pit Jack against Bobby as opposing quarterbacks. All just memories now.

As I dawdled down the autumn beach I recalled my early-morning walk on Nauset Beach the previous winter and all the year-round delights I'd seen, from Woods Hole to Provincetown. During my off-season odyssey, I'd discovered the Cape's deceptive beauty—simple yet profound, delicate but eternal.

I'd met some of its creative, independent, solitude-loving people, a people bound to the Cape by the lure of the land and the relaxed way of life. Best of all, I had glimpsed a bit of the Cape Cod magic that was here long before today's tourists or yesterday's Pilgrims. I left, hoping that progress and time's ever-rolling wheel would not rut too deeply the Cape I had come to know. □

ARROWS SPEAK LOUDER THAN WORDS

The Last Andaman Islanders

ARTICLE AND PHOTOGRAPHS BY RAGHUBIR SINGH

Intruders beware! Taut bow (**above**) greets an Indian Government party bearing gifts to North Sentinel; hunters (**facing page**) rejoice in the boat's withdrawal. A curtain of isolation shrouds the island, last stronghold of Stone Age culture among Negrito tribes in the Bay of Bengal.

WE SCANNED THE DARK JUNGLE and its narrow skirt of sand as our launch approached the beach of North Sentinel Island. In the early-morning light a Negrito emerged from the jungle with a drawn bow. Others joined him, all of them dark skinned, well built, with bark strips around their biceps and amazingly long arrows tucked in their bark belts.

"We are friends. We come in peace," our loudspeaker blared.

One of the Negritos stepped forward and shot an arrow. With a loud clang, it glanced off the metal side of our boat.

We pulled back and proceeded along the coast, seeking a safer place to land our gifts. But the Negritos rushed along the beach after us, waving bows and arrows, hurling stones and driftwood.

Finally we outdistanced them. Several armed police in our party donned padded jackets, took iron shields, and scrambled into a small dinghy we towed. Rowing ashore, they left a tethered pig, eating utensils, coconuts, bananas, colorful baskets, and lengths of red cloth, then quickly withdrew.

The Negritos soon appeared and collected some of the gifts. The red cloth they left lying on the beach. One lifted coconuts and waved them at us. But as we moved closer, another fired his arrow. It hit a motion-picture photographer in the thigh. We pulled it out, a scrap of iron fashioned to a point, lashed with bark to the end of a six-foot cane shaft. The Negrito who had shot it, seeing his arrow hit its mark, laughed, proudly walked toward the shade of a tree, and sat down.

The 20-square-mile island where we encountered the hostile Sentinelese is one of more than 200 islands in the Andaman group, which lies in the Bay of Bengal between India and Burma (map, page 72). The archipelago shelters four tribes of Negritos, surviving

As ancient sea tales had it, the Andamans were an archipelago peopled by savages who killed outsiders. Marco Polo, who never set foot there, passed on another libel, that the inhabitants were brutes with the teeth of dogs. Actually the Andamanese themselves were often the frightened victims of exchanges with

outsiders, who raided for slaves and killed with weapons unknown to the Negritos. Over the years suspicion has only gradually yielded to friendship among most of the tribesmen. For these Sentinelese hunters, who keep their powerful bows ready as they eye a government expedition (**above**), the veil of distrust has yet to fall.

fragments of an ancient pygmy race that may have once been widespread in Southeast Asia and Oceania. Fables of cunning and ferocity still envelop them more than a century after the British, who settled the Andamans, dispelled the myth that the natives were cannibals.

Masters of their jungled homeland for millenniums, the Negritos today number scarcely 600, a small fraction of the Andaman's 115,000 population. Besides the Sentinelese, the remaining tribes are the Jarawas, who live along the western coasts of Middle and South Andaman; the Great Andamanese on Strait Island; and the Onges on Little Andaman.

Though mentioned by Arab travelers as early as A.D. 871, the Andaman Islands remained isolated through the centuries. Heavy rains and driving seas of the southwest monsoon made the islands hard to approach by sailing ship from May to November.

The islands' sinister reputation kept mariners away when the storms did not. Malay and Chinese pirates, raiding here for Negrito slaves, raised superstitious fear and hatred of outsiders. So when a ship put in for water or shelter, or was wrecked, Negritos tore sailors limb from limb and cast them into the flames to destroy evil spirits. Any who escaped brought away lurid tales echoing Marco Polo's hearsay report of brutish idolaters who killed and ate every outsider they could lay hands on.

Seesaw Policy Confuses Tribesmen

As contacts with foreigners increased, the Andaman Negritos faced the problem common to primitive peoples all over the world. Indians and Europeans, with good intentions and bad, deprived them of land and livelihood, undermined their society, and introduced epidemics that wiped out entire groups.

The discipline of anthropology was developed just in time to reveal what a rich variety of cultures was being lost. Yet few students of man came to champion the Andamanese. Edward Horace Man, a colonial administrator in the 1870's, and noted British anthropologist

Pausing to drop gifts of cloth, tools, eating utensils, and food on an unoccupied beach, the expedition then retires offshore as the Sentinelese arrive. "We come in peace," shouts an Onge, a member of a friendly tribe (**above**). The message is in vain. Though all the Negritos speak dialects with the same linguistic base, differences in vocabulary prevent communication. Ashore, the hunters spear the gift pig, examine the cups and plates (**right**), and cart off a bag of coconuts. One bowman again trained his weapon on the visitors, but most of the Negritos let curiosity rule and merely watched the boat party.

Alfred Reginald Radcliffe-Brown early in this century studied the Great Andamanese. Twenty years ago Italian anthropologist Lidio Cipriani spent 162 days among the Onges. Since then, the Indian Government has allowed only two foreign anthropologists to work in the archipelago.

Over the decades the pendulum of policy toward the Negritos has swung bewilderingly: punishments alternating with blandishments, and seizure and control with benign neglect. Several old-time administrators raided Jarawa camps; one had a fiddler serenade the Onges.

In 1950 a policy of protection was adopted toward all the tribal peoples of India. However, in their zeal to improve economic, social, and educational conditions, welfare organizations have pushed assimilation more than protection. They often seem to me to ignore former Prime Minister Jawaharlal Nehru's wise caution: "There is no point in trying to make of them a second-rate copy of ourselves. . . . they are a people who sing and dance and try to enjoy life; not people who sit in stock exchanges, shout at each other, and think themselves civilized. . . . we do not mean to interfere with their way of life, but want to help them live it. . . . according to their own genius and tradition."

Gifts Bid for Renewed Trust

The four tribes of Andaman Negritos represent four different stages of involvement with the outside world over the course of a century. I was eager to observe how civilization affected each of them.

Spending sleepless nights rocking in an open boat off the coast of Great Andaman with Bakhtawar Singh and his men showed me how much patience and perseverance it takes to make meaningful contact with a hostile Negrito group. Bakhtawar, a tall, big-paunched, jovial, gray-bearded deputy superintendent of police from Port Blair, has been conducting the gift operation to the Jarawas since 1973.

"These Jarawas *(Continued on page 75)*

Andaman Islands

ANDAMAN SEA

Barren Island

Great Andamanese—Four thousand members of this tribe once occupied most of Great Andaman. Establishment of a penal colony at Port Blair in 1858 brought the Negritos disease, decimation, and decline. Only two dozen now survive, all on Strait Island.

Jarawas—Some 300 tribesmen dwell in a 300-square-mile reserve on Middle and South Andaman's west coasts. Provoked by encroaching settlements, bombed by the Japanese during World War II, the Jarawas remained resentful and suspicious until recently when one group (**facing page**) finally responded to friendly gestures by island administrators.

Sentinelese—Guarded by treacherous seas and their own stout bows, some 150 tribesmen on North Sentinel Island still maintain their distance toward outsiders and retain a truly ancient culture.

Onges—A settlement at Hut Bay, a proposed port at Jackson Creek, and a road being built between them, nibble at the woodland haunts of Little Andaman's easygoing Onges, befriended in 1886 by an English administrator. Scattered in several bands, they total only 112—a sixth of the number 75 years ago.

Sprinkles of land in the vast Bay of Bengal (**map, left**), the Andamans, with the Nicobars, form a Union Territory of India.

Some 115,000 settlers and civil servants reside in the more than 200 islands. As their numbers swell at the rate of 15 percent a year, elbowroom decreases for the fewer than 600 aborigines, whose culture, some anthropologists think, once extended across much of Southeast Asia.

Affection breaks out near a Jarawa camp on the west coast of Middle Andaman. The Negritos swam to the boat to greet those who had made repeated gift drops. The outsiders then went ashore, where they received smiles (**upper right**) and even touches of welcome.

A boy (**above**) embraces Deputy Police Superintendent Bakhtawar Singh, whose ample paunch delighted the spare, muscular Negritos. The aborigines generally lack body and facial hair. Chin stubble (**right**) was a phenomenon that had to be explored.

are not selfish and greedy like us," he told me. "They want so little—only to live in harmony with their natural environment. It's the settlers—hunting, fishing, cutting trees in Jarawa territory—who have provoked them to hostility. We who have made them hostile must restore peace without harming them."

Bakhtawar's efforts brought encouraging signs. One time the Jarawas left a fish, another time a suckling pig in return for gifts Bakhtawar had left. I saw one place where the Jarawas had suspended strips of bark, a shell, a coconut husk, and an old rubber slipper from canes lashed between trees. Bakhtawar interpreted this bizarre display as a request for more gifts.

One day while we camped on the beach 200 yards from a cache of gifts, the red cloth tied to a tree at the jungle's edge suddenly vanished. We took to our boat, Bakhtawar waving a red cloth above his head to indicate that more gifts were available. But the Jarawas did not show themselves.

Then, in April 1974, came a breakthrough. Moving farther north, Bakhtawar caught sight of brown thatch in a jungle clearing behind a fringe of trees. Seeing no one about, he went ashore. Below a hillock, perhaps used as an observation post, stood two large round huts and a small lean-to. In the huts he found some of the gifts he had left down the coast. He placed new gifts on the beach and anchored nearby.

At dawn a few Negritos swam out—unarmed. Bakhtawar had achieved friendly contact with the Jarawas!

Meeting Pervaded by Party Mood

I joined him on his return to that camp ten days later. As the police motor launch came to anchor 300 yards offshore, we saw a Jarawa on the beach, his legs spread, waving his arms. Over the surf we could not hear what he shouted.

Other Jarawas appeared. None carried bows and arrows. After watching us for a moment, they leaped into the surf and breaststroked toward us, heads bobbing. They climbed aboard, grinning from ear to ear, bodies dripping, chocolate skin glistening in the morning sun. Bakhtawar hugged them like long-lost brothers.

More Jarawas swam out. There were about 30 now, all over the launch: men muscular and lean; women with pert breasts and fine figures; children, some boisterous, some shy. Shouting, flashing smiles, jumping up and down, chattering excitedly, they played with the wheel, inspected the wireless earphones, tugged at the anchor cable.

Metal More Valued Than Matches

Bakhtawar brought out gifts: handsaws, necklaces and ribbons, some umbrellas. The Jarawas took them eagerly, breaking into a chant that sounded something like, *alay, oday, olay, otalay, laday, alay, laylay, yamolay, alay, ahday, waday, ahday, dahday, olo, ahtay, olo, alay*. The men tucked the handsaws into the bark bands, laced in back, that sheathed their torsos and comprised their only clothing. The women, clad only in tasseled belts of bark or strips of red cloth from one of Bakhtawar's earlier gift drops, gleefully tied the ribbons around their heads and wrapped the necklaces around each other's arms. One boy, finally managing to open an umbrella, beamed at his achievement.

Among the gifts were matches, flashlights, and candles; the Jarawas presumably do not know how to make fire, since they keep one burning constantly and carry a brand when they change camp. But before Bakhtawar could show them how to use the matches, flashlights, or candles, these were whisked away. So were a variety of items not intended for gifts: spoons, forks, the deputy commissioner's razor, door hooks and bolts that were pried loose to be used as metal for arrow tips. An isolated people, the Jarawas have had little reason to learn respect for the private property of outsiders. In the early years of settlement this was a cause of several bloody incidents.

But the atmosphere on our launch was permissive. Jarawas patted Bakhtawar's bulging paunch and burst into childlike laughter. He gave them plastic whistles and blew one as a sample. Quickly the air rang with the shrilling of whistles.

Exuberance in motion, a Jarawa woman dances during an explosion of merriment that lasted for several hours after expedition members went ashore. "I've never seen people so happy before," said author Singh. But for other groups of Jarawas, distrust of strangers endures. Settlers who trespass on their forest domain may be attacked and killed.

We went ashore. There Bakhtawar danced none too gracefully arm in arm with a dozen Jarawas, followed by more embraces. Jarawas tied bark strips on our biceps, examined our day-old beards. The Jarawas have peppercorn hair on the head, but little body hair. They stood beside us and laughed at the difference in height. The men were not even five feet tall, and the women were several inches shorter. We gave them photographs from the previous visit, which amazed and delighted them. Seemingly, a hundred years of hostility had ended for this band of Jarawas.

It was an ending—but also the beginning of a difficult period of change and adjustment. What price will these Jarawas pay for their friendship? Are we ready to accept these simple people of the forest without shattering their age-old culture?

Early Settlers Were Ex-convicts

The first European beachhead in the Andamans was a naval station established in 1789 by Lt. Archibald Blair, sailing for the British East India Company. But it was short-lived. Not until 1858 did the British come in force, founding a penal colony at Port Blair for thousands seized in the great Indian revolt of 1857. Convicts were set to work clearing and cultivating land, lumbering, fishing, building roads. After they had served their time, most settled on Great Andaman.

Rainy-season refuge, an Onge communal hut of palm-frond thatch offers shelter at South Bay (**left**) during the monsoon that pummels the islands from May to November.

The Onges have no method of counting, no concept of their ages or the clocking of time. They may also have no tomorrow. A low birthrate and high infant mortality threaten the survival of the tribe, making the arrival of a child a major event. A woman (**below**) nurses her baby near Dugong Creek.

When the Great Andamanese resisted outsiders, they were defeated in battle. When the Jarawas, molested by settlers, retaliated, punitive expeditions were mounted against them. During World War II, Japanese occupation forces bombed and strafed Jarawa camps.

At the end of the war the British abolished the penal settlement. Following the establishment of Indian independence and the creation of Pakistan, refugees from East Bengal swelled the population. Though forest reserves were set aside for the Negritos, the pressure of settlement continued to mount.

Felling forests for timber dries up water sources. Every summer, despite the 125 inches of annual rainfall, there is a water shortage. The Andaman Trunk Road, the first highway to run the length of Great Andaman, is under construction. Part of it cuts through the 300-square-mile Jarawa Reserve Forest, bringing the threat of increased settlement and encroachment.

Bulldozers were clearing the forest for a road on Little Andaman, low-lying southernmost of the island group, as I rode in a jeep toward Dugong Creek, biggest camp of the Onges. Befriended in 1886 after years of skirmishes and gift dropping, the Onges once roamed the entire 270-square-mile island. Today they occupy only a few small pockets.

Halfway to Dugong Creek the road ended. With a guide I trudged the remaining eight

Urge to embellish leads an Onge wife to create a fingertip design when painting a utilitarian ointment on her husband's face (**right**). The paste of clay and turtle fat reputedly repels insects. Some women paint themselves and their spouses every day; newlyweds approach the task with special care and fondness.

Such customs of the past endure, while the practices of the present inevitably insinuate themselves into Onge culture. Face freshly daubed, a woman (**below**) cooks chapaties—Indian unleavened bread—on a skillet. A cigarette is tucked above her ear. No need for newcomers to introduce the Onges to smoking, though. For thousands of years their ancestors had puffed on aromatic leaves, tamped into pipes made from crab claws.

miles through the jungle, emerging in a coconut grove at dusk with the sound of surf and rustling palm fronds in my ears.

I slept in the ramshackle wooden hut of the Indian social worker, Vasant Chowdhary, who had spent four years with the Onges and could mix a few Onge words with his Hindi. The next day he showed me about the camp.

Beside the well, the camp's only supply of drinking water, two Onge women squatted, washing clothing. One man repaired the matting roof of his hut. Another worked on his canoe, singing a monotonous chant about how he had cut a tree at the forest edge and fashioned a dugout. Two Onges fished near shore with bows and arrows. A boy of about seven, who followed them, managed to shoot a fish and proudly brought it into camp.

Visiting the thatched huts, I saw women applying ocher paste in graceful patterns to their husbands' faces as the couples sat on their tiny wooden cots. The paste is not only decorative, I learned, but a repellent against flies and other insects as well.

The men wore loincloths or shorts, and the women a belt with a large tassel in front. I saw a woman fashioning a tassel from palm fiber; others were preparing tea, the favorite drink, or smoking pipes fashioned from crab claws. The Onges are heavy smokers.

Forest Produce Serves as Money

Other than traditional bows and arrows, adzes, digging sticks, and woven baskets, the Onges have few possessions: flashlights, enameled mugs and plates, cooking pots, and the plastic or galvanized buckets that have replaced the containers they formerly hollowed out of logs. Whereas the Jarawas still live entirely off the forest and the sea, some Onges now barter. They take coconuts, and the resin and honey they gather in the forest, to the cooperative store in Hut Bay, where I had arrived by ship. There, under government supervision, they trade these for wheat flour, tea, tobacco, and the airline bags and umbrellas that they fancy. Still, it struck me as incongruous, in a hut festooned with the jawbones of pigs, to find a bed pole hung with a sporty hat!

The largest hut at Dugong Creek, a rectangular thatched dwelling about 40 feet by 20 and open on one side, housed several elderly couples and widows. Smoke from a cooking fire filled it; a turtle boiled in a pot. Some of the aged were busy fashioning rope

With eyes forest-keen, an Onge youth, on a hunt for wild pig, spots a bee colony high in a tree (**facing page**). Once such finds of honey triggered a spree of feasting, according to Italian anthropologist Lidio Cipriani, who spent more than five months among the Onges in the 1950's. "I have seen a group of about sixty Onges demolish in a few days ten pigs and a dozen large, wooden vessels full of honey, with basket after basket of fish. . . ."

For a visit to the store in Hut Bay settlement, a man gathers coconuts (**above**) to be bartered for food and notions.

from strips of bark while children played underfoot. Elder members of Onge groups live separately and look after the children.

Learning that some of the Onges were away in a temporary camp in the forest, I asked Raju, the dugout builder, to guide me to it. After walking twenty minutes along the beach, he suddenly turned off on a footpath. Pausing in the forest, he cooed. "Coo" came the reply. Back and forth Raju and the unseen Onge echoed each other.

We broke into a small clearing. Eight leantos were built in a circle. The Onges were preparing for a day of digging edible roots and tubers, and collecting fruits, mollusks, crayfish, and sometimes turtle eggs. Andaman Negritos never developed agriculture. One man sat on the ground sharpening his *dah* (big knife). Two women were making chapaties, the Indian unleavened bread. One couple sat on the tiny platform under their slanting thatched roof, the wife shaving the forehead and sides of her husband's head with a razor blade. There were no walls; communal life allows little privacy.

"Babulai," they said when they saw me—"outsider." But their expressions signaled welcome. One Onge pointed at my spectacles and said, *"enabotay kala kala."* Chowdhary told me it meant "the circular things on the

eyes." A pack of dogs milled about, growling and whining. Onges are seldom without their pets. Sometimes the animals sleep on the tiny cots with their masters.

Wild-pig Hunt Proves a Yelping Success

The dog was introduced to Little Andaman at the turn of the century, causing a sudden increase in wild-pig bones in kitchen middens, those refuse heaps so meaningful to anthropologists. Why the Onges prize their dogs became clear to me when I joined bachelors Kokalai and Borugegi on a hunt.

With five mongrels yelping behind them and one on a leash leading the way, they kept a fast pace through the forest. The dogs darted left, right, forward, and circled. We were sweating from the exertion and heat, the dogs gasping for breath, their tongues dripping. Then the dogs gave a frantic yelp and darted off. Behind them, like quicksilver, ran Kokalai, spear poised. As Borugegi and I neared the yelping dogs, I heard a wild pig screaming. The dogs had cornered it, and Kokalai soon speared it.

Amid clouds of flies, the hunters cleaned the pig, giving the entrails to the dogs, which crowded round. Then we slowly headed back, Kokalai laden with our prize.

Silk-cotton trees and other forest giants towered like the columns of a forgotten Gothic cathedral that now appeared sinister with age. Only occasional shafts of light penetrated to the rocks covered with slime. The mass of tangled foliage seemed frightening, surrealistic, as if created by some malevolent force. Twisted stems of the sword bean zigzagged before my eyes. Fallen, rotting tree trunks littered the path, crumbling underfoot. Vines, roots, and furrows where pigs had rooted for tubers set traps for the unwary. Monitor lizards rustled through the dead leaves.

Pigeons cooed unseen a hundred feet overhead. Once Kokalai stopped and mimicked one, and the bird replied. Another time Borugegi stopped in his tracks and pointed up into the foliage of a mighty tree. Kokalai was immediately at his side, looking up, and his eyes gleamed too.

I followed their gaze upward, but it seemed minutes before I spotted the bee colony some fifty feet above us. The honey-collecting season had not started, but the young men would remember the spot and return. To get the honey and avoid stings, they would chew *tonjoghe* leaves, supposedly narcotic, and blow their moist breath over the hives, drugging the bees. As further protection, they would smear their bodies with a paste made of the chewed leaves.

Back at the camp, Kokalai and Borugegi singed the pig, then boiled it. When the feast was ready, all the Onges dipped chapaties

On the move in the dry season, Onges roam from place to place in search of food, living in temporary camps. At South Bay (**left**), couples carry poles and palm fronds, building materials for the *kordle*, a lean-to that serves as their home on the trail.

Before the day's hunt, Onges relax in a camp near South Bay (**left**). A wife grooms her husband's hair (**below**) with a razor blade, probably a visitor's gift or a lucky find. A few years ago she would have used shards of glass from bottles cast up on the beach. A boy brushes his teeth with charcoal paste (**bottom**), a rare practice introduced by an Indian social worker; most of the tribe shuns the habit.

Onge hunters wear virtually no clothes in the sweltering forest. When they visit the settlements, they often wear trousers and shirts. These the Onges wash, but they never bathe themselves, at least on purpose. Rain, the sea, and island streams take care of that.

The sea their larder, the Onges pole slender outriggers through coastal shallows of Little Andaman at dusk. Fish are impaled by arrows, while turtles and an occasional dugong are only a harpoon's throw away. Wild pigs in the forest, fruits ripe for the taking, and roots that yield to a digging stick fill out their diet.

A boy (**left**) watches his father nail an outrigger boom to a dugout with a metal adz. Their ancestors used adzes of clamshells.

into the common pot, helping themselves to portions of the pig. According to custom the prized portion, the head, went to the hunters.

Though wild pig is often caught, the dugong, the prized aquatic mammal after which Dugong Creek was named, is hard to find these days. And turtle hunters often return empty-handed. I learned this firsthand among the Onges of South Bay, at the other end of the island.

I had fallen in with several Onges carrying matting and dragging nipa-palm fronds to build temporary shelters. We walked along the shore, a belt of sand lined with deep thickets behind which dense jungle rose high. Through a hole in a thicket we entered a clearing. Several Onges were already there.

I brought out gifts of tea, tobacco, and wheat flour, which pleased them. Then they turned back to their work, completing their shelters and cutting firewood. Huge crabs boiled over two fires.

As dusk fell with the swiftness of the tropics, I watched the men fashion cones of rolled palm fronds. Into these they poured lumps of resin, then embers from the fires. Soon their torches were crackling. They tied these to the outriggers of three dugouts and set out to hunt turtles. I joined them.

For hours we poled about the shallows inside the reef that surrounds Little Andaman, three puddles of light glistening on the dark back of the sea. Occasionally a wave would toss one of the canoes, making a spectacular sight as the torch scribed a flaming arc on the face of the dark. We sought turtles coming in from sea at night to lay their eggs in the sand, though it was still early in the season.

Seeking a Bridge Across a Cultural Gulf

My boatman, well built and lithe, stood in the prow poling with a long harpoon. A bark rope attached to the harpoon fell over his shoulders into a coil at the bottom of the boat. Watching him in the soft glow of the torch, I pondered on how little I knew him.

How much had his supernatural beliefs been challenged by the growing settlement of the island? Did he still believe that the universe was a multilayered structure with Little Andaman as center, with benevolent and harmful spirits inhabiting different layers? Alas, I was unable to ask.

It was now past midnight, and we had no luck with the turtles. The hunters took me to a round hut, a large beehive of thatch that during the rainy season served as a communal dwelling and was now empty. Tiny wooden cots lined the walls around a central hearth with a hole above it in the roof for the smoke to escape. There I slept uncomfortably with a log for a pillow. I had a four-by-two-foot wooden cot all to myself, whereas Onge couples share a cot, their legs bent and crossed over each other. In fact, they also share that tiny space with children and dogs.

Ticks, Flies, Fleas, and Mosquitoes

In the morning I discovered ticks all over me. By the time I had pulled them off, I counted 45. Leeches I was spared, since they are common only during the rainy season. But I suffered the bites of sand flies on the beaches and fleas in Onge camps. And I hardly needed the statistical confirmation an entomologist gave me that, between five and six in the evening, mosquitoes attack at the rate of 300 an hour.

Fortunately the Onges are relatively immune to malaria. But they are plagued by microfilariasis, goiters, bronchitis, and hookworm, as well as ringworm and other skin diseases. Not that they don't receive medical advice. I myself listened to a government health inspector from Port Blair give a talk in English to six Onges at Hut Bay.

"Your bodies are just like vehicles. Only the doctor can look after the inner parts, but the outer parts you can look after yourself, just as we wash the vehicle, keeping it clean and fit for the road," he said, with Chowdhary translating in his Hindi-Onge mix.

"This vehicle goes in the dark. But how can you know where it is going? It is fitted with two lights in front so you are able to see the road. In the same way, your body is fitted with two eyes so you can see the whole world clearly. Therefore, it is most important that you look after your eyes and protect them. They are the light of the body. Now, your eyes are prone to many diseases. . . . If you have any trouble with your eyes, the first thing is to go to a doctor."

The Onges grew apprehensive. Chowdhary calmed them with, "No injections will be given today, so don't worry. Sit down."

"Next are your ears," the health inspector continued. "With these you hear so many sounds. Cover your two ears and you don't hear anything. Therefore you must see that they are always clean. . . ."

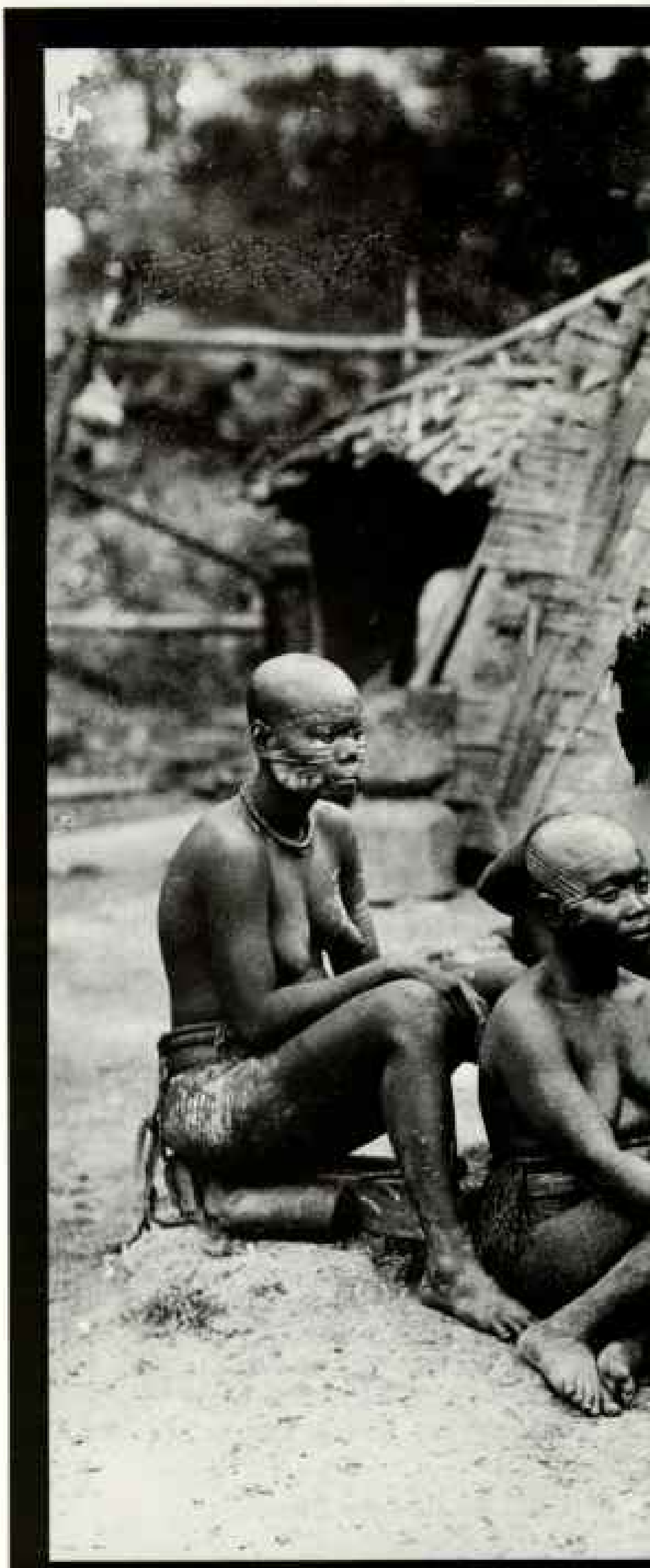
Later asked what he had understood of the

talk, an Onge replied, "He was talking about the needle [injection] and cleaning the ears."

Plagued with infertility and high child mortality, the Onges are declining in numbers. Less nomadic, increasingly dependent, they apathetically see their domain dwindling in the face of accelerated settlement, leaving the survival of their culture in doubt.

Sadder still is the fate of the Great Andamanese, the leading tribal group in the archipelago before the establishment of the penal settlement at Port Blair. In 1859 they attacked the settlement in a desperate bid to force out the invaders. In the unequal battle of bows and arrows against rifles and cannon they were defeated. Soon zealous administrators set about "civilizing" the natives. The Great Andamanese left their jungle homes, adopted clothes, and ate strange foods.

Clearing the forests helped spread malaria.



For generations beyond count, the Great Andamanese thrived on their home islands. When the British established a penal colony at Port Blair in 1858, these Negritos totaled thousands.

Contact with the newcomers brought syphilis, measles, opium addiction, alcoholism. By the 1890's the Great Andamanese had decreased to fewer than 2,000. With sad and empty eyes, they smoked the foreigners' pipes but still wore ocher body decorations (**right**). Today a mere 24, all of mixed blood, survive. Guided by their patriarch Loca (**above**), they live out the final notes in the funeral dirge of a once-proud tribe.

The newcomers' measles, syphilis, and ophthalmia took dreadful tolls—swiftly cutting the 4,000 Great Andamanese by half, crippling and blinding survivors. Of 150 births recorded between 1864 and 1870, no baby lived beyond two years.

Great Andamanese were given opium, tobacco, and liquor in reward for catching escaped convicts and for participating in punitive raids against the Jarawas, who still held out in the forest. By World War II Great Andamanese numbers were down to 45.

Today there are 24, all of mixed blood: Negrito, Burmese, and Indian. By Forest Department boat I visited Strait Island, where they live. Next to a kitchen midden —a centuries-old heap of shells and bones left by their ancestors—were opensided concrete sheds built by the Public Works Department for them to live in. They ignored them,

BOURNE AND SHEPHERD, CALCUTTA

They likely came by sea, but when, and whence, one can only surmise. Perhaps north from Sumatra, or south from Burma, at least five thousand years ago. They may have come by outrigger canoe, a craft still used by the Onges for offshore fishing.

Squatting on the prow of his outrigger (**right**), an Onge rides a breaking wave. He propels his boat with a long harpoon, standing on a platform jutting from the bow. Unable to shed the old, uneasy with the new, his amiable people live in a cultural no-man's-land. For the Sentinelese and most Jarawas, however, the customs and ancient traditions still endure, protected by a shield of hostility.

preferring their own thatched huts. A garden in the clearing stood untended.

"The Great Andamanese never work in the garden," a social worker told me. "They wait for the government to send someone." And they no longer sing and dance.

Hasty Changes Could Destroy Two Tribes

With the object lesson of the Great Andamanese before them, and the Onges losing their viability, officials have reason to be concerned about the future of the Jarawas and Sentinelese.

"Anxiety on our part to rush the pace with these people will only expose them to our diseases and destroy them," the Chief Commissioner of the Andaman and Nicobar Islands, Har Mander Singh, told me in Port Blair.

I thought of that remark as another arrow sped toward our launch from the shore of North Sentinel Island. We ducked, and it splashed down and bobbed in the water behind us. This arrow, unlike the one that had wounded the cameraman in the thigh the day before, was triple-pronged and barbed with bone. But its message was the same: hostility.

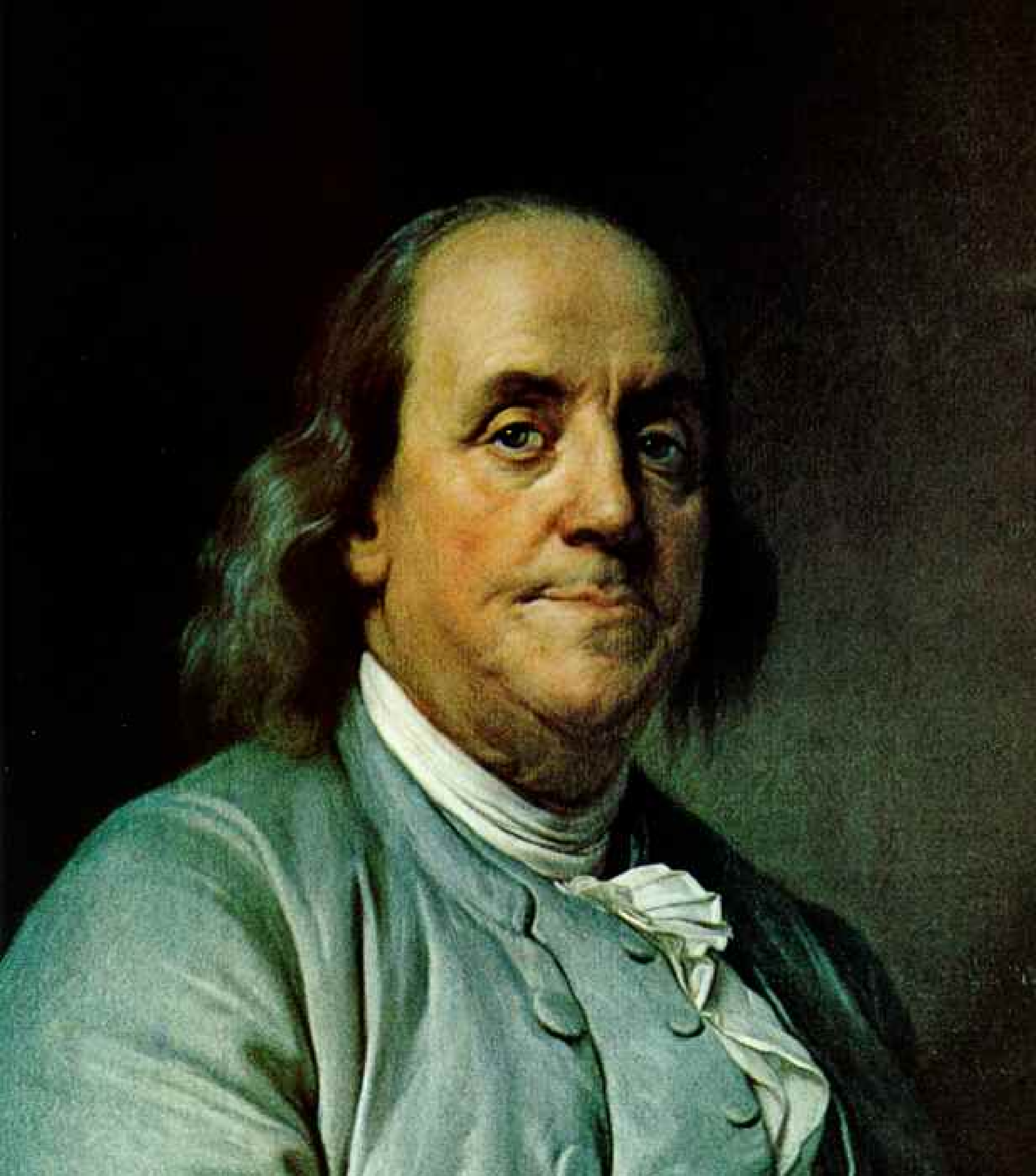
Time and again during our two days along the island's coast, we put in to drop gifts. We

got close enough to observe Sentinelese ripping away coconut husks with their teeth, spearing a doll we had left, and carrying off other gifts. But at no time did we succeed in making friendly contact.

Our presence, however, brought groups on the island together. We sighted a band of armed Sentinelese, a score or more, moving along the coast toward us. Then another large armed group emerged from the jungle and joined them. Through field glasses we saw them embrace for minutes, one man sitting in another's lap. We were witnessing a ritualized greeting common among Negritos after a long separation. This suggested that the able-bodied Sentinelese males had assembled to meet the outside threat to their island, their people, their age-old way of life.

To the Sentinelese, hostility spells survival. If they are right, what will become of the Jarawas, whom I had seen abandon hostility in a joyous orgy of receiving gifts?

At dawn as I flew out of Port Blair to Calcutta, I gazed down at the somber Andaman forest. Like a montage in a movie, the joyous faces of the Jarawas seemed to dissolve into those of the sad Onges and the fading Great Andamanese. □



PHILOSOPHER of DISSENT

Benj. Franklin

BY ALICE J. HALL
NATIONAL GEOGRAPHIC STAFF

PHOTOGRAPHS by LINDA BARTLETT

"THE GREAT FOMENTER of the opposition in America," Lord North had branded him.

"A factious, turbulent fellow . . . enemy to the King's service," the Earl of Hillsborough complained.

The insults of the British establishment burned in the old man's brain as he packed his belongings at his London flat in March 1775. He had lived for 15 years here in the heart of the empire, promoting American rights within the British system. Now friends urged him to retire. Perhaps the Crown would grant a pension, just to buy his silence.

Instead, with a buoyancy belying his 69 years, he boarded a Philadelphia packet and sailed to America, there to join the Revolutionaries he had encouraged from afar. Later, George III would call him the evil genius behind the Revolution.

Anyone surprised at Benjamin Franklin's dissent hadn't been paying attention for the previous fifty years. His very rise from rags to riches had challenged the conventional belief that pedigree determined destiny. Always fighting the forces of privilege, he had pointed the way for common people—on their own—to achieve lives of liberty and happiness, before those ideals were spoken aloud in the Declaration of Independence.

This I learned, and more, as I searched for Franklin's spirit in Boston, Philadelphia, London, and Paris. Each city marked a chapter in the ever-expanding career of this supremely versatile and modern Founding Father.

Franklin was essentially an urban man, never hankering for the manor or the plow. It seems fitting that the Colonies' major seaport —the city destined to be the cradle of the Rebellion—was his own nursery.

Northeasters still hurtle down on Boston as they did on that blustery Sunday, January 17, 1706, when a small frame house on narrow Milk Street throbbed with the excitement of his birth.

In sturdy boots and wool scarf wound high, I trudged across the snowbound Common to stand at the site, now occupied by a 19th-century industrial building. Here a midwife brought the boy squalling into a loving home already crowded with a dozen brothers and sisters, and into the exhilarating world of Boston. The city of 8,000 was just then unlacing the somber vest of its Puritan heritage

"He snatched the lightning from the heavens and the scepter from tyrants." Thus a French statesman lauded his friend Benjamin Franklin, eldest of our Founding Fathers. Native genius elevated him from obscure poverty in Boston and business success as a Philadelphia printer to world renown as scientist, colonial agent in Britain, and envoy to France. PAINTING BY JOSEPH-SIFFRED DUPLESSIS, PRIVATE COLLECTION

Propelled by ambition, Benjamin at 17 ran away from Boston in 1723, but only after he had mastered the printer's trade and read more books than most adults. When he arrived in Philadelphia—an event commemorated by this statue at the University of Pennsylvania—he was virtually penniless. His intelligent conversation impressed the governor, who offered to set him up in business, then reneged after sending the boy on a buying trip to London. There Franklin found work as a printer, improving his skills—and his judgment of human nature. Back in Philadelphia, he married and began his own business and his rise to fame.

and bursting its seams with maritime wealth.

Franklin's father, Josiah, a respected tallow chandler, had emigrated from Ecton, England, to follow the nonconformist beliefs of the Congregationalists; his mother, Abiah, was a Folger from Nantucket. Now they dreamed of dedicating the tenth and last son to the ministry. Josiah immediately bundled the baby across the street to the cedar meetinghouse of Old South to be baptized.

Old South now draws tourists for its ties with the Revolution, not with the Franklins. But the visitor, resting on the hard wooden pews and leafing through a Bay Psalm Book, can picture young Benjamin sitting ramrod straight through three-hour exhortations to godliness, good works, and self-reliance.

Franklin drank deep of the Protestant ethic and then, discomforted by church constraints, became a freethinker. All his life he kept Sundays free for reading, but would visit any church to hear a great speaker, no doubt recognizing a talent he himself did not possess.

With typical honesty and humor he wrote out his creed in 1790, the year he died:

"I believe in one God, Creator of the universe. . . . That the most acceptable service we render Him is doing good to His other children. . . . As to Jesus . . . I have . . . some doubts as to his divinity; though it is a question I do not dogmatize upon, having never studied it, and think it needless to busy myself with it now, when I expect soon an opportunity of knowing the truth with less trouble."

TO KNOW THE TRUTH—that yearning always stirred in Benjamin's mind. "I do not remember when I could not read," he wrote. At age 8 he entered Boston's one-room grammar school, reaching the head of his class with no prompting from the cane. He devoured history and Latin.

"The classics nurture dissent, you know." Gentle, white-haired headmaster Wilfred O'Leary was explaining to me the principles that guide 340-year-old Boston Latin School, the city's most prestigious public school and the descendant of Franklin's alma mater.

"All great leaders have been great dissenters," he continued. "Not the rock-throwing kind, but responsible opponents of injustice.

"Our 2,100 boys and girls take entrance exams and arrive by way of talent, not family name or wealth. Their meeting ground is ambition—the very stuff Franklin was made of."

We ducked into a spartan-plain classroom

where a seventh grader was describing Franklin. "You had to work for what you wanted in those days, and not wait for others to give it to you."

"Franklin invented things he needed," another scholar affirmed, impressed by Franklin's stove, bifocals, and lightning rod. "Most inventions today are just for entertainment."

Education began to look like entertainment to Josiah Franklin, who realized he could not afford to send his son on to Harvard College. Ben dropped out of school. But he dropped into a lifelong avocation—self-education.

In his father's library the youngster sailed on mind-expanding voyages with Plutarch, Defoe, and Bunyan. Imitating Socrates, he "put on the humble Enquirer and Doubter" role, shunning even the "Air of Positiveness to an Opinion." Thus he avoided arguments and gained a hearing for his ideas.

> To cease to think is but little different from ceasing to be.*

Using the *Spectator*, a London paper famous for satire, he taught himself to write. After taking notes on an essay, he set them aside; later he would try to write the piece from memory, correcting it against the original. Eventually, he credited prose writing as "a principal Means of my Advancement."

For a while Benjamin helped his father as a tallow chandler. Ben boiled the noxious animal fat, skimmed, mixed, and dipped, turning out candles for the town watch, and fragrant green cakes of soap. And he hated it all. The salt air filled his lungs, and with the gulls his spirit took flight; he longed to go to sea.

Finally, at 12 years of age, Benjamin pledged himself to an apprenticeship, the most common schooling in colonial America. His master was his overbearing 21-year-old brother, James. The occupation—printing—would win him a basic freedom: economic independence.

To learn about his tasks, I signed on as a printer's devil at a demonstration print shop at the Smithsonian Institution's Museum of History and Technology near my office in Washington, D. C. "I always wanted to be a printer," said graphic-arts specialist Stan Nelson (page 99), "and Franklin is still my hero."

From a typecase resembling a giant egg

*Franklin at 19 wrote this line in his first published pamphlet; other inset quotations come from his letters, speeches, articles, and *Poor Richard's Almanack*.

Rattling the Boston establishment, Ben had helped his brother James begin a crusading weekly newspaper, the *New-England Courant*, in 1721. Benjamin wrote lively satires under the byline Silence Dogood. These and other articles tweaked the town's leading minister, Cotton Mather, and ridiculed the government. Mather called the Franklins "the Hell-Fire Club," and James spent a few weeks in jail. To earn extra money, Benjamin wrote and hawked ballads through the streets of Boston. Here, near the Common, science student Tom Smith helps finance his education by selling two of Boston's younger newspapers.

An East Perspective View of the CITY of PHILADELPH

1. Christ Church *3. Academy* *5. Dutch Calvinist Church*
2. State House *4. Presbyterian Church* *6. The Court House*

Engraved from the Original Drawing sent over from Philadelphia in the possession of Carrington Bowles.

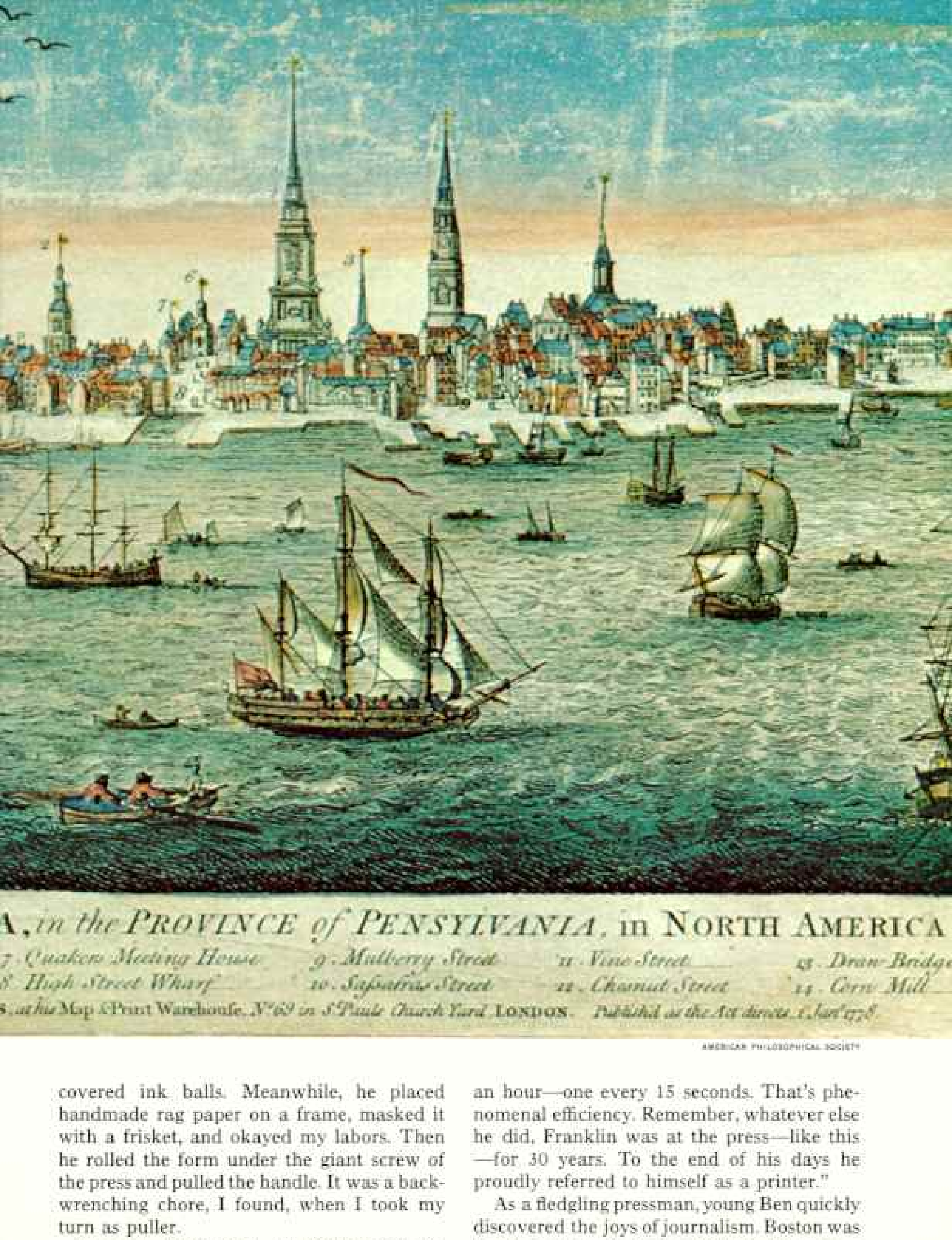
Printed for and Sold by CARINGTON BO

"**City nearest the Centre**" of the Colonies: Thus Franklin promoted Philadelphia, and it became the meeting place for nation makers. The metropolis along the Delaware River owed much of its development to this adopted son. He helped to light, pave, and patrol its streets; to win its selection as a general post office; to found its academy and philosophical society; and to build its churches and Pennsylvania's first synagogue.

carton, I was soon picking tiny metal letters to set on a composing stick as Stan dictated, "Early to bed and early to rise." A nick at the bottom of each slug permitted me to drop it in place right side up without looking.

We locked up the type on the bed of a restored wooden handpress and Stan asked, "Do you want to be puller or beater?"

We flipped a coin, and I lost. As puller, Stan was able to keep his hands clean, while I pounded black goo onto the type with leather-



covered ink balls. Meanwhile, he placed handmade rag paper on a frame, masked it with a frisket, and okayed my labors. Then he rolled the form under the giant screw of the press and pulled the handle. It was a back-wrenching chore, I found, when I took my turn as puller.

"It takes two people, coordinating 13 distinct movements, to get a single impression of type on paper," Stan explained. "Yet colonial printers could produce as many as 240 sheets an hour—one every 15 seconds. That's phenomenal efficiency. Remember, whatever else he did, Franklin was at the press—like this—for 30 years. To the end of his days he proudly referred to himself as a printer."

As a fledgling pressman, young Ben quickly discovered the joys of journalism. Boston was a two-newspaper town when brother James founded the *New-England Courant* as an irreverent opposition weekly. Ben wrote social commentaries under the pseudonym Silence

Dogood, a country widow who was "a Friend to Vertue. . . . a mortal Enemy to arbitrary Government and unlimited Power."

In this disguise, Benjamin spoofed Harvard, attacked religious hypocrisy, promoted education for women, and even discussed the economic impact of streetwalkers on the cobblers' trade. His essays outraged the establishment, but they made the *Courant* Boston's most talked-about paper.

Silence's success prompted Franklin in later years to speak through a host of satirical characters: Polly Baker, defending her right to bear illegitimate children; the King of Prussia, claiming England because of early German settlements there; Poor Richard, serving "scraps from the table of wisdom."

At 17, chafing under his brother's buffetings, Benjamin also realized he was infamous as "a young Genius that had a Turn for Libelling and Satyr." He made the first of the pragmatic decisions that characterized his life. He ran away to start anew.

He ended up—broke, jobless, and dirty—in Philadelphia, a small settlement scarcely older than he was.

Keep thy shop,
and thy shop
will keep thee.

"If Franklin pulled in like that today, they'd throw him in the pokey," a Philadelphia cabbie said as we rode from the Delaware River waterfront, where Ben landed in 1723, to the American Philosophical Society, which he helped found 20 years later.

"The City of Brotherly Love was slightly more tolerant then," said Whitfield Bell, librarian of the APS. "William Penn, the colony's Quaker founder, offered freedom of conscience, separation of church and state, and 'laws of your own making.' The credo attracted dissidents of every stripe. English Quakers were followed by Scotch-Irish Presbyterians, French Huguenots, Irish Catholics, and Germans of various sects. They made Philadelphia what America was to become—an amalgam that no businessman or promoter could ignore. Franklin succeeded because he sized up this situation quickly. He built up a business by printing everything from hymnals and antislavery tracts to handbills for slave auctions."

In September 1730 Franklin entered a common-law marriage with longtime friend Deborah Read, whose first husband had disappeared without benefit of divorce. She was a hardworking, amiable young woman. "We throve together," a contented Franklin wrote, "and have ever mutually endeavour'd to make each other happy."

The year he married, Franklin found himself father of an illegitimate son, William; the mother's name has never been discovered. Without a blush, he and Deborah raised the boy with their own daughter, Sally. Another son died of smallpox in childhood.

Early on, the young printer brought together "ingenious Acquaintance into a Club for mutual Improvement," called the Junto. With "leather-apron men" like himself, Franklin met at a tavern on Friday nights to mix moderate drinking with heavy thinking. What does our community need most? Which of our friends is in trouble? They answered with advice, loans, business, ideas.

Once a project was chosen, Franklin's tactics implemented it. First, discuss and refine the idea. Write it down; improve it. Publish an article about it in Franklin's *Pennsylvania Gazette* to test public opinion. Gather signatures; petition the assembly for action.

With such methods Franklin and his friends attacked urban problems so successfully that institutions they founded thrive today.

Medical care then was abysmal. The patient with money called a practitioner to the home while the penniless stumbled to the poorhouse. With the construction of the Pennsylvania Hospital, America could boast its first medical center, open to all. To launch it, Franklin inaugurated the idea of matching funds. When subscribers promised 2,000 pounds, the Pennsylvania Assembly was pressured into donating a like amount.

Poor people had little chance for an education apart from church schools. So Franklin and his friends began a public academy to give needy boys a practical education. It evolved into the University of Pennsylvania.

Since books were expensive commodities

"Foundation of my fortune," Franklin proclaimed the printing press; in London he used this one, now displayed at the Smithsonian Institution. Although the bulk of his trade was printing business forms, he kept his press busy by launching a weekly four-page newspaper and *Poor Richard's Almanack*, soon America's most popular annual paperback.

Weapons against fire: hand pumpers became common in Philadelphia after Franklin brought "order and method" to the wild confusion surrounding conflagrations. His Union Fire Company was the city's first brigade of volunteers.

MODEL OF A 1743 NEW YORK ENGINE

PHILADELPHIA CONTRIBUTIONSHIP

Owner's name on a leather bucket assured its return when he threw it to passing fire fighters. Franklin's company brought such buckets to monthly meetings, where men practiced techniques; fines from absentees paid for new equipment.

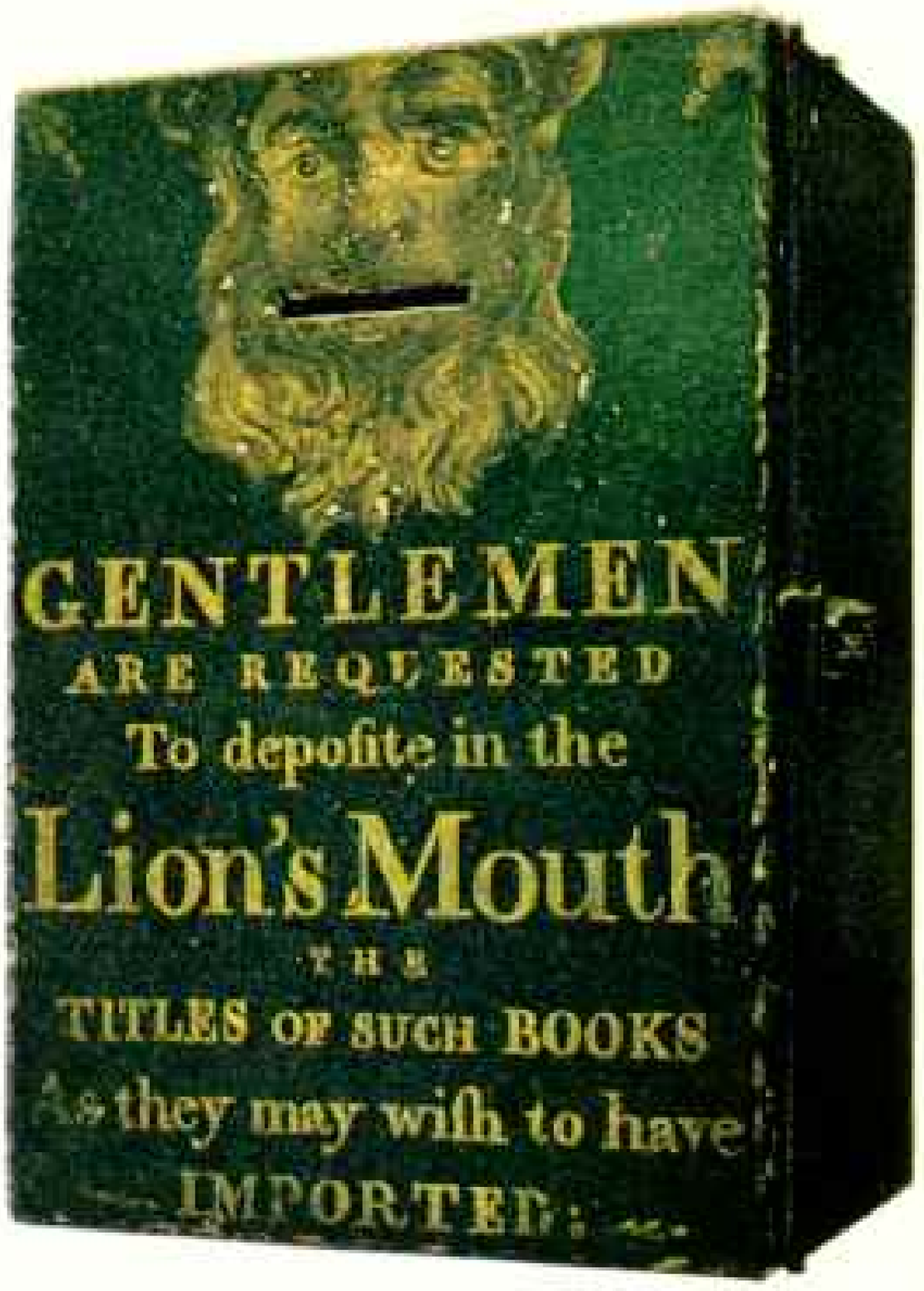
Interlocked hands on this fire mark identified a colonial home insured by the Philadelphia Contributionship, America's oldest fire insurance company. Promoted by Franklin in 1752, it flourishes still.

HSP CONTRIBUTION MUSEUM, PHILADELPHIA (ABOVE AND TOP)

HISTORICAL SOCIETY OF PENNSYLVANIA; LIBRARY COMPANY OF PHILADELPHIA (BELOW)

Franklin's front yard, the busy corner of Second and Market Streets proved a fitting stage for one "who must mix with the World." The up-and-coming printer occupied several home-shops just steps away from the Court House, left. His wife, Deborah, and their daughter, Sally, attended Anglican services at Christ Church, where chimes and steeple, center, were partly paid for by lotteries he managed.

Franklin's religion was pragmatism: Will it work? Will it make people happy? Never solitary, he worked through a widening circle of friends to make things happen. With the Junto, a club of like-minded men, he undertook his "first Project of a public Nature," the still-thriving Library Company. In this box (**right**) subscribers once requested any title they desired, an improvement over the restricted collections of church and college libraries. Franklin credited the burgeoning of public libraries with making tradesmen and farmers as intelligent as aristocrats elsewhere and giving impetus to the people's defense of their rights.



imported from London, few could afford to accumulate a library. The Junto began the Library Company, where subscribers pooled funds to build up a collection for common use.

"It's the same old hard-work story today," explained Rickey Bucciero, a carpenter on restoration projects, and a booster of "Little Italy." In such resurgent inner-city neighborhoods, "everything starts with an idea—like cleaning up vacant lots. Neighbors get together. Then someone has to take the initiative. It takes time to build up public opinion."

In free governments the rulers are the servants and the people their superiors and sovereigns.

Rickey knows a lot about Franklin, as he should. He is the best known of several Philadelphians who don colonial suits and tricorns to impersonate Franklin at city festivals.

I first met him on the January Saturday when Philadelphia—not Boston—celebrates Ben's birthday. Being Philadelphians, they do it with a contest. It's called "Go Fly a Kite."

Under soggy skies I watched a hundred bundled-up kite fliers on the expansive brick mall near Independence Hall. Chinese men were trying to loft bird-shaped silks that preferred to nest in bare-branched trees. Jewish boys watched their hand-lettered Hebrew slogans smear in the mist. Ten-year-old Richard Lipinski, Jr., flew the most appropriate kite, I thought. Over crossed sticks he had taped a page from the Philadelphia *Bulletin*. After all, Franklin's *Gazette* lofted him to fame and fortune. Richard won only a third prize.

Another contestant alluded to the famous electrical experiment that took place nearby. "If Ben had taken this much time to launch a kite, we'd still be in darkness."

Benjamin and his 21-year-old son undertook the test on a stormy summer day in 1752. They fixed a metal wire atop a silk-handkerchief kite and tied a key to the bottom of the string. Had a bolt of lightning struck the kite —as in popular illustrations of the scene— the jolt, traveling along the wet string, might have electrocuted them. Instead, electrical charges merely caused the key to dance and tingle, just as metal behaved in Franklin's other experiments with static electricity. Lightning and electricity were one.

The demonstration snatched lightning from the realm of superstition, lifting Franklin to fame as a scientist. Soon the world would know him as a supreme politician as well.

"THIS BUILDING must have seemed a second home to Franklin," remarked Martin Yoelson, chief historian at Independence Hall. "We can trace his 54-year career as a politician right here." We entered America's foremost shrine to stand in the airy Assembly Room, its tables arranged as if the Continental Congress might be seated momentarily (right).

"Independence Hall opened in 1735 as the State House," Marty explained, "and the next year Franklin began 15 years of service as

HISTORICAL SOCIETY OF PENNSYLVANIA

Setting for a politician on the rise, the Pennsylvania State House, now Independence Hall (**right**), saw Franklin appointed clerk of the assembly at 30. The post gave him "the Business of Printing the Votes, Laws, Paper Money, and other . . . Jobbs for the Public, that on the whole were very profitable." The 1747 Indian treaty on the table recalls his first diplomatic mission. He parleyed at the 1753 Carlisle conference with representatives of the Six Nations, whose scheme of union he openly admired.

To thwart counterfeiters, Franklin designed currency containing the prints of actual leaves (**left**), since he had observed that no two are alike. At 42, he took David Hall as his working partner and retired to a life of science and politics. Though loyal to King George II, he fought for the people's causes: military defense and tax relief.

ANNO REGNI
GEORGII III.
REGIS

PHILADELPHIA:
Printed and Sold by B. FRANKLIN, at the New
Printing-Office, near the Market. MDCCLXIII.

TREATY

PHILADELPHIA:
Printed and Sold by B. FRANKLIN, at the New
Printing-Office, near the Market. MDCCLXIII.

"This is the Age of Experiments," Franklin wrote—and made it so. During several of his eight transatlantic voyages, he measured the temperature and flow of the Gulf Stream and published the first scientific description of it in 1786. He hoped to improve navigation, but he saw potential evils in the transporting of slaves and useless luxuries.

clerk, sitting by the speaker's chair to record debates. The job gave him an advantage in obtaining the assembly's printing business. We'd probably call that conflict of interest.

"Franklin won his own seat in the assembly in 1751." Marty pointed to the Pennsylvania table. "As a member of the Second Continental Congress in 1775-76 and of the Constitutional Convention in 1787, he sat here urging his countrymen toward unity."

Franklin was the principal proponent of the radical idea, embraced in the Albany Plan of Union, that the Colonies should join for common defense against the French and Indians and for more power in petitioning the Crown.

Unimpressed in the 1750's, Pennsylvanians showed more concern with a peculiar tax problem. The colony's power brokers, heirs of William Penn, lived in London and refused to pay taxes on Pennsylvania properties. The cost of defense against the Indians was rising; someone had to negotiate a change. Who better to rattle the silver platters of privilege than Benjamin Franklin?

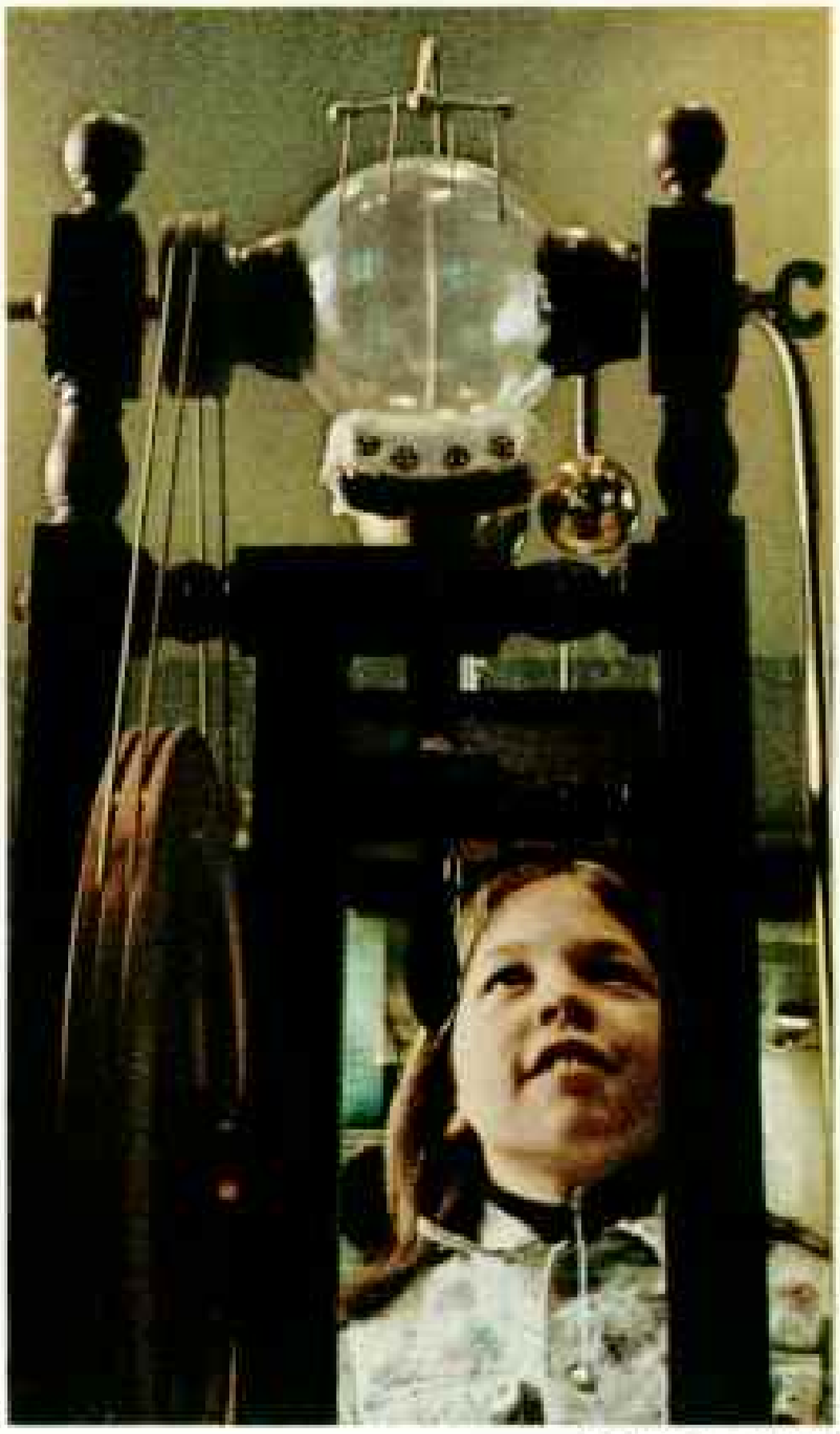
So the assembly directed him, a leading member, in 1757 "to go Home to England"—a notable phrase for the halcyon days when America and England were one, and Franklin could proudly boast, "I am a Briton."

London then counted nearly a million inhabitants, 50 times more than Philadelphia. Accompanying his father, William exulted over the "infinite Variety of new Objects; the continued Noise and Bustle in the Streets. . . . frequent Engagements amongst Politicians, Philosophers, and Men of Business."

IN SUMMER TWILIGHT, I pushed my way through London's crowded Trafalgar Square and turned into a deserted passage

"That charming science," Franklin called music. After he heard water glasses played in London, he had glass hemispheres blown and ground to produce 37 tones, and mounted in a case. Seated, he played the moistened revolving edges with his fingers. Mozart and Beethoven composed music for the armonica, for 40 years the rage in Europe.

PRIVATE COLLECTION



THE FRANKLIN INSTITUTE

"These new wonders": The scientist marveled at the hand-cranked machine that produced static electricity. Franklin himself named the charges positive and negative.

leading toward the Thames, Benjamin's words in hand: "I lodge in Craven Street near Charing Cross, Westminster; We have four Rooms furnished, and every thing about us pretty genteel."

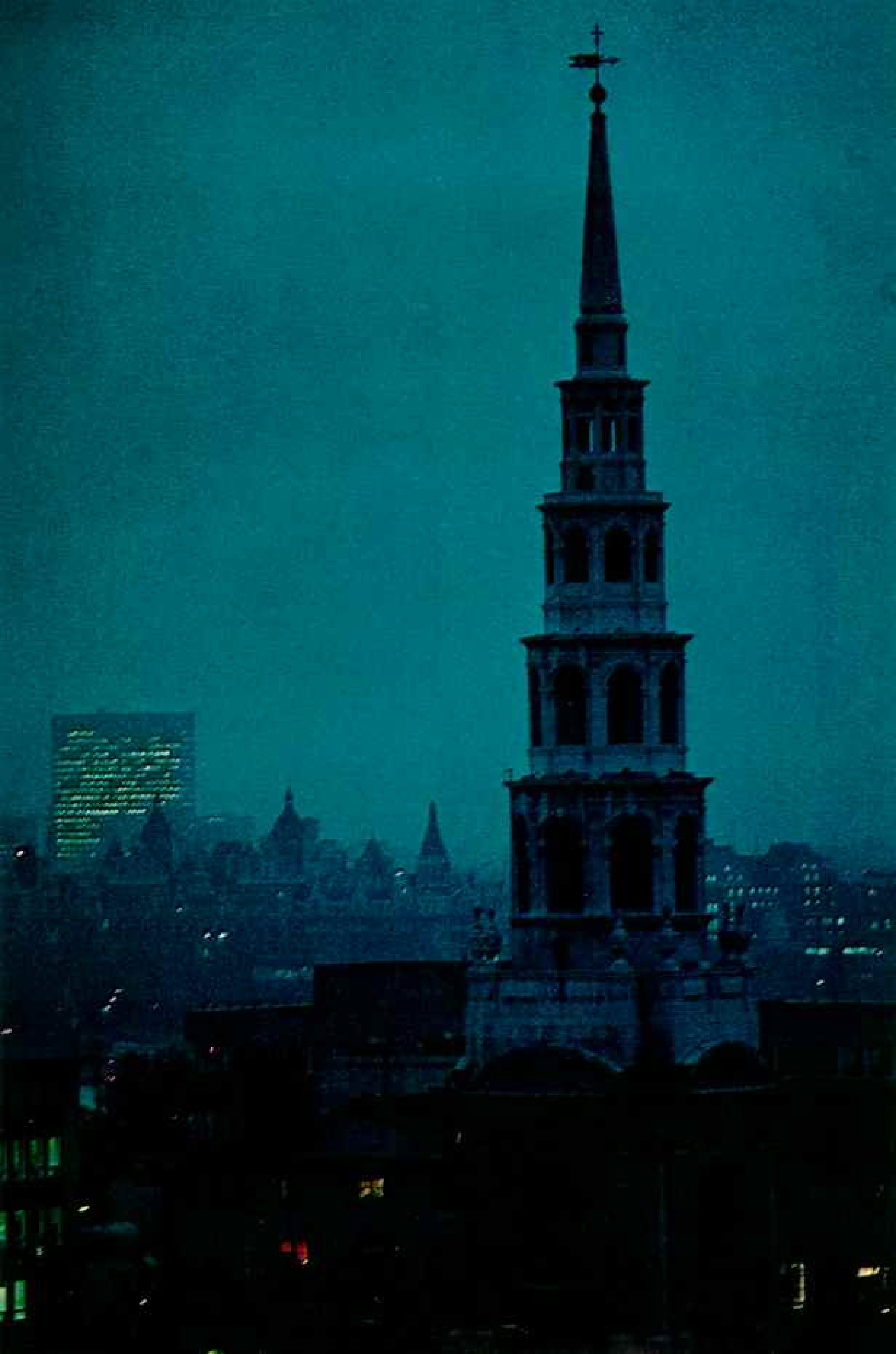
Nothing very genteel about the down-at-the-doorstep Georgian brick town houses that now shelter small, earnest international organizations and transients. I paused before No. 36, the only Franklin dwelling that survives anywhere. And just barely. Damaged during World War II bombing raids, the rehabilitated building is divided into offices. The block's landlord, British Railways, understandably has no plans to turn No. 36 into a shrine to an American rebel.

As he did everywhere, Franklin made warm friends in London. His landlady, Margaret Stevenson, and her daughter, Polly, became "our family here." Still Benjamin missed his wife: "I have a thousand times wish'd you with me."

But Deborah refused to risk the imagined terrors of 30 days at sea, even when months of separation stretched into years. Meanwhile, she kept their account books, educated their daughter, entertained mutual friends, and circulated her husband's ideas. With gossipy letters, the couple bridged the miles, addressing each other as "My dear Child."

To her "dear Pappy," another nickname, Deborah sent barrels of American specialties: apples, cranberries, smoked beef, bacon, dried venison. Benjamin shipped home china from every English factory and silver salt ladles of the "newest, but ugliest, Fashion."

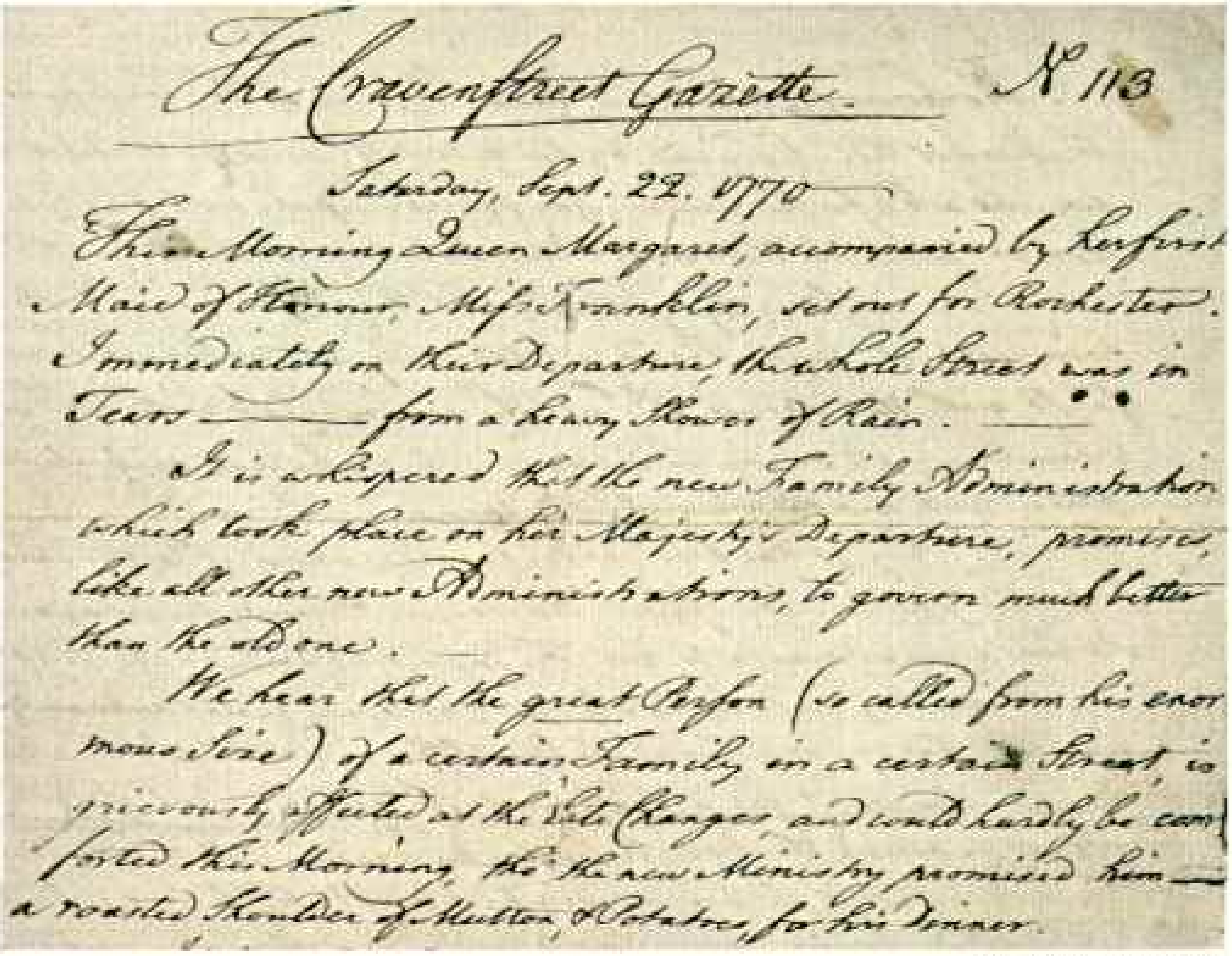
While awaiting appointments with the Penns, Franklin set about enlarging his circle of influential friends. He was admitted to the Royal Society. At the Society of Arts he



"**A Lover of Britain,**" Franklin signed one of his letters to the press in London, where he defended colonial interests within the empire for 15 years. He often met with friends at the George & Vulture, today a favorite pub of retired electrician Arthur A. Feaks (**right**).

Electricity entered English politics after lightning struck the steeple of St. Bride's (**left**) in 1764. The Royal Society later recommended protecting buildings with pointed rods of Franklin's design. During the Revolution, George III so abhorred using the discovery of a leading Rebel that he switched to blunt-knobbed conductors for his palace, thereafter a symbol of loyalism.

Always full of fun, Franklin wrote a parody (**below**) of London journalistic style and of himself as "the great Person." The queen was his landlady, Margaret Stevenson; Miss Franklin was an English cousin.



The Cravenstreet Gazette No 113

Saturday, Sept. 22. 1770

This Morning Queen Margaret, accompanied by her first Maid of Honour, Miss Franklin, set out for Rochester. Immediately on their Departure, the whole Street was in Tears —— from a heavy Shower of Rain. ——

It is whispered that the new Family Administration which took place on her Majesty's Departure, promises, like all other new Administrations, to govern much better than the old one. —

We hear that the great Person (so called from his enormous Size) of a certain Family in a certain Street, is grievously affected at the late Changes, and could hardly be comforted this Morning, tho' the new Ministry promised him — a roasted Shoulder of Mutton, & Potatoes, for his Dinner.

AMERICAN PHILOSOPHICAL SOCIETY

attended some fifty meetings, judging which artists and inventors should be encouraged with premiums. That society remembers him today by granting Franklin medals to those who promote Anglo-American relations.

Known as "the sage of Philadelphia," Franklin was a popular member of half a dozen men's clubs that met at different London public houses, or pubs. One of his favorites, the Monday Club, "that chearful, sensible and intelligent Society," gathered at the George & Vulture.

Today's patrons push through the antique glass doors and crowd upstairs to find an empty booth in the domain of Dolly, the unflappable waitress who wears a broad smile as badge of 25 years of friendly service.

"What's in the silver tankard?" a thirsty customer inquires.

"You can have anything you want in a silver tankard, luv, including me," Dolly replies.

The supplicant settles for a frothy porter, and leans back to pick up the latest word on North Sea oil deals and union power.

In the same convivial atmosphere, Franklin's coterie ate salt fish, drank brandy, and talked of electrical experiments and freedom of the press. By late 1759 the central topic was the winding down of a global war.

Leader of Commons William Pitt had coolly directed successful campaigns against France for mastery of the seas, the North American heartland, and India. Now some British negotiators were so anxious for "peace at any rate," that they spoke of turning Quebec back to France. Outraged, Franklin dipped his pen in irony. Yes, he wrote, we the victorious British, "should restore Canada, that we may *soon* have a new war, and another opportunity of spending two or three millions a year in America; there being great danger of our growing too rich. . . ."

> Those who would give up essential liberty, to purchase a little temporary safety, deserve neither liberty nor safety.

This was the bitterest of gibes, for the war had practically ruined the British economy, swelling the national debt. Franklin helped sway opinion, and Canada stayed British.

With the coronation of George III in 1761, which Benjamin and William attended, a new set of ministers came to power, determined to pay the bills. Country gentlemen were already heavily taxed on land, and all Englishmen paid a stamp tax on documents, but revenues still fell short. The solution: Tax the colonists. On paper, in a tidy government office in Westminster, the proposal must have looked so simple, so logical.

Franklin's thoughts were elsewhere. He had won a compromise after prolonged negotiations with the Penns. His son, with a law degree from the Middle Temple, received an impressive Crown appointment as Royal Governor of New Jersey. The proud father sailed home in 1762, forecasting a reign of prosperity and praising the "sensible, virtuous and elegant Minds" of the English people.

Within two years the assembly asked Franklin to return to London. Sadly, he accepted the call, leaving Deborah to oversee the completion of their new home on Market Street, today a vacant lot where the National Park Service is developing a memorial.

London was embroiled in controversy over the Stamp Act aimed at the colonists, and Franklin's attention turned to Parliament, regarded by the Colonies as "the great bulwark and security of their liberties."

HIGH ABOVE VICTORIA TOWER, the Union Jack caught my eye as it snapped in the windy sky, signaling "Parliament in session." I climbed narrow stairs to the visitors' balcony to watch the House of Commons in action. Scattered members of the majority party lounged on my left, the minority on my right. Front-bench men crossed their feet on the speaker's table where a woman Member of Parliament had left her purse; members consider this their home. In the balcony opposite, House reporters scribbled every word in shorthand and the words flowed nonstop from 2:30 p.m. until after 10. The accents ranged from the BBC precision of Oxford to the burr of Scotland to the lilting tones of Wales.

As I listened, a government spokesman fielded questions regarding restrictive policies against the white-minority governments of Rhodesia and South Africa. Across the aisle, Winston Spencer Churchill, grandson of Sir Winston, leaped to his feet: "Is the right honourable Gentleman aware. . . ?" He pleaded for 700 men in his constituency who would lose their jobs because their company sold locomotives in South Africa.

"Hear, Hear!" "SHAME!" "Sit down! HISSS!"

The debate was just as raucous in 1765,

when "the American problem" embroiled the House, and Franklin often watched from the Strangers' Gallery. Once Charles Townshend spoke with condescension about "these Americans, children planted by our care, nourished up by our indulgence."

"No!" cried Irish M.P. Col. Isaac Barré. "Your oppressions planted 'em in America. They fled from your tyranny." Colonel Barré coined the expression, "sons of liberty," and today towns in Vermont, Massachusetts, and Pennsylvania immortalize his name.

Such skirmishes set off Parliamentary warfare that lasted a decade and so divided the country that friendship or enmity toward America became "one of the distinctions of party," as Franklin noted.

In 1766 Franklin himself stood before the august body to speak against the Stamp Act. His appearance was stage-managed brilliantly by the great Edmund Burke and other pro-American activists. Questions were planted

The Original Print done in England on the back of a Message Card, the Invention and for the use of BENJAMIN FRANKLIN ESQ; LL.D. Agent for the Province of Pennsylvania in London.

LIBRARY COMPANY OF PHILADELPHIA (ARCHIVE) FRANCO-AMERICAN MUSEUM, ELEANCOURT, FRANCE

Master of propaganda, Franklin created several political cartoons. While in London he conceived a scene (**above**) "to show the Mischiefs of reducing the Colonies by Force of Arms." A lance from the severed leg, New England, points at the breast of Britannia, threatening the death of the empire. Brooms atop masts indicate ships for sale. Franklin employed a man to hand the cartoon to Members of Parliament before the Stamp Act debate in 1766.

To commemorate British surrender 15 years later, Franklin designed a medallion, executed by Augustin Dupré. France as Minerva fends the British lion from the cradle of Hercules—the infant United States.

among friendly M.P.'s to correct misconceptions about America.

QUESTION: "Was it an opinion in America before 1763, that the parliament had no right to lay taxes and duties there?"

Franklin's answer: "... a right to lay internal taxes was never supposed to be in parliament, as we are not represented there. ... The Colonies raised, paid and clothed, near 25,000 men during the last war ... they went deeply into debt in doing this. ..."

QUESTION: "Is there no means of obliging them to erase those resolutions [of Colonies against the Stamp Act]?"

ANSWER: "None that I know of; they will never do it unless compelled by force of arms."

QUESTION: "Is there a power on earth that can force them to erase them?"

ANSWER: "No power, how great soever, can force men to change their opinions."

By a vote of 275 to 167, after 11 hours of debate, on February 22, 1766, the Stamp Act died. But worse measures were aborning, as anti-American ministers ignored Franklin's advice and rammed bill after bill through Parliament to extract money—and submission—from America.

Irate assemblies in New Jersey, Georgia, and Massachusetts joined Pennsylvania in asking Franklin to be their agent. As the increasingly radical voice of America, he spoke out "by every Effort of Tongue and Pen." Even before Samuel Adams or Patrick Henry preached independence, Franklin realized that either "Parliament has a power to make *all laws* for us, or that it has a power to make *no laws* for us; and I think the arguments for the latter more numerous and weighty."

Looking at a map of North America, he wrote with foresight, "America, an immense Territory, favor'd by Nature ... must become a great Country, populous and mighty; and will ... be able to shake off any Shackles that

"The sweet air of Twyford," offered relief in 1771 from the political heat of London. At the home of Jonathan Shipley, Franklin began his autobiography in the garden study (**above, left**). Fondly, he recalled a visit with a cousin near his ancestral village of Ecton, where a girl dreams away a day (**right**). Franklin imported a squirrel from Philadelphia for Shipley's five young daughters. When it died, he wrote the epitaph: "Here Skugg lies snug as a bug in a rug."

may be impos'd on her, and perhaps place them on the Imposers."

Finally, to fuel the propaganda battle, Franklin precipitated the notorious affair of the Hutchinson letters. Lord North later complained, "These brought on the war."

Thomas Hutchinson, the Boston-born Royal Governor of Massachusetts, sincerely believed that America's best interests lay in continued association with Britain; after all, a worse European power might swallow up an independent America. Most of all, he believed in law and order. However, his private correspondence made him sound traitorous to Massachusetts, and when Franklin mysteriously obtained some letters, he immediately sent them on to the Boston Rebels.

Where complaining is a crime, hope becomes despair.

Their publication created a scandal. In retaliation, the King's Solicitor General, Alexander Wedderburn, attacked Franklin at a Privy Council meeting as a thief with a "new code of morality." Silent during this humiliation—the darkest moment of his career—Franklin later snarled at Wedderburn, "I will make your master a little king for this."

The Hutchinson affair made Franklin a hero in America, an abomination in Britain. But he decided to stay on in London, feeding information and advice to the Rebels. "Specify every oppressive act of Parliament," he told them. "Make a virtuous, firm and steady Resistance."

I walked beside the Thames thinking of those last months he spent in London. The Tower, in his day a jail for the mighty, loomed on the horizon. The government had collected information against him as a traitor, and he knew it. On March 20, 1775, Franklin, recently widowed, turned his back forever on Britain and sailed *home to America*.

Back in Philadelphia he must have felt reborn, entering upon a new career as midwife for a nation. Recognizing his genius, Congress placed him on several committees. He might well have been asked to write the Declaration of Independence but for a fresh stain on the family honor. Son William—still Royal Governor of New Jersey—had chosen to remain loyal to the Crown.*

There was no time for regrets, only time for new challenges, and Congress handed him the biggest one yet: Go to Paris to win French aid. The assignment would call for the skills of a provincial politician and the wisdom of a worldly philosopher.

SO THE 70-YEAR-OLD SAGE went a-courting to the land ruled by the passive, 22-year-old King Louis XVI and his 21-year-old auburn-haired queen, Marie Antoinette (page 116). Theirs was the "reign of youth," sighed an aging countess, a favorite of the previous court. "They think anyone over thirty is in his dotage."

Anyone, that is, but Franklin. Overnight, public opinion—a rising force in Paris—proclaimed him a premier celebrity. "Who is this old peasant who has such a noble air?" the crowds asked, and in the same breath replied: "The living symbol of liberty . . . chief of the American insurgents."

John Adams, who later joined the mission, admitted, "There was scarcely a peasant or a citizen . . . a lady's chambermaid or a scullion in a kitchen . . . who did not consider him as a friend to human kind."

Paris remembers him still. "For one thing, his name is easy to pronounce in our language: Fronk-lann," a Parisian history professor told me with a chuckle. "Unlike George Washington. More important, Franklin's simplicity evokes Rousseau; his wit matches Voltaire's. This along with his scientific achievements places him among our beloved *philosophes*."

Franklin had to transmute this nebulous personal acclaim into guns and butter for the American war. King Louis hesitated openly to aid a cause that might fail. But Franklin found an ally in France's brilliant foreign minister. The Count de Vergennes savored the prospect of humiliating England and at the same time trading freely with an independent America. Already he had worked out

*See "The Loyalists: Americans With a Difference," by Kent Britt, NATIONAL GEOGRAPHIC, April 1975.

"The agreeable and instructive Society" of Scotland impressed Franklin, who traveled there for "Six Weeks of the densest Happiness" in 1759. The University of St. Andrews—where students walk the pier after Sunday church—had awarded him an honorary degree for his inventions and experiments. Thereafter, friends called him "Doctor Franklin."

a plan with the financier-playwright Caron de Beaumarchais. Together they set up a dummy trading company to funnel supplies secretly to the Americans.

For such schemes, Franklin became the focal point. He made his headquarters in a mansion in Passy, "a neat village on a high ground, half a mile from Paris, with a large garden to walk in."

In his Passy office-home Franklin negotiated loans and received gifts from concerned Frenchmen. He commissioned privateers to prey on British ships, then served as judge for the disposition of captured goods. Like a protective father, he worried about American sailors held in English prisons and sought their exchange for captured British seamen. With John Paul Jones he plotted an abortive invasion of Scotland. He wrote letters home, which introduced von Steuben and Lafayette.

Some schemes ended before they began. But Beaumarchais's supplies reached Gen. Horatio Gates at Saratoga, and the Frenchman was with Franklin when a messenger arrived on December 4, 1777, with the astonishing news, "General Burgoyne and his whole army are prisoners of war!"

This military victory, as often happens in history, turned the diplomatic tide; Louis could back a winner. On March 20, 1778, the king received the Americans at Versailles.

Less than 30 minutes from Paris, a snappy red Renault delivered me to the gates at which my rebellious countrymen had arrived by carriage.

Curator Guy Kuraszewski welcomed me with torrents of information. "Versailles was designed for show," he began. "On Sundays

Brushed by dawn's pastels, Auray seems little changed since December 1776 when Franklin,

Parisians used to journey the 12 miles by boat and on foot to watch the king eat dinner in public, to stroll in these formal gardens, to draw near to the soul of France."

We were jostling through similar crowds of German, English, and Japanese tourists, thronging the palace turned museum.

Our cause is the cause of all mankind.

"Here is the Queen's Staircase, by which Franklin entered." We climbed the great marble steps and passed through rooms of silk hangings, mirrors, Gobelin tapestries, pale hand-knotted rugs, gilded bronze garlands and cupids.

In this most spectacular setting, Franklin stood out. He had purposely dressed in the simple style of a Quaker. The royal chamberlain faltered at the sight of a guest without wig, brocades, and sword. A noblewoman marveled that he "wore a russet velvet coat, white stockings, his hair hanging loose, his spectacles on his nose, and a white hat under his arm. Is that white hat a symbol of liberty?"

"At noon," Mr. Kuraszewski continued, "Vergennes led the Americans into the king's state bedroom. Louis probably stood here."

The curator, posed before a fireplace, played the parts.

The king spoke first: "Firmly assure Congress of my friendship. I hope this will be for the good of the two nations."

Franklin thanked him graciously: "Your Majesty may count on the gratitude of Congress and its faithful observance of the pledges it now takes."

France was openly in the war, but spying

then a U. S. Commissioner to France, debarked with two grandsons on his way to Paris.

MUSEUM OF VERSAILLES; PRIVATE COLLECTION (FACING PAGE)

Where women ruled: Grande dames gathered the wittiest philosophers, most powerful officials, best musicians, and wealthiest merchants to Parisian salons. Franklin quickly became a star attraction. At Versailles, Queen Marie Antoinette (**above**) called him *"l'ambassadeur électrique."* He quipped that her eyes "do more mischief in a week than I have done in all my experiments."

Under the masquerade of nonchalance, he carried out his mission of winning popular support for a French alliance with America. Hundreds of Frenchmen volunteered to serve in the American Army. Merchants offered loans, outfitted ships, and pledged gifts. One musical lady wrote a triumphal march to celebrate the victory at Saratoga.

In many homes Franklin's picture hung over the mantel—the god of liberty enthroned. Anne-Catherine Helvétius (**right**) set a place for him at every meal. The widow had captivated Franklin, now an aging widower, with her "artless simplicity." He proposed marriage, but she refused, true to her vow to stay single. Still, she remained his friend for the rest of his life. She wrote to him, remembering "the light you poured into my soul. I never left you that I did not feel a little worthier the next day."

was still the order of the day. Who was seeing Franklin? What did he plan?

With Gallic flair, an agent of Vergennes gave the American the code name Prométhée, after the Greek god who brought fire from the heavens; in British cipher Franklin was a prosaic number, "72."

The sage recognized that it was impossible "to prevent being watched by spies" or to plug leaks. He resolved "to be concerned in no affairs that I should blush to have made public." Still, it was a disaster that a trusted aide worked for the British secret service.

Dr. Edward Bancroft copied countless Franklin documents in invisible ink, stuffed the papers in bottles, and left them in a tree on the south terrace of the Tuileries for his British contact. I walked along that breezy esplanade last summer, positive that one aging chestnut tree—its cavity plugged with concrete—bore witness to Bancroft's treachery.

Franklin himself joined in James Bond skullduggery. He changed carriages en route to meetings with Vergennes. His friends served as unpaid agents when they traveled, reporting on public opinion—and ship movements.

Successful at cloak-and-dagger shenanigans, Franklin was positively brilliant at the negotiating table. His rules were timeless: Say as little as possible. Hint you will parley with the enemy's agents. Publish propaganda showing the devilish behavior of your foe. Ask for an extreme; agree to a compromise.

Give us Canada, Franklin demanded of the British as he negotiated a peace treaty. He settled for borders at the Mississippi and St. Lawrence and for fishing rights off Newfoundland. When the British sought compensation for the Loyalists, Franklin calmly suggested that England first pay for burning American towns. Small wonder some of his countrymen consider him one of history's preeminent diplomats.

There never was a good war or a bad peace.

Success aroused envy in those who should have been close friends. John Adams carped, "No man will ever be pleasing at a court in general, who is not depraved in his morals." And more directly, "The moment an American minister gives a loose to his passion for women, that moment he is undone."

Today Franklin folklore overflows with tales of womanizing, including a fictitious family of 13 illegitimate children. A Franklin scholar at Yale University, Claude-Anne Lopez, who also happens to be French and female, corrected the myth. "Franklin always admired and respected lively intelligent women. He paid attention to them as people."

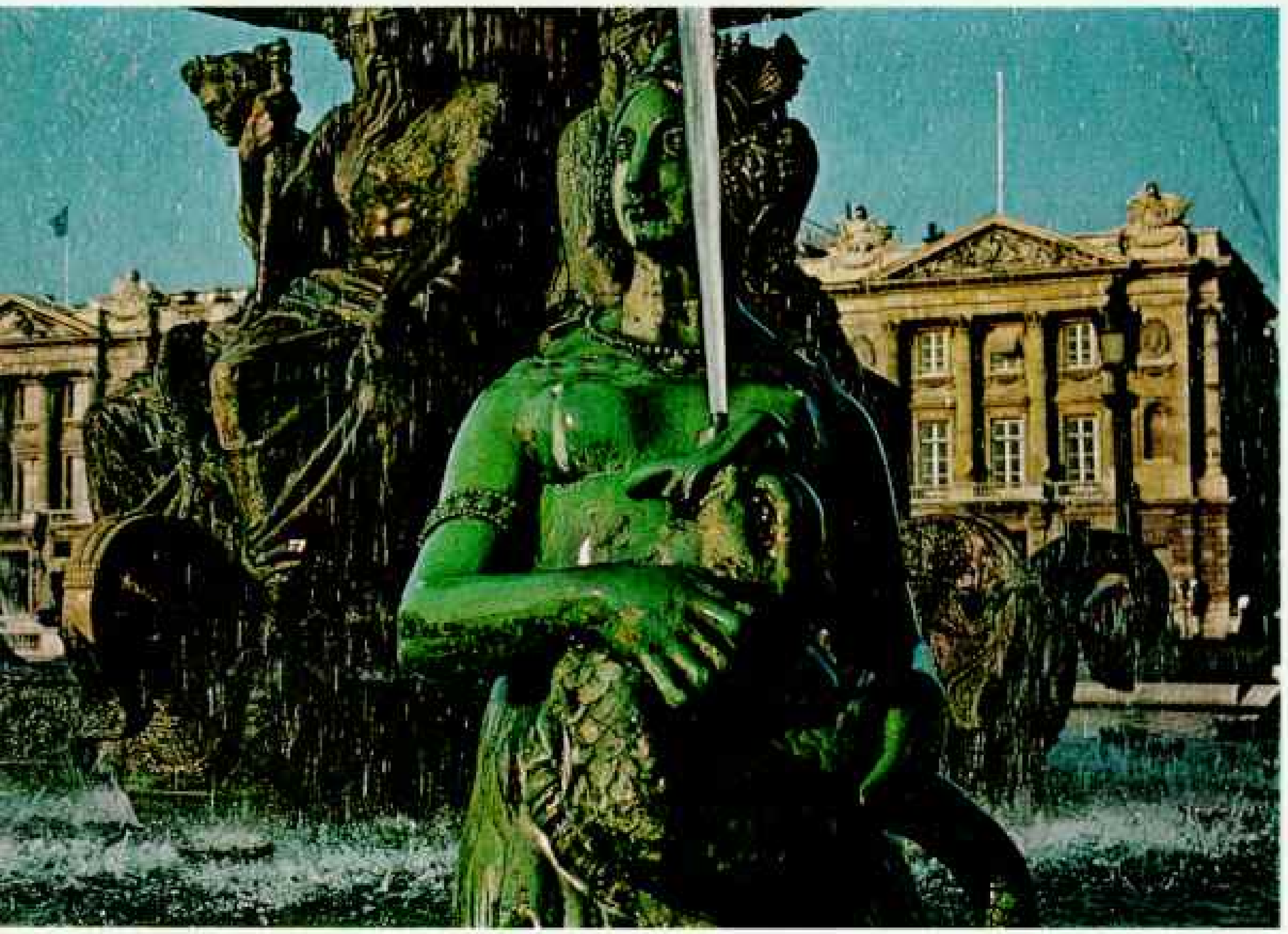
In French society he quickly adapted to the prevailing mood of flirtation. A Franklin letter describes France as "the civilest nation upon earth. Your first acquaintances endeavour to find out what you like, and they tell others. . . . Somebody, it seems, gave it out that I loved ladies; and then everybody presented me their ladies . . . to be embraced; that is, have their necks kissed. For as to the kissing of lips or cheeks it is not the mode here; the first is reckoned rude, and the other may rub off the paint."

This lighthearted wit made the American popular with husbands and wives. A lovely neighbor, Madame Brillon, flirted with him constantly. When she learned her husband was unfaithful, she turned to Franklin as to a father, addressing him as "*mon cher Papa.*" Keenly she pinpointed his allure—"that gaiety and that gallantry that cause all women to love you, because you love them all."

FRANKLIN, who often played the host at Passy, initiated the first Fourth of July parties outside America. In 1778 Americans in Paris joined with French neighbors—about fifty in all—at Franklin's table. "Joy and festivity crowned the day," a guest recalled. "A number, say thirteen, toasts were drunk after dinner."

Now champagne flows on July Fourth at midday when the American Ambassador in Paris celebrates at his residence in the Rue du Faubourg St. Honoré. I joined a crowd of 750 diplomats, French officials, and Americans on the spacious terrace of the former Rothschild mansion. Lifting a glass to a ranking

"**I propose to serve your country** as if it were my own." This pledge of playwright-financier Caron de Beaumarchais echoes through the Frenchman's stately Paris mansion. His company, headquartered here, gathered guns, powder, clothing, and blankets to send to the American Army before France entered the war. In New England a grateful patriot recorded in his diary for August 1777, "Drew 5 more F[rench] Arms & bayonets."

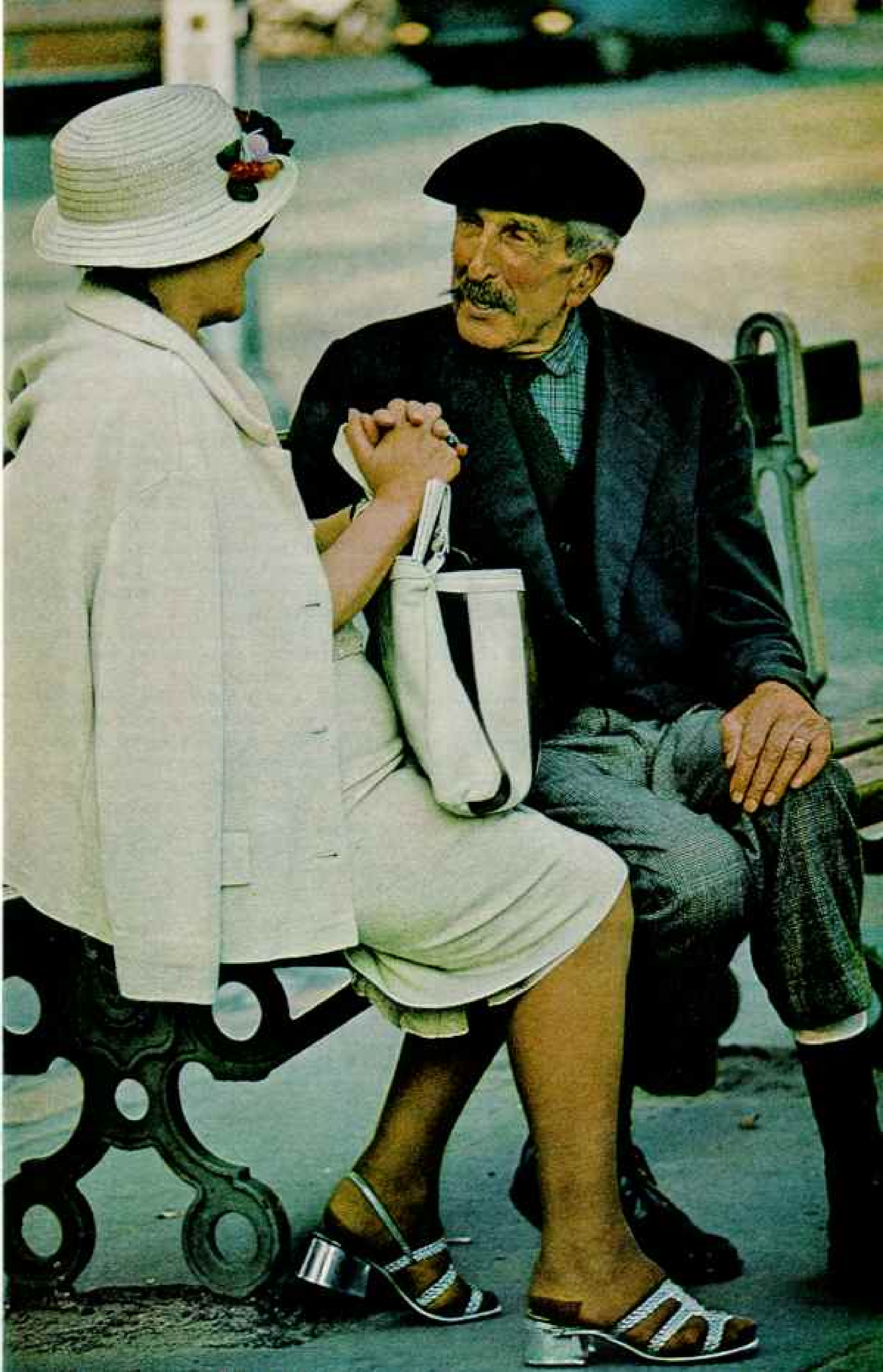


"**All my pleasant dreams** are laid in that city." Franklin remembered his nine years in Paris in "the sweet society of a people whose conversation is instructive, whose manners are highly pleasing, and who . . . [have] the art of making themselves beloved by strangers." Like a scene from those reveries, a couple meet in the Tuileries beside the Seine (**right**).

Champion of charm, Franklin was hard-nosed at the conference table. Shrewdly he implied that America would come to terms with the British if the French did not soon commit support against their longtime foe. At last they did, in 1778, and the first Franco-American treaties were signed in a mansion (**above**) that now overlooks voluptuous 19th-century statuary on the Place de la Concorde.

Franklin's popularity spread, even after his death in 1790. English potters mass-produced this china figure, based on a French sculpture, and sold it labeled as Franklin, or as Washington, or as Country Gentleman.

FRANCO-AMERICAN MUSEUM, RAMBOUILLET



French general, I complimented his nation's role in the birth of my own.

"Ah, it was inevitable. It was for *liberté*," he replied. As we remembered England, our mutual enemy then, he added, "*Alors*, it was also for policy!" Idealism and self-interest—those two horses have pulled Franco-American friendship ever since.

It must have been tempting to Franklin, after the war was won and the victory signed, to stay on in Paris. But he wanted to go home to die.

There are many sorrows in this Life. . . . there are many more pleasures. This is why I love life.

Philadelphia greeted him in 1785 with adulation and honors. And with five long years of work and pain, Franklin's afflictions—gout and bladder stones—grew worse, and opium failed to kill the agony. Still, he labored on. At the Constitutional Convention he combined the highest idealism with a canny understanding of the imperfectibility of man. He spoke out . . .

FOR: Money bills originating in the House of Representatives, in order "that the people should know who had disposed of their money and how."

AGAINST: Absolute veto power of the chief executive over the legislature.

AGAINST: Property qualifications for voters or office seekers.

FOR: Impeachment of the president. The other recourse—assassination—leaves the accused "not only deprived of his life but of the opportunity of vindicating his character."

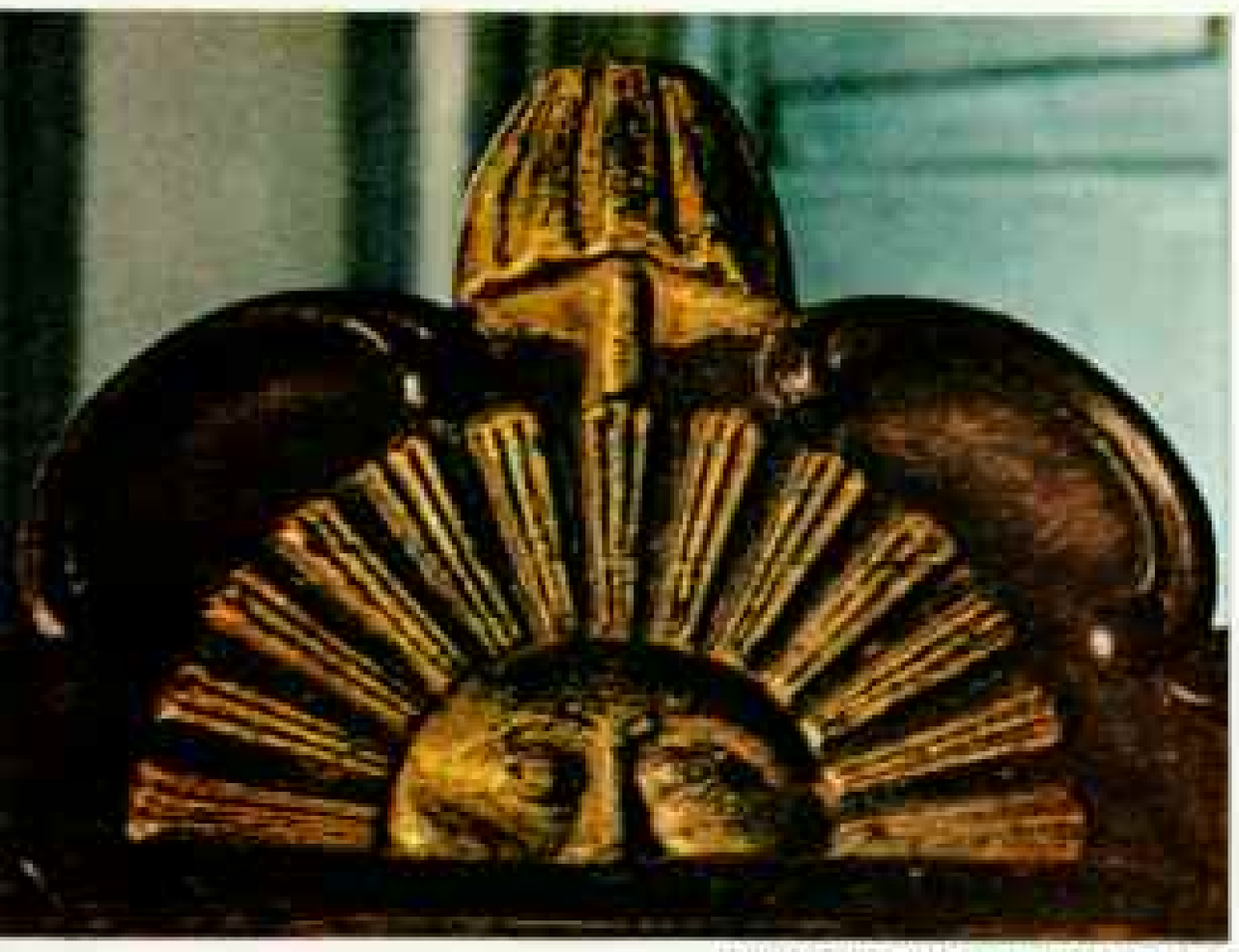
At the finale, the philosopher left his legacy of conciliation: "I consent, Sir, to this Constitution because I expect no better. . . . [I] wish that every member . . . would, with me . . . doubt a little of his infallibility, and, to make manifest our unanimity, put his name to this instrument."

SO IT WAS IN PHILADELPHIA, in his own bed, with his daughter and seven grandchildren nearby, that Franklin sank into his final sleep on April 17, 1790. The largest crowd yet assembled in America, 20,000 people, paid tribute. His funeral cortege, half a mile long, marched from the State House to Christ Church cemetery to bury him beside Deborah. Son William, a Loyalist exile in London, was conspicuously absent.

In Paris Franklin was exalted as the "model of the common man." The French Revolution was well underway, spurred by his ideals. Parisians applauded as the Abbé Fauchet eulogized: "France, thy family by adoption, has honored thee as the founder of her laws; and the human race has revered thee as the universal patriarch who has formed the alliance of nature with society."

To French printers he was the divine demonstration that the press was the most effective weapon against tyranny.

It was in a small bistro in Passy that I too said good-bye. Raising a glass of Madeira, Franklin's favorite wine, I toasted the spirit that lives on wherever youngsters love books as much as toys, where neighbors join hands to build a better life, where politicians maneuver for the public good, and men and women stake their fortunes and their lives on freedom's guiding star. □



INDEPENDENCE NATIONAL HISTORICAL PARK

Eternal optimist: Franklin puzzled over the design on the back of Washington's chair (**left**) throughout the Constitutional Convention. At its successful conclusion, he declared, "It is a rising and not a setting sun." He had assured union by recommending the Great Compromise: numerical representation in the House and equal votes for each state in the Senate.

To the end he joyously reminisced about his Boston boyhood. Once he had harnessed a kite to pull him across a pond. The feat, attempted here by a student from Boston Latin School, Franklin's alma mater, epitomizes his goals in swimming as in life: "the graceful and easy, as well as the Useful."

An Ozark Family Carves a Living and a Way of Life

A PICTURE STORY BY
BRUCE DALE
NATIONAL GEOGRAPHIC PHOTOGRAPHER

"WE WERE RAISING CHICKENS at the time," Ivan Denton says of the early 1950's, when he began to turn a lifetime hobby of wood carving into extra cash. He had come to the Ozarks from North Carolina by way of Canada, Alaska, and New Mexico, where as a cowboy he worked the spirit of the West into his bones. His first carvings sold for a dollar apiece. Then, "chickens started going down, and I saw I couldn't supply the demand for carvings part time, so I just kept on carving."

He put a lot of wood behind him—10,000 carvings in the first ten years. That apprenticeship led to fewer but more complex pieces, such as the four-inch-high "Drifter" (**above**), whose features resemble his own.

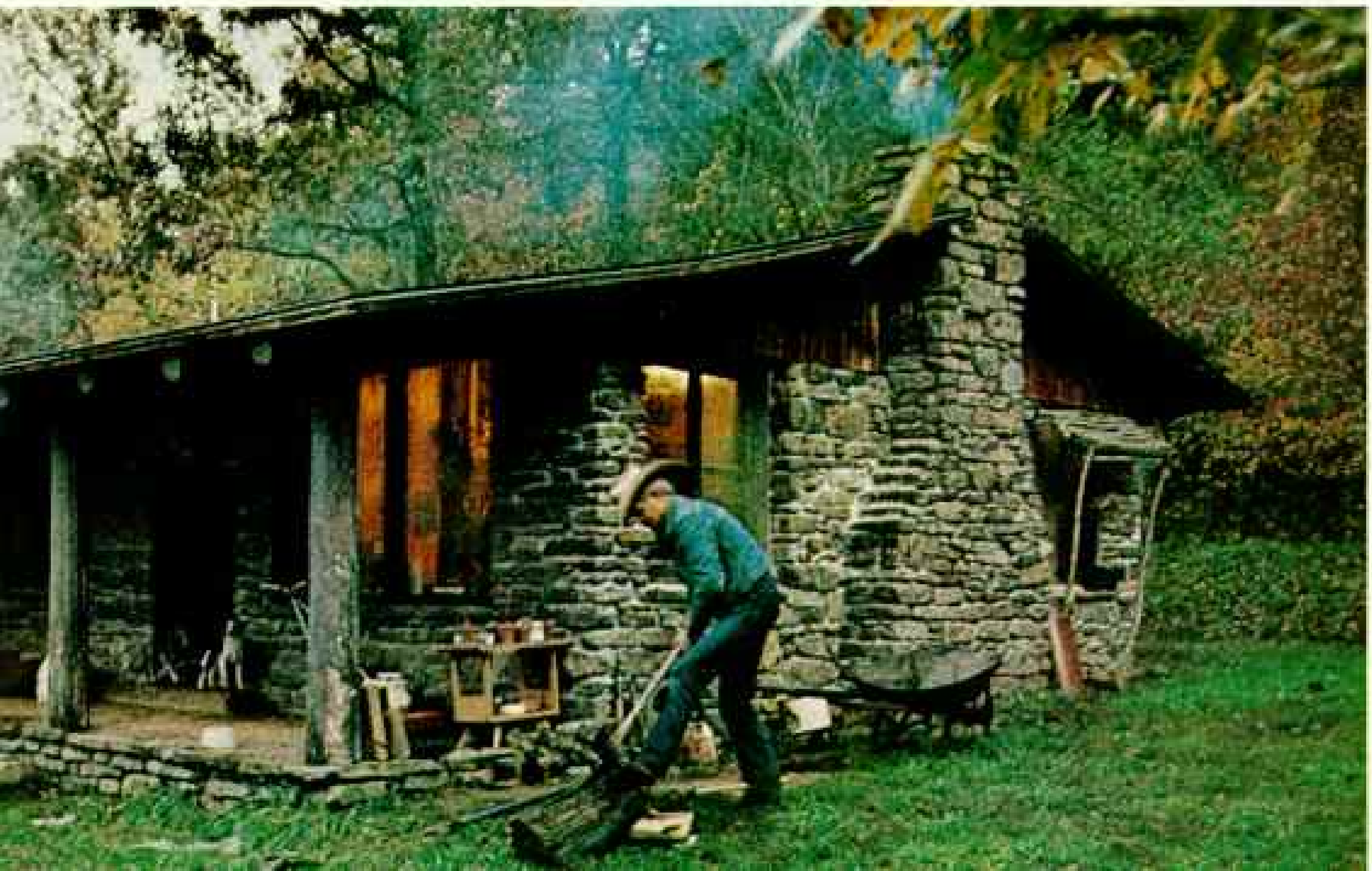
Ivan sets up shop anywhere on his place and carves (**left**) while he talks with friends like Phil Casey, sometime bronc and bull rider who now works in a city. For that, Ivan says, "I pity him."

Ivan's herd of wooden animals are doing better than live chickens ever did. His at-home show in the fall of 1974 saw one buyer pay $1,125 for a three-horse set. Another carving of a cowboy shoeing a horse went for 300 bales of hay, two cows, and a heifer.

"Now I've whittled my way back into the cow business, I guess," Ivan says. "As a matter of fact, I've whittled just about everything I've got."

AUTUMN'S PATCHWORK settles over the Dentons' land near Mountainburg, Arkansas, where a local outlaw, "Runnin' Roy," once played fox to the hounds of the law. "I would rather live in these hills for less money than I would in the flatlands for more," says Ivan. "Plain flat commercial country generally produces plain flat commercial men."

The house echoes the Western themes and careful details of Ivan's carvings. With a sharpened shovel he textured the front-door planking into a scallop pattern. To cover his porch light, he cemented clear quartz crystals around it. That suits a wren family just fine, and they've taken up a homestead there.

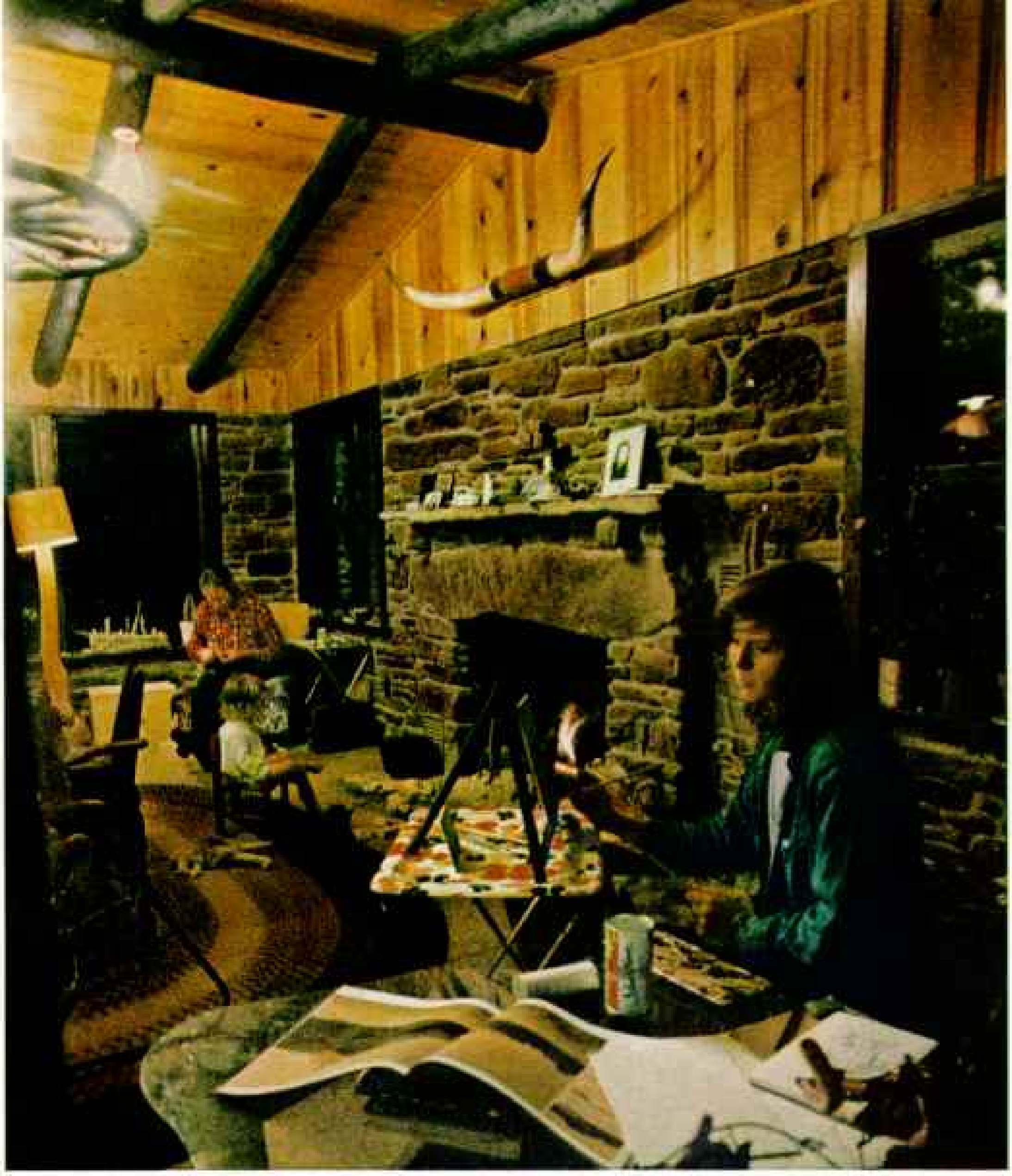


THE WHOLE FAMILY took to carving years back when Ivan had to go to New York for a while. He showed them how to carve and what—to keep the groceries coming. But daughter Laura (**below,** far left) would rather train and ride the family's part-Arabian horses than carve wooden ones. Terry, next to Laura, has become one of the best carvers in the Ozarks. Her signaling Indian, half of a joint composition with Ivan, sits on a fence post at Laura's right.

Janet, atop the other fence post, has taken up her tools again since her marriage. Barbara, holding little Adina, combines the talents of carver, musician, and mother.

A one-family cottage industry sets to work after supper (**right**). Ivan carving and Terry displaying another of her talents, painting, while Adina dreamily stares into the fire. It throws all the warm air the house comes by. "We sit up close when it gets cold, or we put on more wood," Ivan says. No phones interrupt. "I don't want a bell in my house anybody in the world can ring."

Baked on the hearth in a cast-iron pot, bread dough becomes an edible art. Barbara starts with about three cups of flour, and other ingredients in proportion, now and then including homemade maple sugar. The risen dough in the pot goes onto a bed of warm ashes and several medium-size coals. More are heaped on top (**near right**), and in 30 to 40 minutes off comes the lid (**middle**) for bread hot enough to make butter melt and mouths water (**far right**).



LIBERATING a tethered horse from a block of linden (**left**), Ivan Denton's hands themselves become a study in delicacy and power. His love of horses literally springs to life in "Survival" (**below**), as a mustang mare rushes to protect her four-inch-high foal from a cougar. Though self-taught, Ivan has carefully studied the works of Western artists, finding special kinship with Charles M. Russell, also self-taught.

From scale drawings, Ivan sometimes roughs out the form with a friend's band saw. From there on it's all chisels, gouges, and knives. When he gets a jackknife of good carbon steel, he wraps the handle and buries the knife, blade open. "A lot of guys think that's superstition. But when I dig it up, deeply pitted with rust, and sharpen it, the edge really holds."

One of the first wood-carvers in an art reviving all over the Ozarks, Ivan mostly sells to private collectors or through Peter Engler, who has shops in Branson and Reeds Spring, Missouri. Of Engler, Ivan says, "He's bought people's work that he had to throw away or sell at cost just to encourage them. He's really a man of character."

Ivan doesn't keep any of his own carvings. "It's like love. It's no good unless it goes out from you."

WINSOME NAIAD of Clear Creek, Terry Denton cools off in the family swimming hole just above Rattlesnake Hollow. Many of her carvings conjure up a fantasy world. An elf knight's charger paws fingertip terrain (**right**). A nine-inch-high maid from the mythical region of "middle-earth" plays her lute (**far right**), her eyes on some other-world vision.

"Sometimes," Terry says, "I enjoy taking a piece of wood and carving

whatever wants to come out of it." Her strong will matches her father's, but their preferences do not always jibe. He likes to stain his work; she likes hers close to linden's natural light color. He favors Western scenes. The whole world appeals to her. Since Terry has been at Peter Engler's shop in Reeds Spring, her work and Ivan's have diverged further. Yet their bond remains strong.

"We both seem to work off the same source of inspiration," Terry says. "So, even if I'm up here in Reeds Spring and he's down there at home, we both can do good carvings."

Though the artist's work is a solitary business, she says, "I'm not lonely. My home is within me. You have to be friends with yourself."

She will make her career as an artist, but what is art? "Daddy says the worker uses hands," Terry answers. "The craftsman uses hands and head. But the artist uses hands, head, and heart." □

TIRELESS VOYAGER

The Whistling

By WILLIAM J. L. SLADEN, M.D., Ph.D. Photographs by BIANCA

Far cry from the fabled ugly duckling, a whistling swan stretches its great wings, rose-tinged by day's last light. Tiny radios and easy-to-read neckbands help scientists

Swan

LAVIES NATIONAL GEOGRAPHIC PHOTOGRAPHER

study the birds from North Carolina's lakes and estuaries to Arctic breeding grounds.

"COLOR-DYED SWAN BELOW!" As our floatplane circled low over the tundra of Alaska's North Slope, pilot Jim King's sudden shout called our attention to a pair of swans swimming on a lake; one bird's plumage bore patches of familiar orange dye.

Surely it had to be one of the 48 swans we had marked on Chesapeake Bay the previous winter.

The pilot dipped a wing, sized up lake depth, wind direction, and room for takeoff, then set the plane down. As a U. S. Fish and Wildlife Service waterfowl expert, Jim knew the swans' habits. He taxied on the water to herd the birds onto land.

After a short stalk with my tripod-mounted telescope, I verified the code—C028—on the black neckband. My records identified it as an adult female handled less than six months earlier near Galesville, Maryland—3,500 miles away!

I felt truly elated: This bird—later named Hope—was the very first Chesapeake Bay swan sighted in Alaska.

The pair were molting, and thus flightless. We placed a blue (for Alaska) neckband on C028's unmarked mate, and he became for us A301, nicknamed Bud.

That event of an Alaskan summer day in 1970 was a milestone in my seven-year pursuit and study of the far-wandering North American whistling swan, *Olor columbianus*, one of the most elegant of our native waterfowl.* Comparatively little has been known about the migratory behavior of this graceful bird, whose yearly round-trip voyages link the Western and Middle Atlantic States with the rim of the Arctic. And no one knows for sure how the species got its name; its cry is more of a baying than a whistling.

Adult whistlers are physically distinguished from their close relatives, the trumpeter swans, primarily by their smaller size. Most mature birds also have yellow spots in front of the eyes.

Some of my friends have puzzled over my giving up a medical career for studies in conservation and environmental health. But, I respond, wouldn't they perhaps trade whatever they are doing to witness the spectacle

*The author's research was supported through Johns Hopkins University by the National Geographic Society, the U. S. Air Force, the World Wildlife Fund, the Chesapeake Bay Foundation, the U. S. Fish and Wildlife Service, the Canadian Wildlife Service, the Prudhoe Bay Environmental Committee, and many state agencies.

of 300,000 Adélie penguins in Antarctica, to round up thousands of pink-footed geese in Iceland, to sit among harems of fur seals on the Pribilof Islands in the Bering Sea, or to take inspiration from the wandering albatross as it soars majestically above the southern oceans?

All these experiences have been mine, and they are unforgettable, yet for me the lift-off of whistling swans from Chesapeake Bay on spring migration equals or even surpasses, in emotional and scientific impact, those other more exotic adventures.

I remember the great spring assemblies of the 1960's at Eastern Neck National Wildlife Refuge on Maryland's Eastern Shore. Rarely were there fewer than 3,500 swans gathered on the shoals—those that had wintered there, and others on stopover from southern Virginia and the Carolinas. The air was filled with their mellow baying—"Wow-HOW-oo, wow-HOW-oo!"

Just before sunset small groups of swans began swimming slowly, sleek and straight necked, toward the sandbar and the open bay. The first flock prepared for flight, swimming faster, baying louder. Then a new sound—the patter of black-webbed feet and wing tips slapping the water as the powerful birds, each weighing as much as twenty pounds, gained speed to lift themselves into the air. Flying low, they climbed on the back of the southeasterly breeze, rhythmically winging toward the reddening horizon.

They were on their way, at the start of an incredible journey that would end on the ice-chilled North Slope of Alaska, or in the river deltas of Canada's Northwest Territories. Under the midnight sun the birds would nest and rear their young.

Flocks of Migrants Span the Sky

In the eastern spring migration they fly en masse, not in a dense cloud of thousands like some ducks, but as an almost continuous sky parade of small flocks, ten to a hundred or more birds in each. The sky is mottled with far-reaching phalanxes that may stretch from the marshes of the East Coast to the Appalachian Mountains.

During fall migration, from late September until November, North America's estimated 100,000 whistling swans come back across the continent, the western Alaska population reaching wintering grounds as far south as California, and the eastern birds dispersing along the mid-Atlantic region from Delaware to North Carolina. We know less about these fall migrations, but it appears that this airborne cavalcade flies at a higher altitude, and that the birds may travel nonstop for 1,350 miles from the plains to the coast. But bad weather can cause them to swing low, sometimes with surprising results.

With a confident stride, the author, an ex-cross-country champion, overtakes a cygnet (**right**) that he later bands and weighs (**left**) on Alaska's tundra. A floatplane doubles as a swanherd, taxiing gently to point swimming birds to shore, where, in August, flightless molting adults and their cygnets offer a challenge to the fleet of foot.

A professor at Johns Hopkins University, Dr. Sladen heads a research program funded in part by the National Geographic Society, to probe the habits and migrations of swans. Over the past five years some 2,500 whistlers have been fitted with color-coded neckbands that allow long-term observation of individual birds. Others have been fitted with lightweight radio transmitters as well, and tracked along their flyways from Chesapeake Bay to the Canadian prairies.

PAINTING BY NANCY GUMBINER

In October 1971, for example, celebration riots broke out in Pittsburgh following the Pirates' victory over the Baltimore Orioles in the World Series. Two weeks later, heavy clouds forced migrating swans to land on the Allegheny River near Pittsburgh in the blackness of night. Dr. Mary Clench, Associate Curator of Birds at Carnegie Museum, told me with a chuckle that suburban police, hearing the loud and unfamiliar baying of a thousand swans, thought another riot had broken out—only to discover that nature was playing a Halloween trick on them.

An earlier event resulted in tragedy. On November 23, 1962, a United Airlines turboprop flying at 6,000 feet near Ellicott City, Maryland, met a flock of whistling swans. One bird punctured the left horizontal stabilizer. The plane crashed and all on board lost their lives.

The U. S. Air Force estimates a multi-million-dollar cost from damage to Air Force planes colliding with birds—though, admittedly, swans are infrequently involved. The continuing hazard of such encounters gave urgency to our studies. With heavy airline traffic continuing, lives might depend on our plotting precise migration paths in relation to their routes. How high do these large birds fly? What is their speed? How often, en route, do they land and take off?

Beyond their real (if very rare) threat to

Flaps and landing gear down, whistlers prepare to alight on Chesapeake Bay. Of a total population of some 100,000 birds, more than half winter on the mid-Atlantic seaboard, the remainder in western states and British Columbia (**map, below**). At many of their eastern wintering grounds, the swans have served as ecological barometers. When their natural menu of shallow-water vegetation becomes scarce along Maryland's Eastern Shore, the birds turn to foraging in harvested fields and pastures.

aircraft, whistling swans provide a barometer for environmental conditions. At Eastern Neck refuge, scene of those earlier vast congregations of thousands, for instance, no more than a few hundred whistling swans took off this spring. The security and shelter afforded by the wildlife refuge are still there, but food has been seriously depleted, the result of dramatic changes in the Chesapeake Bay ecosystem.

Habits Change When Vegetation Fails

Swans generally feed on aquatic vegetation, supplemented, in the Chesapeake, by thin-shelled clams. In the upper bay there has been a major dieback of vegetation in the last few years. As I flew over certain areas, I saw bare mud bottoms where underwater greenery formerly flourished. The causes have not been precisely identified.

Natural erosion, runoff from land development, and excessive nutrients from human and agricultural wastes increase turbidity and thus reduce vital sunlight for photosynthesis. These are sure factors. Agricultural herbicides and industrial wastes are less easy to measure, but they may also contribute to the degradation of the natural aquatic habitat of waterfowl.

Fortunately, the overall population of the whistling swan is still healthy. On the East Coast they are adapting—by finding food

on land—to these environmental changes.

As the study proceeded, we adopted two important ways besides dyeing to identify individual swans: radiotelemetry and neckbands coded by colors, letters, and numbers.

My collaborator, William W. Cochran of the Illinois Natural History Survey, organized the telemetry studies. The small transmitters he designed weigh under three ounces —less than one percent of a swan's weight. Harnessed to a bird's back with special tubing, the radio broadcasts over a range of five to 150 miles, depending on the location of the bird and of our receivers. Each swan radio transmits on a particular frequency and at its own pulse rate.

The radio signals are picked up through a receiver, which may be carried in a ground vehicle, in an airplane, or set up at a permanent or temporary tracking station (page 144). We established a permanent station with receiving antennas atop a 120-foot tower at the Smithsonian Institution's Chesapeake Bay Center for Environmental Studies on the Rhode River, near Annapolis, Maryland.

The Rhode River station monitors all the swan frequencies. When a signal suddenly increases, it sets off an alarm, indicating the transmitting bird has taken flight and is high enough to send a more powerful signal to our line-of-sight UHF receiver. We can tune in, following the swan's course with the directional antenna, contact pilots and trackers, and give them a bearing to follow as the swan migrates to the northwest.

The station first saw action on March 14, 1973, during spring migration. All the way from Virginia to Ontario, weather was favorable, with a light southeast breeze. At about 5 p.m. the evening before, we went on alert when observers reported groups of swans taking off from Back Bay National Wildlife Refuge, Virginia. Others were seen flying in from farther south, presumably from the Mattamuskeet and Pungo National Wildlife Refuges in North Carolina. Great numbers were landing in all the swan-favored areas. Swans were reported flying over Baltimore, and were seen above our ground station. All evening we waited in vain.

Off on a Wild Swan Chase

At the uncivilized hour of 1 a.m. the first radio-swan takeoff triggered our alarm system. It was F589, a bird we called Russell—because he was captured and harnessed at the Eastern Shore farm of Environmental Protection Agency Administrator Russell E. Train. At almost twenty pounds, Russell was one of the heaviest of our radio swans.

Phone calls routed out of bed our pilots, Professor Everett Schiller of Johns Hopkins University and Ron Zimmerman, and student-tracker George Fenwick. They all drove to Baltimore-Washington International Airport and were up in the tracking plane within an hour. Meanwhile we at the station aimed our

Wings akimbo, a female, banded five years and more than 20,000 migration-miles ago, is retrieved from a funnel trap in Maryland's Blackwater National Wildlife Refuge by George Fenwick (**left**). Keeping fast company, a stray barnyard duck will be passed over by swan-watchers (**right**) who are helping to band the whistlers.

directional antenna at Russell as he flew northwest toward the Chesapeake Bay Bridge. After only 18 minutes, we lost Russell's signal! The plane confirmed that he had put down off Kent Island, Maryland. We had dragged the tracking team from their beds needlessly, but it was good practice.

Later, our electronic sentinel was caught napping; and Russell took off undetected. But on March 25, on a subsequent mission, the big swan's signal came in loud and clear to our tracking plane, which was flying over Rondeau Harbour, Ontario, on the northwest shore of Lake Erie. He and another radio swan, F135, were part of a flock of 500 resting on the water.

Russell's behavior typified that of many of our radio swans—a pattern confirmed also by observation of our neckbanded birds. They displayed a premigratory restlessness, moving step-by-step a little farther north on Chesapeake waters until, at some moment to their liking, they whistled aloft in earnest on the long haul.

Our first fully successful tracking as far as the Great Lakes started on March 20. Two of our radio swans, F583 and F563, took off in the same flock from the Blackwater National Wildlife Refuge on Maryland's Eastern Shore, triggering the first alarm at the Rhode River tracking station at 5:30 p.m. After two short stops in Maryland, they left on the first long leg of their migration.

Bill Cochran and George Fenwick were our airborne trackers for the night; Gordy Allen—one of our student volunteers—was monitoring the receivers at the permanent ground station, Professor Schiller and Ron Zimmerman were standing by with the rented Cessna 172 at the airport. I was in Baltimore at telephone control.

The final alarm went off at 8:35 p.m., while

Gordy and George were finishing a hurried dinner of cabbage and beans. One hour later our team was in the air.

By 11 p.m. the plane caught up with the flock three miles southwest of Frederick, Maryland, and Bill Cochran's instruments told them that the plane was right over the radio birds. At this time, with the birds 65 miles from takeoff, our ground station finally lost the signals.

Swans and tracking plane played hopscotch across Pennsylvania and Ohio. The birds landed before dawn on Mosquito Creek Reservoir, Ohio, after flying nonstop for more than eight hours. The plane, only an imitation bird, had to land for refueling—a humbling thought!

Bill was uneasy because he knew that Ontario, not Ohio, was the swans' normal destination on this first leg of spring migration. So while the exhausted pilots slept in a motel, he and George rented a car to keep constant contact.

The birds were taking off as the trackers reached the reservoir. From there they followed the signals by car, with receiver and hand-held antenna. Fortunately, a strong wind from the north kept the swans south of Lake Erie, so the car was able to pursue them along the Ohio Turnpike.

"When we finally telephoned the pilots," George reported later, "we asked them to meet us in Toledo. We failed to specify which of the two Toledo airports, but luckily we all picked the right one."

Reassembled aboard the plane, the team relocated the two radio swans that evening as the birds landed to end their flight on a flooded field near the little village of Arner, Ontario, 24 miles southeast of Detroit.

Tail Wind Boosts a Migrant's Speed

We were pleased with what we had learned. F583, F563, and their flock had taken exactly 25 hours to fly from Maryland to Ontario. They had covered an estimated 520 miles with three stops—two brief ones in Maryland, and an eight-hour layover in Ohio. Their average speed over the Appalachians was 37 miles an hour at an estimated altitude of 2,700 to 3,500 feet. These are levels at which many small aircraft fly, and through which commercial planes climb and descend.

Our tracking team had barely returned from Detroit when, on March 24, more radio swans took off.

On this second tracking, F113 and F582 were followed in the Cessna throughout their nonstop flight of 420 miles from the Blackwater refuge to the north shore of Lake Erie. The swans flew continuously for 14 hours and 42 minutes at an average speed of 29 miles an hour.

One swan continued to give us good data across Minnesota and North Dakota and into Canada. On April 13, less than 29 hours after the swan had made a stopover at the Upper Mississippi River Wild Life and Fish Refuge, Chip Welling and I picked up its signal from an aircraft near Deloraine, Manitoba, some 550 miles to the northwest. We tracked it 90 miles farther to a landing near Carlyle, Saskatchewan. A tail wind pushed the bird's ground speed up to an estimated 72 miles an hour. We calculated that this radio-harnessed swan migrated at least 640 miles, probably with only one stop, in less than 30 hours.

Russell Reappears—With No Radio

That was our last tracking by plane that year. All eight swans successfully harnessed with radios in Maryland had been relocated in the Great Lakes; we had followed five of them over the whole route either by aircraft or by ground vehicle. Subsequently, six were located again in Wisconsin, Minnesota, and the Dakotas. Two of these were then tracked into Saskatchewan, as their flocks flew stage by stage toward the Arctic.

What did we learn? For one thing, never before had such a wealth of long-distance telemetry data been obtained from any species of waterfowl. We gathered excellent information on altitude, speed, stopover places, and routes—information otherwise unobtainable during overnight migrations. Our radio birds were also neckbanded, so that we would still be able to identify them after the transmitters' batteries had died.

Russell, for instance, was back for a hand-out in the fall of 1973 at the Train farm. He had shed his radio and appeared none the worse after his round trip to and from the Arctic. Russell reappeared in Maryland again last winter—now with at least 10,500 miles behind him.

Through color and code protocols for neckbands worked out with the International Waterfowl Research Bureau and a U.S.–U.S.S.R. environmental agreement, we are moving slowly into the first truly international program of marking—a system that identifies the

End of a long journey: With a dusky cygnet between them, a mated pair arrives on Chesapeake Bay. Whistlers are monogamous, and stay with their brood—as many as six youngsters—through the spring migration. After this family returns north, the cygnet will join other immature and nonbreeding swans for at least two more years before mating and starting its own family.

swan and the major geographic area where it was banded. The code can pinpoint the individual amid thousands of birds.

The percentage of resightings has been remarkable because we are able to read the neckband codes at some distance with powerful telescopes. Of a test group of 179 Maryland swans neckbanded as well as metal-banded on the lower leg, we recovered or resighted 84 percent. This compares strikingly with the 7 percent recovery rate of swans we marked with only hard-to-read Fish and Wildlife leg bands.

Family Bond Seems Strong

That historic Alaska pair, Bud and Hope, now rebanded as T001 and T002, have provided us with an extraordinary mass of data. With help each summer from Angus Gavin, ecologist for Atlantic Richfield Company, we have now identified them for five consecutive summers in their Alaska nesting place on the fringe of the Prudhoe Bay oil field. And for two out of five winters, they've been spotted with their youngsters in Maryland. The pair's nine crossings of the continent total more than 31,500 miles.

Our best pair, considering depth of data acquired, has to be A303 and A304, which we banded close to the territory of Bud and Hope. We've checked this pair and their broods for four summers in Alaska, four winters in Maryland, and on spring migration in Ohio, Ontario, and North Dakota.

Angus Gavin has reason to be proud that the swans are holding their own in his Prudhoe Bay study area. The swans on the North Slope contend with extremely adverse weather. Yet productivity is stable, due in part to the oil companies' prohibition of hunting on their extensive holdings.

We've discovered many important things about whistling swans, but very much remains to be learned. Romantic tradition, for instance, ascribes faithfulness to swans. Of the few neckbanded pairs we've followed, all seem to be knit in durable family bonds, and they've raised cygnets year after year. But we have seen some couples temporarily separate during winter or on migration as they independently explore new feeding grounds. In any case, the pairs we have followed still represent so small a sample that lifelong fidelity for whistling swans cannot be claimed.

Electronic tracking provides valuable migration data as the author, son Hugh, and project collaborator Bill Cochran monitor an airborne swan from their station near Annapolis (**below**). A sudden signal increase from a swan radio, indicating that the bird has taken flight, sounds an alarm that sends a tracking team into action. With a specially equipped van (**below, right**) and a small plane (**bottom**), they follow the birds to Canada. Swan F582 (**facing page**) gets the feel of an electronic passenger attached to its back by a light, nonchafing harness designed to fall off after several months. This bird flew 420 nonstop miles to the Great Lakes in 14⅞ hours. Along with the birds' speed and altitude—estimated as high as 8,000 feet—the study plotted migration routes and usual stopovers. These statistics may help prevent tragedies such as the one in 1962, when an airliner flew into a flock of whistlers and crashed, killing all on board.


F582
F582

With consummate grace, a snowy squadron takes off from the Eastern Shore. Protected from hunters in most areas, whistling swans are in no danger of extinction. Yet

Our neckbanding technique, when used in conjunction with radiotracking, enables us to make multiple resightings and gives us important clues to whistling swans' adaptability to environmental changes.

The evidence is solid, for instance, that the birds' feeding habits are changing in many areas. In Chesapeake Bay wintering birds have moved into harvested corn and soybean fields to feed on the stubble, and more recently, into winter grain and pasture where they, like Canada geese, need to be watched to prevent crop damage.

A Swan-watchers' Bonanza

Our Canadian collaborator, Dr. William W. H. Gunn, says that the switch from aquatic feeding to field foraging started more than ten years ago in the marshes and river deltas of Lake Erie and Lake St. Clair. The swans are now using these areas mostly for roosting. During the day they blanket nearby harvested fields. Here, swan-watchers have recorded more than a hundred individual neckbands in a day during spring migration.

Through increased field observations, it has become evident that whistlers are not adversely affected by this shift of feeding habits. For the past two springs, well over half of our total estimated 60,000 eastern population seem to have funneled through this southernmost tip of Canada.

But whistling swans still show a preference for aquatic food when available. Birds arriving at Mattamuskeet National Wildlife Refuge in North Carolina in winter have increased from 5,000 to almost 20,000 in the past five years, and some of our Maryland neckbands have been resighted there. Mattamuskeet Lake supports abundant aquatic vegetation, but danger lurks in these apparently attractive waters. Ingestion of lead shot, accumulated on the bottom from years of hunting, killed nearly 1,000 swans in the winter of 1973-74.

We are discovering how the swans make use of the vitally important network of national, state, provincial, and private wildlife refuges in the United States and Canada, and how they are adapting to habitat disturbances

man and his creations—from planes to pollution—are intertwined with these birds. Ongoing research will help people live in harmony with whistlers, and the swans with us.

in their Arctic breeding grounds, notably in the northern Alaskan oil fields. Above all, perhaps, we are learning how better to live in harmony with these magnificent native waterfowl.

Volunteers Follow "Adopted" Birds

A donation to our Chesapeake Bay Foundation Swan Research Program enables supporters to "adopt" an individual bird, and among the most satisfying dividends from our work is hearing from those who have actually sighted "their" swans. Jeanette and Floyd Evans helped us band swans offshore from their home beside the Severn River in Maryland (page 141). They later had the thrill of resighting four of their birds in Ontario during the 1974 spring migration.

Tony Bernhardt from the tiny Eskimo village of Kobuk and Lee Staheli of Kiana help us check on their swans and others in western Alaska. Bud Helmericks, on the Colville River Delta, and Angus Gavin at Prudhoe Bay keep a watchful eye on their birds, T001 and A303. Jim Stage of McHenry, North Dakota, welcomes the swans each fall and spring as he works on his farm.

Swan-watching is a productive pleasure. It allows nonscientists to work together with wildlife specialists, to the benefit of all.

Swans and people can get along together well. To the Chesapeake Bay waterman, to the householder owning precious shoreside property, and to the retired couple snugged beside some quiet creek, the wintering whistling swan of Maryland and Virginia is a cherished presence, "on loan" for a few months to enrich their world.

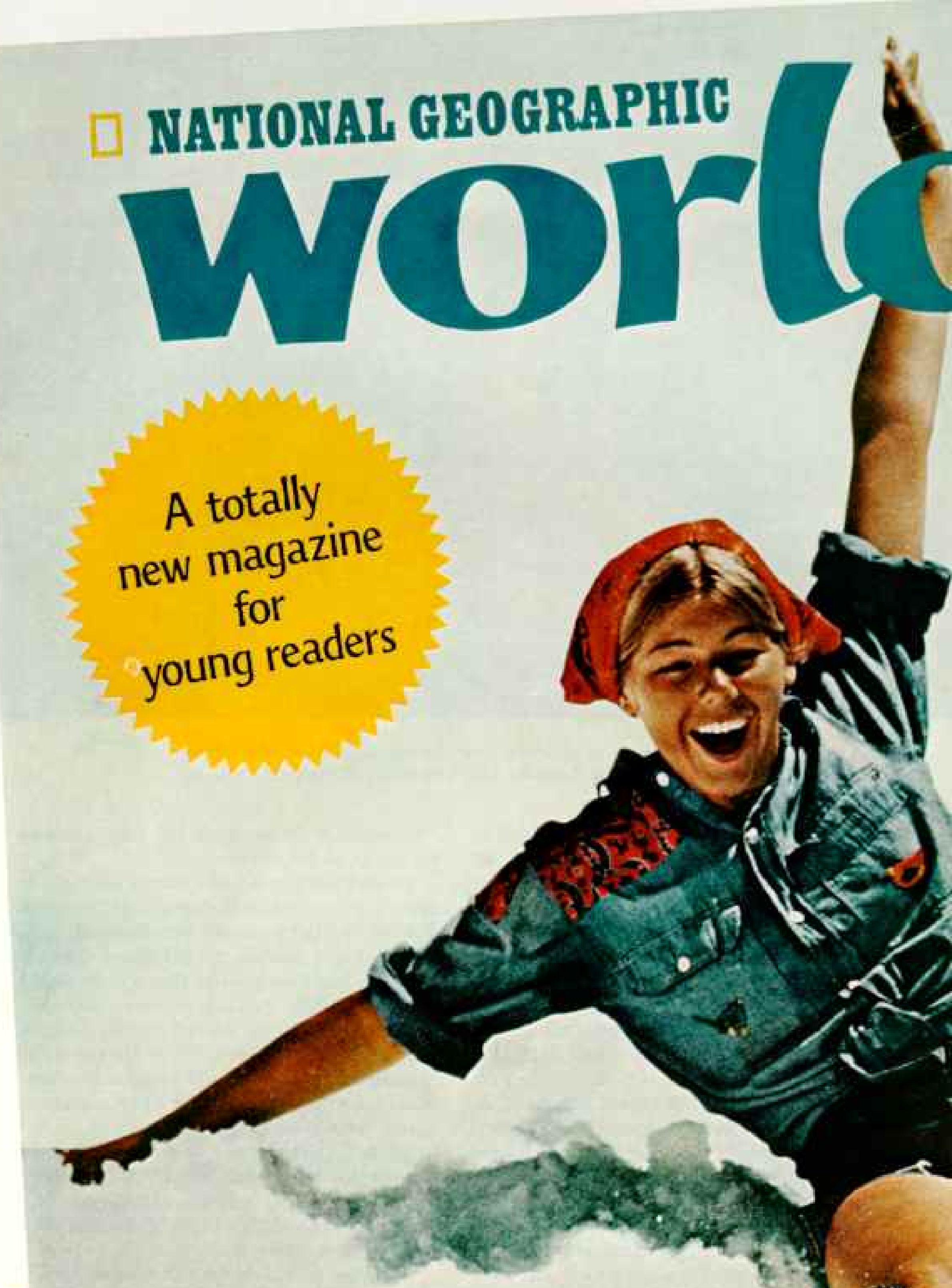
To the prairie farmer and the small-town dweller on the plains, these birds of passage signal the turning seasons. Many such folk respond to the swan's sky-wide baying with an inward surge of joy.

And throughout the vast tundra of the Canadian and Alaskan north the whistling swan breeds at the very elbow of the Eskimo. To him this great bird equally belongs, since polar man and the itinerant swan share the frugal Arctic world which, each spring, renews them both. □

NATIONAL GEOGRAPHIC

world

A totally new magazine for young readers



Supersize Chimp Picture
Running the Rapids
Far-Out Facts
Colorado Canyon Maze
Animal Eyes

Start the world, I want to get on!

THAT'S WHAT YOUNGSTERS everywhere are saying. We know because we've spent the past year talking with them—and with you, their parents and friends.

We know you are concerned about the distortions children are exposed to in some comics, on television, and even in publications that call themselves educational. We share your concern.

You have bright, inquisitive young minds in your home—minds that are reaching up and out in every direction. Those 8- through 12-year-olds are amazingly curious people. They want to learn about gigantic whales and tiny ants. About children in Siberia and children next door. About a huge lizard that flew over Texas 65 million years ago, and how people might someday travel to Mars.

To help them learn all this and more, we've designed an exciting new educational tool. We call it National Geographic WORLD, because that is what it's about—the whole wide, wonderful world.

Our photographers and writers have been exploring this world for more than eight decades. We've made *seven and a half million* photographs, in color, of its peoples, places, and wonders. And for nearly six decades we have shared our global adventures with young readers through the pages of their own publication, the National Geographic *School Bulletin*.

But today the world isn't as easy to understand as it once was. There's a lot more for young people to learn and sort out. So we have decided to retire the *School Bulletin*, with thanks for a job well done, and to give young readers a completely new all-color magazine.

We've enlarged the pages to a full 8½ by 10¾ inches and doubled their number to 32. WORLD will not come just during the school year; it will arrive *every* month, all year long.

A lot of time, thought, and care went into our planning—the kind of care you expect from the National Geographic Society. We assembled a team of topflight writers and artists in the children's field. We talked to educators and parents, and we created

Fun that teaches, learning that lasts

Here's what parents, children, and educators said about the sample magazine many of you saw:

"WORLD has instant appeal."

"My 9-year-old daughter, who can't seem to sit still for five minutes, sat for two hours and read WORLD from cover to cover."

"Kids can relate to the articles because kids are involved."

"I enjoy WORLD more than any other magazine. It makes you feel grown up and makes you *want* to read."

"... the high quality we have come to expect from National Geographic."

Complete order form on reverse side, remove flap from magazine, then fold on line, staple or tape, and mail.

First Class
Permit No. 138-R
Washington, D.C.

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the United States

Postage will be paid by

National Geographic Society
Post Office Box 1640
Washington, D. C. 20013

Would you like to give your child the world?

OF COURSE you would! And we'll help you do it by providing a brand-new learning tool. Fill out the coupon today, so your favorite young person can be the first on the block to get WORLD. Every month will bring fresh surprises—surprises youngsters won't want to miss.

- A study of albinism, from the white gorilla Snowflake to rare blind fish . . .
- Heart-stopping adventures on wild rivers and mountains, under the sea and underground . . .
- Close-ups of cuddly animals like pandas and not-so-cuddly cobras . . .
- Far-out facts about how much a blue whale's tongue weighs (as much as 40 men) and dogs that "drive" cars . . .
- Children from everywhere who have knowledge to share with your children . . .
- And much more . . .

PLEASE ENROLL MY YOUNG READER as a charter WORLD explorer and bill me for $4.85 ($5.50 in Canada and Mexico, elsewhere $5.85, in U. S. funds or equivalent). The first issue of National Geographic WORLD will arrive in September.

MAIL WORLD MAGAZINE TO: (Please print in ink)

NAME _____ YEAR OF BIRTH _____

ADDRESS _____

CITY, STATE, ZIP _____

SEND THE BILL TO:

NAME _____

ADDRESS _____

CITY, STATE, ZIP _____ 2101

a prototype—a sample magazine that we showed to a lot of you. We came up with a WORLD of ideas—colorful, different ideas that make learning fun. Ideas that will challenge the most inquisitive. And ideas that will stimulate a TV generation to rediscover the joys of reading.

National Geographic WORLD will help the young minds at your house grow and grow and GROW into a lifetime of learning. Right this minute our photographers and writers are out in the field, getting to know the children your children will want to meet. Children who can tell them what it is like to live in a tent or to roar down rapids. How it feels to grit your teeth as you inch up a mountainside or to concentrate on charming a deadly cobra.

We don't want the 8- through 12-year-olds at your house to miss any of these adventures. Make sure your favorite young explorer gets in on the very first spin of National Geographic WORLD! Enroll him or her today as a charter subscriber. Treat your youngster to hours of pleasure for little more than a penny a day. □

Look what's in my magazine!
A lot more than just words and pictures. MY magazine has a giant picture of a chimp that I can hang on my wall. It has a punch-out globe that my friends and I can put together. It has a scale model of a prehistoric pterosaur that actually flies. It has mazes that are fun to do—and I learn things from them too. It has games I can play, craft ideas I can try, and brain teasers from many countries.

MY magazine comes every month—right to me—from people who travel all over the world. It's the National Geographic Society's *first new magazine* in 56 years. They realize I'm important!

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

GILBERT HOVEY GROSVENOR
Editor, 1899-1954; President, 1920-1954
Chairman of the Board, 1954-1966

THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D.C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization for increasing and diffusing geographic knowledge and promoting research and exploration. Since 1890 the Society has supported 1,158 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; more than 50 million maps distributed each year; its books, globes, atlases, and filmstrips; National Geographic WORLD, a magazine for 8- through 12-year-olds; information services to press, radio, and television; technical reports; exhibits from around the world in Explorers Hall; and a nationwide series of programs on television.

Articles and photographs of travel, natural history, and expeditions to far places are desired. For material used, generous remuneration is made.

MELVIN M. PAYNE, *President*
ROBERT E. DOYLE, *Vice President and Secretary*
GILBERT M. GROSVENOR, *Vice President*
THOMAS M. BEERS, *Vice President and Associate Secretary*
HILLEARY F. HOSKINSON, *Treasurer*
OWEN R. ANDERSON, WILLIAM T. BELL,
LEONARD J. GRANT, W. EDWARD ROSCHER,
C. VERNON SANDERS, *Associate Secretaries*

BOARD OF TRUSTEES

MELVILLE BELL GROSVENOR
Chairman of the Board and Editor-in-Chief

THOMAS W. McKNEW, *Advisory Chairman of the Board*

FRANK BORMAN, *Executive Vice President, Eastern Airlines*
WARREN EARL BURGER, *Chief Justice of the United States*
ROBERT E. DOYLE, *Vice President and Secretary, National Geographic Society*
LLOYD H. ELLIOTT, *President, George Washington University*
CRAWFORD H. GREENEWALT, *Director, E. I. du Pont de Nemours & Company*
GILBERT M. GROSVENOR, *Editor, National Geographic*
ARTHUR B. HANSON, *General Counsel, National Geographic Society*
CARYL P. HASKINS, *Former President, Carnegie Institution of Washington*
CARLISLE H. HUMELSINE, *President, The Colonial Williamsburg Foundation*
MRS. LYNDON B. JOHNSON
CURTIS E. LeMAY, *Former Chief of Staff, U. S. Air Force*
WM. McCHESNEY MARTIN, JR., *Former Chairman, Board of Governors, Federal Reserve System*
MELVIN M. PAYNE, *President, National Geographic Society*
LAURANCE S. ROCKEFELLER, *President, Rockefeller Brothers Fund*
ROBERT C. SEAMANS, JR., *Administrator, Energy Research and Development Administration*
JUAN T. TRIPPE, *Honorary Chairman of the Board, Pan American World Airways*
FREDERICK G. VOSBURGH, *Former Editor, National Geographic*
JAMES H. WAKELIN, JR., *Former Assistant Secretary of Commerce for Science and Technology*
JAMES E. WEBB, *Former Administrator, National Aeronautics and Space Administration*
ALEXANDER WETMORE, *Research Associate, Smithsonian Institution*
CONRAD L. WIRTH, *Former Director, National Park Service*

Trustees Emeritus
H. RANDOLPH MADDOX
BENJAMIN M. McKELWAY
LLOYD B. WILSON
LOUIS B. WRIGHT

COMMITTEE FOR RESEARCH AND EXPLORATION

MELVIN M. PAYNE, *Chairman*
EDWIN W. SNIDER, *Secretary*
ALEXANDER WETMORE, *Chairman Emeritus*

BARRY C. BISHOP, GILBERT M. GROSVENOR, MELVILLE BELL GROSVENOR, CARYL P. HASKINS, STERLING B. HENDRICKS, *Scientist Emeritus, U. S. Department of Agriculture*, THOMAS W. McKNEW, ROBERT C. SEAMANS, JR., T. DALE STEWART, *Physical Anthropologist Emeritus, Smithsonian Institution*, FREDERICK G. VOSBURGH, JAMES H. WAKELIN, JR., GEORGE E. WATSON, *Curator of Birds, Smithsonian Institution*, FRANK C. WHITMORE, JR., *Research Geologist, U. S. Geological Survey*, CONRAD L. WIRTH, LOUIS B. WRIGHT, and PAUL A. ZAHL, *Former Senior Scientist, National Geographic Staff*

Assistant Secretaries of the Society: FRANK S. DELK, JOSEPH B. HOGAN, ADRIAN L. LOFTIN, JR., LEWIS P. LOWE, RAYMOND T. McELLIGOTT, JR., EDWIN W. SNIDER. *Assistant Treasurer:* WARD S. PHELPS
Leonard J. Grant, *Editorial Assistant to the President*. Edwin W. Snider, Richard E. Pearson, *Administrative Assistants to the President*

Secretary's Staff: Administrative: Earl Corliss, Jr., Harriet Carey, Frederick C. Gale. *Accounting:* Jay H. Givans, Alfred J. Hayre, William G. McGhee, Martha Allen Baggett. *Membership Promotion and Statistics:* Charles T. Kneeland (Chief), Thomas M. Kent. *Educational Services:* Jerome P. Owecke. *Payroll and Retirement:* Howard R. Hudson (Supervisor); Mary L. Whitmore, Dorothy L. Dameron (Assistants). *Procurement:* J. P. M. Johnston, Thomas L. Fletcher, Robert G. Corey, Sheila H. Immel. *Member Relations:* Paul B. Tylor. *Publications:* Geneva S. Robinson. *Data Assembly:* Peter F. Woods. *Promotion:* Robert J. Warfel, Towne Windom, F. William Rath, Peter P. Jones. *Printing:* Joe M. Barlett, Frank S. Oliveto. *Production Control:* James P. Kelly, James M. Swartz. *Personnel:* James B. Mahon, Glenn G. Pepperman, Nellie E. Sinclair. *Medical:* Thomas L. Hartman, M.D. *Translation:* Zbigniew Jan Lalyk.

 Second-class postage paid at Washington, D. C., and additional mailing offices. Cover design and title protected by U. S. and foreign trademark registrations. $10 a year, $1.25 a copy.

NATIONAL GEOGRAPHIC MAGAZINE

MELVILLE BELL GROSVENOR *Editor-in-Chief and Board Chairman*
MELVIN M. PAYNE *President of the Society*
GILBERT M. GROSVENOR *Editor*
JOHN SCOFIELD *Associate Editor*

Senior Assistant Editors
Robert L. Breeden, James Cerruti, W. E. Garrett, Kenneth MacLeish, Jules B. Billard, Allan C. Fisher, Jr., Carolyn Bennett Patterson

Assistant Editors: Andrew H. Brown, William Graves, Robert P. Jordan, Joseph Judge, Edward J. Linehan, Samuel W. Matthews, Burt McDowell, Merle Severy, Howell Walker, Kenneth F. Weaver
Senior Editorial Staff: Thomas Y. Canby, William S. Ellis, Rowe Findley, Bryan Hodgson, Elizabeth A. Moize, John J. Putman, Gordon Young
Foreign Editorial Staff: Luis Marden (Chief); Thomas J. Abercrombie, David S. Boyer, Howard La Fay, Volkmar Wentzel, Peter T. White
Editorial Staff: Harvey Arden, Kent Britt, Mike W. Edwards, Noel Grove, Alice J. Hall, Werner Janney, Michael E. Long, John L. McIntosh, Ethel A. Starbird, George E. Stuart (Archeology)
Art Director: Howard E. Paine; Charles C. Uhl (Asst.), Robert E. Pullman
Research: Margaret G. Bledsoe (Chief); Ann K. Wendt (Associate Chief); Newton V. Blakeslee (Assistant Chief for Geographic Information); Carolyn H. Anderson, Susan L. Anderson, Judith Brown, Marcia M. Butler, Susan Day Fuller, Bette Joan Goss, Ann B. Henry, Jan Holderness, Levenia Loder, Jean B. McConville, Carol M. McNamara, Frances H. Parker, Lesley B. Rogers, Frances W. Shaffer, Michaeline A. Sweeney. *Correspondence:* Carolyn F. Clewell, Clifford R. Duffins
Library: Virginia Cartor Hills (Librarian); Patricia Murphy Smith (Assistant Librarian), Louise A. Robinson
Editorial Administration: Joyce W. McKean, Assistant to the Editor; Virginia H. Finnegan, Lucille L. McInerney, Winifred M. Myers, Shirley Neff, M. Jean Vile (Assistants); Jolene M. Blozis (Indexes); Evelyn Fox, Dolores Kennedy (Travel); Jeanne S. Duiker, Lorie Wendling, Mary Anne McMillen (Records)

ILLUSTRATIONS STAFF: *Illustrations Editor:* Herbert S. Wilburn, Jr. *Associate Illustrations Editor:* Thomas R. Smith. *Art Editor:* Andrew Poggenpohl. *Assistant Illustrations Editors:* David L. Arnold, O. Louis Mazzatenta, Charlene Murphy, Robert S. Patton, Elie S. Rogers, W. Allan Royce, Jon Schneeberger, Mary Griswold Smith. *Layout and Production:* H. Edward Kim (Chief). *Picture Editors:* Bruce A. McElfresh, Paula C. Simmons, Barbara A. Shattuck (Assistant). *Librarian:* L. Fern Dame. *Assistant Librarian:* Carolyn J. Harrison
Geographic Art: William N. Palmstrom (Chief); Walter Q. Crowe, John D. Garst, Jr. (Assistant Chiefs). *Artists:* Lisa Biganzoli, William H. Bond, John W. Lothers, Robert C. Magis, Ned M. Seidler, Lloyd K. Townsend. *Cartographic Artists:* Victor J. Kelley, Snejinka Stefanoff. *Map Editor:* John T. Blozis. *Research:* Virginia L. Baza, Dorothy A. Nicholson, Ann Rubinko. *Production:* Isaac Ortiz (Supervisor); Iskandar Baday, Elie Sabban, Leo B. Zebarth
Engraving and Printing: Dee J. Andella (Chief); William W. Smith (Assistant Chief); John T. Dunn, John R. Metcalfe, James R. Whitney

PHOTOGRAPHIC STAFF: *Director of Photography:* Robert E. Gilka. *Assistant Directors:* Dean Conger, Joseph J. Scherschel. *Photographers:* James L. Amos, James P. Blair, Victor R. Boswell, Jr., Bruce Dale, Dick Durrance II, Gordon W. Gahan, Otis Imboden, Emory Kristof, Bates Littlehales, Robert W. Madden, George F. Mobley, Robert S. Oakes, Winfield Parks, Steve Raymer, Robert F. Sisson (Natural Science), James L. Stanfield, Lilian Davidson (Administration). *Film Review:* Guy W. Starling (Chief). *Photographic Equipment:* John E. Fletcher (Chief), Donald McBain
Photographic Services: Carl M. Shrader (Chief); Milton A. Ford (Associate Chief); Jon R. Adams, Herbert Altemus, Jr., David H. Chisman, Lawrence F. Ludwig (Assistant Chief, Photolypography), Claude E. Petrone, J. Frank Pyles, Jr.; Joan S. Simms (Assistant)

RELATED EDUCATIONAL SERVICES OF THE SOCIETY

Cartography: William T. Peele (Chief); David W. Cook (Associate Chief). *Cartographic Staff:* Margery K. Barkdull, Charles F. Case, Ted Dachtera, Richard J. Darley, John F. Dorr, Russel G. Fritz, Richard R. Furno, Charles W. Gotthardt, Jr., Thomas L. Gray, Catherine M. Hart, Donald A. Jaeger, Harry D. Kauhane, Manuela G. Kogutowicz, Mary Anne McAleer, Charles L. Miller, Robert W. Northrop, Richard K. Rogers, John F. Shupe, Charles I. Stern, Douglas A. Strobel, Tibor G. Toth, Thomas A. Wall, Thomas A. Walsh, Charles M. Wilson III
Books: Jules B. Billard (Chief); Thomas B. Allen, Seymour L. Fishbein (Associate Chiefs); Ross Bennett, Charles O. Hyman, Anne Dirkes Kobor, David F. Robinson, Wilhelm R. Saake, Verla Lee Smith
Special Publications and School Services: Robert L. Breeden (Chief); Donald J. Crump (Associate Chief); Philip B. Silcott (Assistant Chief); William L. Allen, Josephine B. Bolt, David R. Bridge, Linda Bridge, Susan C. Burns, Jan N. Clarkson, Ronald Fisher, William R. Gray, Sallie M. Greenwood, Mary Ann Harrell, Suzanne J. Jacobson, Margaret McKelway Johnston, Geraldine Linder, Louisa V. Magoon, Robert Messer, Ursula T. Perrin, Cletis Pride, Tee Loftin Snell, Joseph A. Taney, Jennifer C. Urquhart, George V. White, Merrill Windsor, Peggy D. Winston. *National Geographic WORLD:* Ralph Gray (Editor); Charles H. Sloan (Associate Editor); Joseph B. Goodwin, Ellen Joan Hurst, Anne H. Oman, Patricia F. Robbins, Veronica Smith, James K. Wheat. *Books for Young Explorers:* Cynthia Ramsay. *Filmstrips:* Jimmie Abercrombie, James B. Caffrey, Margery G. Dunn, Jacqueline Geschickter, Jane R. McCauley, H. Robert Morrison, George Peterson, Judith E. Rinard
Recording Division: John M. Lavery (Chief)
News Service: Windsor P. Booth (Chief); Paul Sampson (Assistant Chief); Donald J. Frederick, William J. O'Neill, Robert C. Radcliffe
Television and Educational Films: Dennis B. Kane (Chief); Sidney Platt (Supervisor, Educational Projects); Carl W. Harmon, Jr., Patricia F. Northrop, Carl E. Ziebe, Marjorie M. Moomey (Chief of Research)
Lectures: Joanne M. Hess (Chief); Robert G. Fleegal, Mary W. McKinney, Gerald L. Wiley

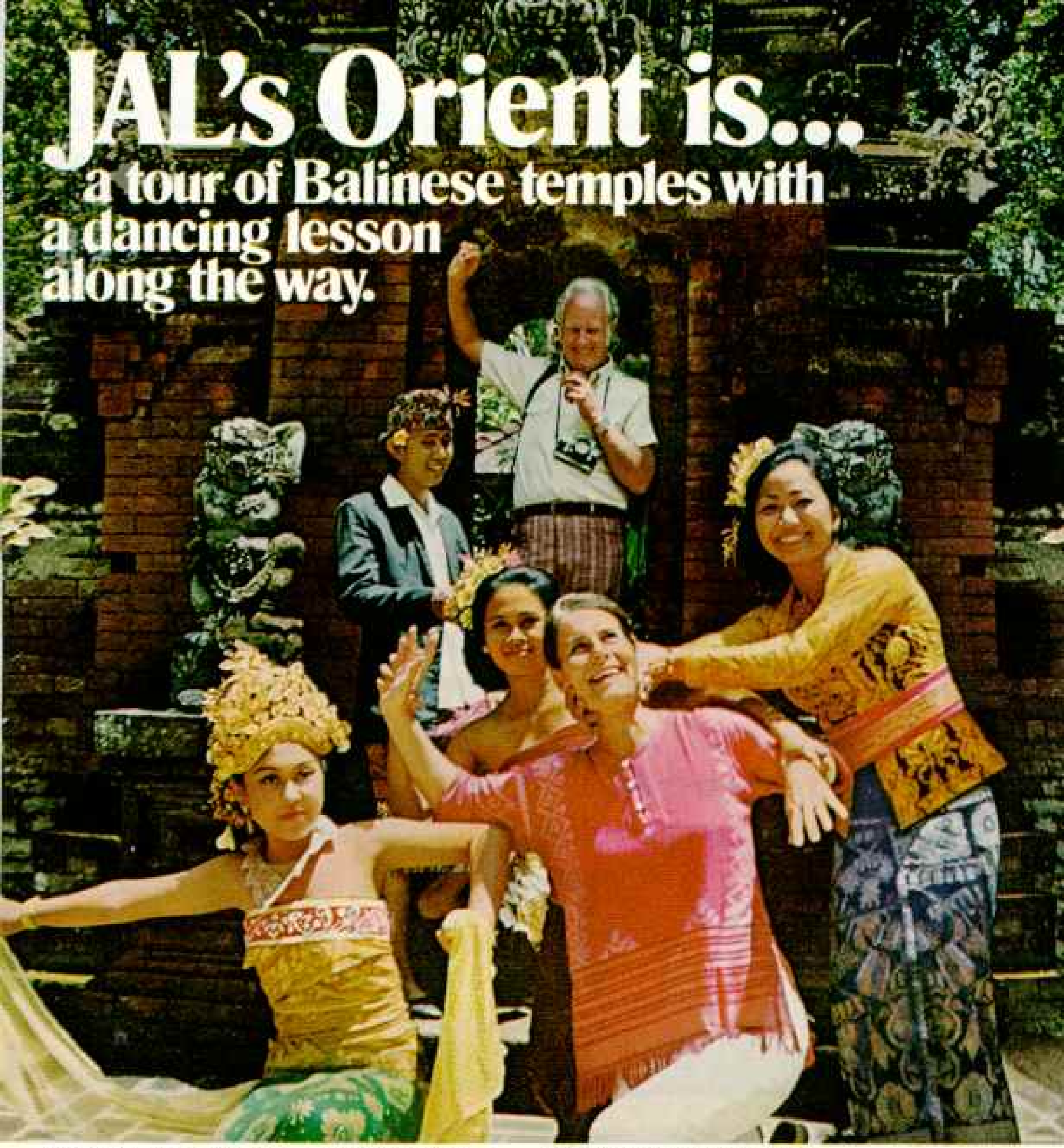
EUROPEAN OFFICE: W. Edward Roscher (Associate Secretary and Director), Jennifer Moseley (Assistant), 4 Curzon Place, Mayfair, London, W1Y 8EN

ADVERTISING: *Director:* James L. Till. *Manager of Agency Relations:* William Turgeon, 1251 Avenue of the Americas, New York, N.Y. 10020. *Regional managers—Eastern:* George W. Kellner, New York. *Midwestern:* Robert R. Henn, Chicago. *San Francisco:* Cecil H. London. *Los Angeles:* Jack Wallace. *Canada:* Robert W. Horan, New York. *Automotive:* John F. Grant, New York. *Travel:* Gerald A. Van Splinter, New York. *European Director:* Richard V. Macy, 21 rue Jean-Mermoz, Paris 8e, France. *Production:* E. M. Pusey, Jr.

POSTMASTER: Send change of address form 3579 and undelivered copies to National Geographic, 17th and M Sts. N.W., Washington, D. C. 20036.

JAL's Orient is...

a tour of Balinese temples with a dancing lesson along the way.



The Orient is like nowhere else. To get the full flavor—your very first trip—go with the airline that was born there. Go with JAL.

JAL's Happi Holidays tours do more than show you the sights. We try in a thousand and one ways to help you make friends with our friends.

Our Orient Caravan (tour #2002, 22 days, $2335*) escorts you to Bali, plus canoe trip into the wilds of North Borneo. Also Japan, Bangkok, Singapore, Hong Kong. All meals, deluxe hotels.

On Orient Holiday (tour #3000, 24 days, $2826*) join our dinner party at Mandarin Palace in Taiwan. Do Tokyo, Nikko, Kamakura, Atami, Kyoto, Manila, Bangkok, Hong Kong. Most meals, deluxe hotels.

Follow our Asian Sun (tour #5500, 16 days, $1178*) to Tokyo, Kyoto, Bangkok, Singapore, Hong Kong. Optional low-cost gourmet tour.

On Pacific Affordables/Japan (tour #7700, 15 days, $907*) explore Tokyo, Kyoto, 7 other Japanese cities.

EXPO '75—ask your travel agent about including a stopover at this fabulous international fair of The Sea, Okinawa, July 1975–January 1976.

For free "JAL's Orient" booklet and complete information on these JAL Happi Holidays tours and others, see your travel agent.

Or write Japan Air Lines, P.O. Box 455, Old Chelsea Sta., New York, N.Y. 10011.

JAL's Orient is the experience of a lifetime.

*Price includes land arrangements and round trip air fare from the West Coast. (Prices are subject to change and are based on double occupancy in hotels and G.I.T. Economy basic season air fare. Additional charge for June-October peak season.)

making friends

HAPPI HOLIDAYS

JAPAN AIR LINES

...We get people talking (To 23,000,000 people we're the telephone company)...We brighten their lives (Sylvania lighting for home, industry and photography)...We entertain them (Sylvania color TV and stereo)...and we serve their needs in a lot of other ways: street lighting, microwave systems, earth stations for Comsat, electronic telephone equipment, powder metallurgy, specialty inorganic chemicals, television picture tubes, data transmission, quadraphonic receivers, circuit breakers, telephone directories, mine-drilling bits, printed circuit boards, alumina ceramics, motor control centers, electrical metering equipment, electronic security systems, tungsten wire, video terminals, projector lamps, welding electrodes, Sun Gun™ movie lights, airport electronics, automotive flashers, electro-optic systems, digital multiplexers, transceivers.

...We're General Telephone & Electronics, a growing concern for your growing needs.

General Telephone & Electronics, One Stamford Forum, Stamford, Conn. 06904

PATRICK E. SMITH (ABOVE); ALBERT P. GIANNINI

Salute to courage

FEW MEN HAVE EVER DARED SO MUCH: To set off alone from Sydney, Australia, in a 32-foot sloop (**right**) on a round trip to Antarctica, braving hurricane-force winds on earth's stormiest seas. In next month's NATIONAL GEOGRAPHIC, Dr. David Lewis (**above**) describes the second leg of his epic adventure in *Ice Bird*; the first part appeared in the December 1973 issue.

Altogether, the solitary sailor endured six and a half months at sea, traversing 11,000 miles. Thrice capsized and twice dismasted, *Ice Bird* had to abandon the original mission and end her ill-fated odyssey in Cape Town, South Africa. Even so, Dr. Lewis became the first to sail single-handed to and from Antarctica. Share such stirring sagas; nominate friends for membership on the form below.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

$12.75

18-MONTH MEMBERSHIP, JULY 1975 THROUGH DECEMBER 1976

Mail to: The Secretary
National Geographic Society
Post Office Box 2895
Washington, D. C. 20013

CHECK ONE

18-MONTH DUES in the United States and throughout the world are $12.75 U. S. funds or equivalent, which is 1½ times the annual fee. To compensate for additional postage and handling for mailing the magazine outside the U.S.A. and its outlying areas, please remit for Canada $14.50 in Canadian or U. S. funds; for all other countries $16.50 by U. S. bank draft or international money order. 80% of dues is designated for subscription to the magazine.

MEMBERSHIP DUES include subscription to the magazine. Upon expiration 18-month memberships are renewable on a calendar-year basis.

LIFE MEMBERSHIP is available to persons 10 years of age or older. The fee for U. S. (including its outlying areas) and Canada is $200 U. S. or Canadian funds; for all other countries $250 by U. S. bank draft or international money order.

☐ **I WISH TO JOIN** the NATIONAL GEOGRAPHIC SOCIETY and enclose my dues $_____

(FILL IN NAME AT LEFT.)

☐ **(GIFT MEMBERSHIP)** I nominate and enclose $_____ for dues of the person named at left.

Send gift card signed: _____

☐ **I NOMINATE** for Society membership the person named at left. (Use separate sheet for additional nominations.)

NEW MEMBER _____
PRINT NAME OF AN INDIVIDUAL ONLY (MR., MRS., MISS)

_____
STREET

_____
CITY, STATE, ZIP CODE

MY NAME _____
PLEASE PRINT (MR., MRS., MISS)

_____
STREET

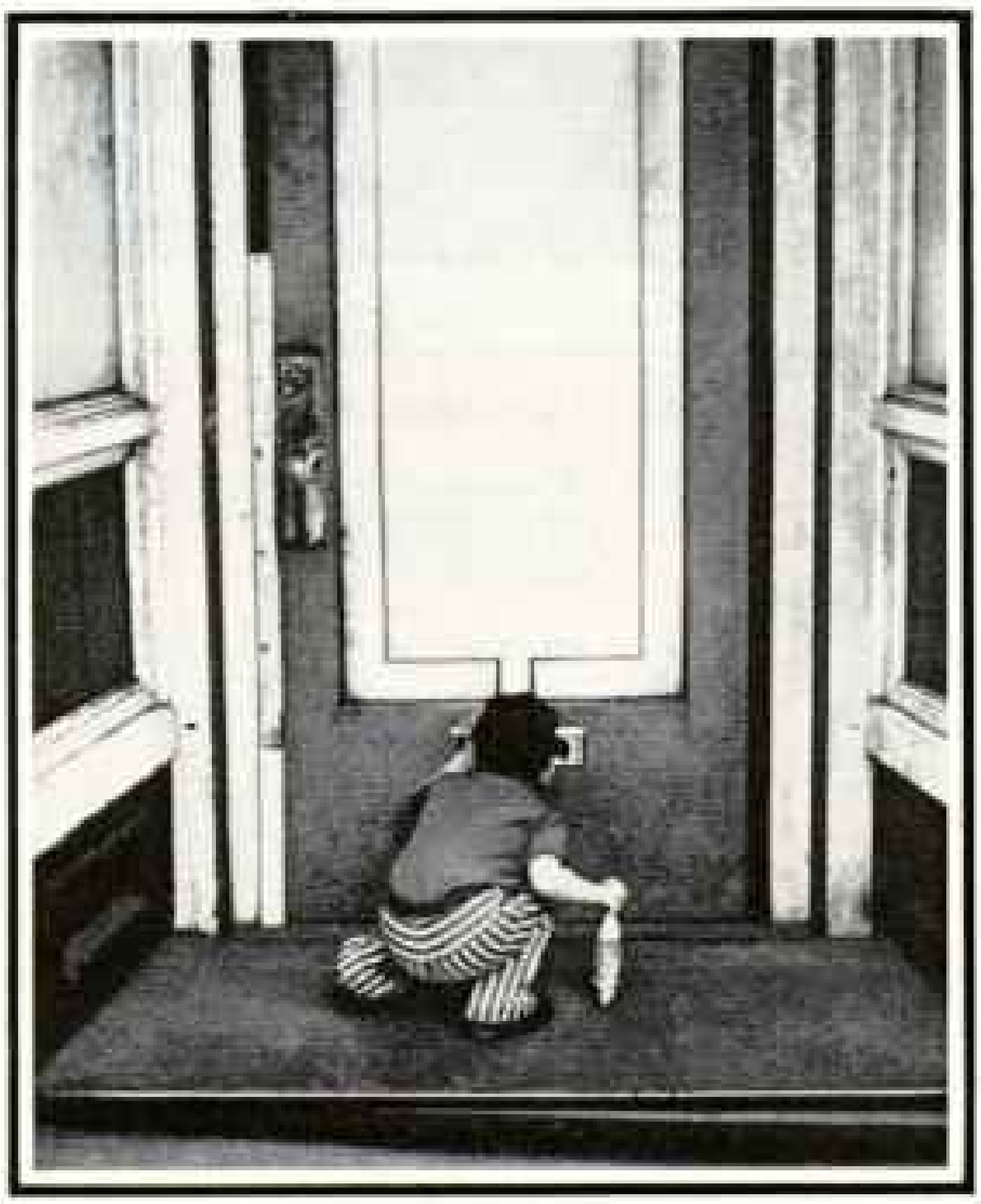
_____
CITY, STATE, ZIP CODE

M775

one incredible collar for fleas and ticks

It's different! It's better!
The only collar you activate — just a snap and these collars are ready to give your pet continuous protection against the misery of both fleas *and* ticks! Unconditional money back guarantee

Minolta helps you discover a new world.



A Minolta SR-T 35mm reflex can help you share the wonder of discovery by not holding you back.

You're comfortable with a Minolta SR-T from the moment you pick it up. Because the viewfinder shows all the information needed for correct exposure and focusing, you never lose sight of your subject.

And for a different perspective, Minolta SR-T cameras accept a complete system of interchangeable lenses, from "fisheye" wide angle to super-telephoto.

Look into the fast handling Minolta SR-T and discover your own new world. For more information, see your photo dealer or write Minolta Corporation, 101 Williams Drive, Ramsey, New Jersey 07446. In Canada: Anglo-photo Ltd., P.Q.

Minolta SR-T Cameras

The First Bicentennial Bell

PAUL REVERE'S RIDE

LIMITED EDITION

- ★ The first in a series of six china bells to be issued in 1975 and 1976 to commemorate, in vivid color, the key 1775-1776 historic events in the birth of America.
- ★ Beautiful personal heirlooms of our nation's proud Bicentennial celebration.
- ★ This first Bicentennial Bell will be issued in a limited edition only for orders postmarked by July 31, 1975.
- ★ Each bell will be hallmarked and registered by The Danbury Mint.
- ★ Priced at only $25.00.

Bell Shown Actual Size (6")

PAUL REVERE rode in 1775 to foil British plans for a surprise attack at Lexington and Concord. Since then, the clatter of his horse's hoofbeats has echoed through the centuries. His ride remains a stirring and fateful moment in the history of America — a reminder of the brave men who risked their lives and fortunes so that we might be free today.

Now, as the world celebrates 200 years of American freedom, we re-dedicate ourselves to the American ideal by recalling the proud deeds of patriots such as Paul Revere. To commemorate the 200th anniversary of his ride, The Danbury Mint will issue its first Bicentennial Bell.

This beautiful porcelain heirloom will be available only briefly in a limited edition which closes forever on July 31, 1975. After that date, this first Bicentennial Bell will be available only from original owners willing to part with it, and only at their asking price, whatever that might be.

Experience suggests that few of these bells will ever reach the open market. Most will be kept as prized reminders of our Nation's Bicentennial, and proudly passed on to future generations of Americans.

A-144 — Must be postmarked by July 31, 1975

The Danbury Mint

The Danbury Mint
10 Glendinning Place
Westport, Connecticut 06880

Please enter my order for ____ first Bicentennial Bell(s) commemorating Paul Revere's ride. My check or money order is enclosed at the rate of $25.00 (plus $1.25 postage and handling) per bell.*

Please notify me as additional Bicentennial Bells are issued in the future, so that I may decide whether to purchase them.

Name _____

Address _____

City _____ State _____ Zip _____

*Connecticut residents add $1.84 per bell to cover sales tax.

Make check or money order payable to THE DANBURY MINT.

"Fixing up these country roads takes a lot of tax dollars."

Opposing views? Perhaps, but both are right. We have to be concerned about government expenditures. Most rural roads were built before 1930, and it often requires large sums to update them for today's farm-to-market traffic.

But it's also true that without usable roads we can't maintain present food production—much less meet the larger needs of tomorrow.

Our rural transportation system is falling farther behind every day. National and world food requirements call for massive amounts of fertilizer, fuel, equipment, chemicals, seed, feed and livestock to move to our farms—and for ever larger harvests to move to market. Yet we have 46,000 fewer miles of railroad—mostly rural—than in 1940. Another 78,000 miles are proposed for abandonment.

The result is severe overloading of roads two generations old. Roads designed for far less traffic and far lighter vehicles. Ninety-five percent of pre-1935 rural bridges are still in use. Many of them were built to carry 2-ton loads. Many of today's grain and livestock trucks can carry 20 tons or more.

In areas where rural transportation becomes inadequate, farm income is lower. Fields are taken out of crop production. Land values decline. There is less incentive to make the capital investment and personal commitment required for productive, profitable farm operation.

Despite the need for food today, we obviously can't spend all of our tax dollars just to improve rural roads. We can, however, give farm-to-market roads a higher priority in total highway expenditures.

Caterpillar is concerned because we manufacture machines used in construction and maintenance of roads. More importantly, we recognize that the ability to grow and distribute more food with lower costs is vital to the social and economic well-being of our nation.

There are no simple solutions. Only intelligent choices.

CATERPILLAR

Caterpillar, Cat and ⊞ are Trademarks of Caterpillar Tractor Co.

"Good roads help us grow more food–and keep costs lower."

Your kids are invited to a birthday party.

In fact, your whole family is invited. To celebrate the 200th anniversary of America's birth right here in Pennsylvania, where it all happened. With pageantry, parades, and history come alive.

It only happens once in your lifetime, or in your children's. And, because a Bicentennial visit fits even the tightest family budget, there's no reason to miss it.

Plan ahead now. Don't miss the birthday party of a lifetime.

Find out about all the wonderful things Pennsylvania's planning for you in 1976. Here's your personal invitation.

Pennsylvania,
The Nation's Host
for our 200th Birthday

cordially invites you
to send for your
free "Bicentennial Package."

RSVP to
Travel Pennsylvania 1976,
Room NG5, South Office Building
Harrisburg, Pennsylvania 17120

Milton J. Shapp, Governor

Bicentennial Pennsylvania 1976

So your children can tell their children.

IF THE PICTURE'S WORTH THE TAKING,

IT'S WORTH GOOD PROCESSING.

Taking a good picture doesn't just depend on who takes it– and with what. Processing can make a world of difference. And that's why it's so important to choose a quality processing service. Someone who can make the picture worth the taking. So, when you leave your Kodak color film for developing, ask your dealer for quality service by Kodak or one of the many other quality photofinishers.

A message from Eastman Kodak Company on behalf of photo dealers and finishers.

Change of Address?

(Please give six weeks notice.)

1. Print your new address below:

NAME

ADDRESS

CITY, STATE, ZIP CODE

2. Attach the address label from your NATIONAL GEOGRAPHIC Magazine wrapper here, so your record can be updated.

Paste Label Here

3. Clip this entire form and mail to: **National Geographic Society, Washington, D. C. 20036**

The right way to use an aluminum can is to use it again.

The aluminum can is lightweight, chills quickly and keeps beverages fresh and flavorful. It's also easy to recycle. Used aluminum cans are baled or shredded and shipped out from the reclamation center, then remelted and fabricated into brand-new cans. Recycling is important because it saves energy and gives aluminum new life, over and over. That's why Alcoa supports recycling programs throughout the country.

Aluminum cans are being remelted with only five percent of the energy it took to make molten metal from the ore in the first place. Recycling saves natural resources, too. You can see that recycling cans is beneficial to all of us. In the future, the high value of aluminum scrap could help make it economically attractive to recycle municipal solid waste.

The point is that a used aluminum can has become far too valuable to waste. Alcoa's "Yes We Can" recovery program is just one way of making certain that we don't ignore one of the valuable resources of our country.

Over 30 million dollars have been paid to collectors through the combined recycling efforts of the aluminum and beverage industries. Since 1970, almost six billion cans have been recovered. There is no doubt that the collection and recycling of aluminum cans is working. More than two billion were collected last year, and the number is growing.

For more information on aluminum can recycling and how one community established a reclamation program, please write for our free brochures. Aluminum Company of America, 975-G Alcoa Building, Pittsburgh, PA 15219.

The reasons for using aluminum are found in aluminum itself.

ALCOA

For Unforgettable Steak, Clip This Coupon.

A truly great steak is a memorable experience. You see it in your mind's eye. You smell its fragrance. You taste it over and over again.

Such great steaks are Pfaelzer steaks. Juicy and tender, unforgettable.

Guaranteed money-back if your steaks do not arrive in perfect condition. They're fast-frozen before shipping and packed in a reusable styrofoam cooler.

If you really love great steak, order from Pfaelzer.

LIKE TO GRILL?

Try the Pfaelzer Grill Assortment. As many as ten meals for a family of four.

☐ Grill Assortment #31008 $106.00
12-8 oz. boneless top sirloin steaks
12-8 oz. chopped sirloin steaks
16-6 oz. loin lamb chops
8-10 oz. half slabs barbeque spare ribs

Add applicable sales/use tax: _____

Total: _____

☐ Please send your free full-color catalog.

☐ Here's my check. ☐ Please bill me:
☐ Master Charge: ☐ American Express
Card # _____ Expiration Date _____
If Master Charge, enter 4-digit interbank number appearing above your name: _____
Allow 14 days for delivery.

Name

Address

City State Zip

Telephone

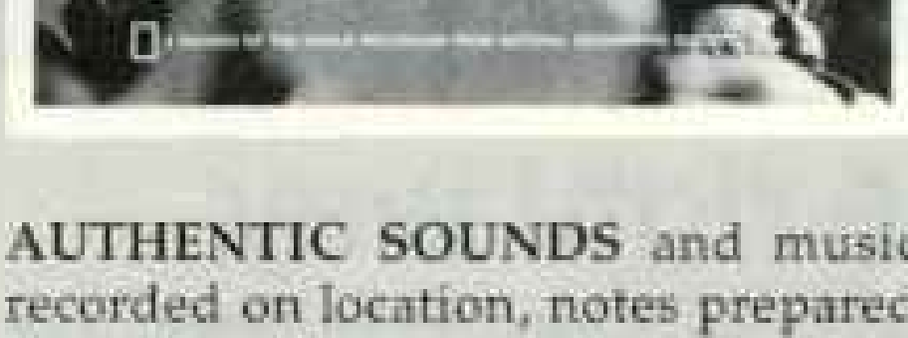
Mail to: Pfaelzer Brothers, 4501 West District Boulevard, Chicago, Illinois 60632 Telephone (312) 927-7100

pfaelzer BROTHERS

UNFORGETTABLE STEAKS

NATIONAL GEOGRAPHIC SOUNDS OF THE WORLD.

Lively listening for the entire family.



AUTHENTIC SOUNDS and music recorded on location, notes prepared by outstanding musicologists, color-illustrated brochures. Choose from eight albums (12" LPs *or* audio cassettes), just $4.95 each plus postage and handling. You will be billed upon delivery, but pay *only* for the records you wish to keep.

NATIONAL GEOGRAPHIC SOCIETY
Washington, D. C. 20036

Please send me the albums checked below. Bill me, satisfaction guaranteed, just $4.95 each plus postage and handling, upon delivery.

	12" LP	Cassette
The Music of Scotland	☐ 07707	☐ 07717
The Music of Hawaii	☐ 07706	☐ 07716
Songs and Sounds of the Sea	☐ 07705	☐ 07715
The Music of Spain	☐ 07704	☐ 07714
Music of the Ozarks	☐ 07703	☐ 07713
The Music of Tonga	☐ 07702	☐ 07712
The Music of Trinidad	☐ 07701	☐ 07711
The Music of Greece	☐ 07700	☐ 07710

NAME

ADDRESS

CITY, STATE, ZIP 80

You don't have to live near the water to live near the water.

Flickering reflections sprinkle ever-changing patterns on the surface. Underwater formations paint areas of contrasting colors and hues, creating wonders never seen from any other vantage point.

Looking down from your Beechcraft Baron gives you an entirely new perspective on the world you saw only at ground level before. Or from an airliner six miles high.

Whatever adventure beckons: sailing, snorkling, speedboat racing or big game fishing, your own Beechcraft Baron can be the difference between daydreaming and doing. And it makes getting there at least half the fun.

A weekend becomes a mini-vacation when an hour of leisurely flight can replace a long half-day on the road. (And thousands of people, just like you, learn to fly each year, in a lot less time than they had imagined.) Here's something else they may not have imagined. Time isn't the only saving when you travel in a Beechcraft Baron. On many trips it will actually use less fuel than a standard-size automobile.

The Beechcraft Baron is a limited-production aircraft, a careful blend of hand-craftsmanship and the most advanced manufacturing processes. The cabin can be styled to reflect your individual taste, surrounding you with elegance and comfort.

Make your move now to gain a new perspective on the world. We can help. We designed a unique adventure package for National Geographic readers.

Understanding your bent for the unusual, the out-of-the ordinary, we put together a guide to unusual, out-of-the ordinary places and events in the U.S.A. It's one of a kind, available only from Beech Aircraft. We call it the Beechcraft Adventure Kit, and we would like to send you one free of charge.

THIS IS NOT A COUPON

We think a magazine as beautiful as National Geographic shouldn't be clipped. So write to us on your letterhead instead.

We'll send your Beechcraft Adventure Kit by return mail, absolutely free. And we know you'll like it.

Write to Beech Aircraft Corporation, Department A, Wichita, Kansas 67201.

Please include name, address, occupation and title. Also, please let us know if you're already a pilot.

The Beechcraft Baron 58