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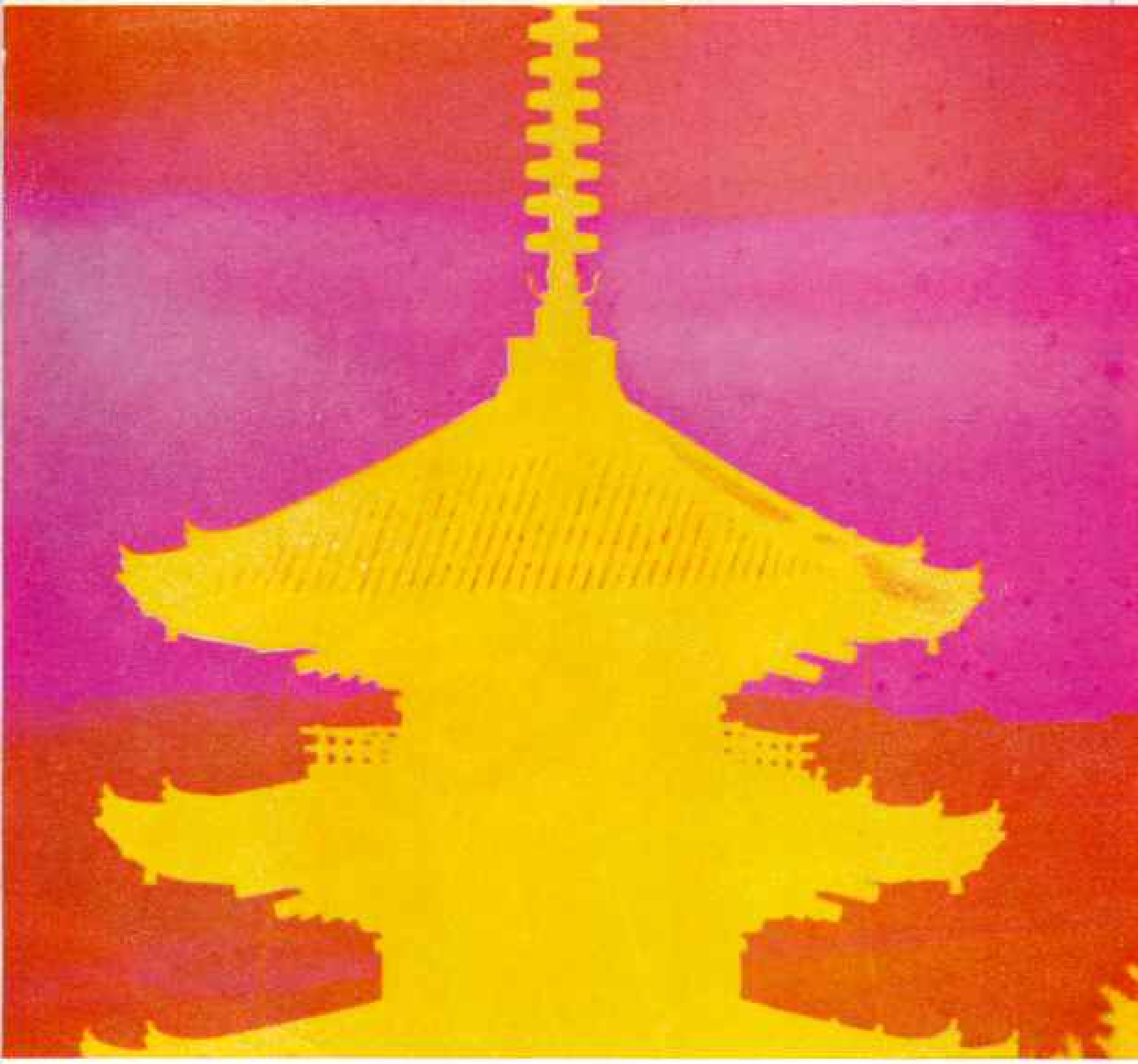

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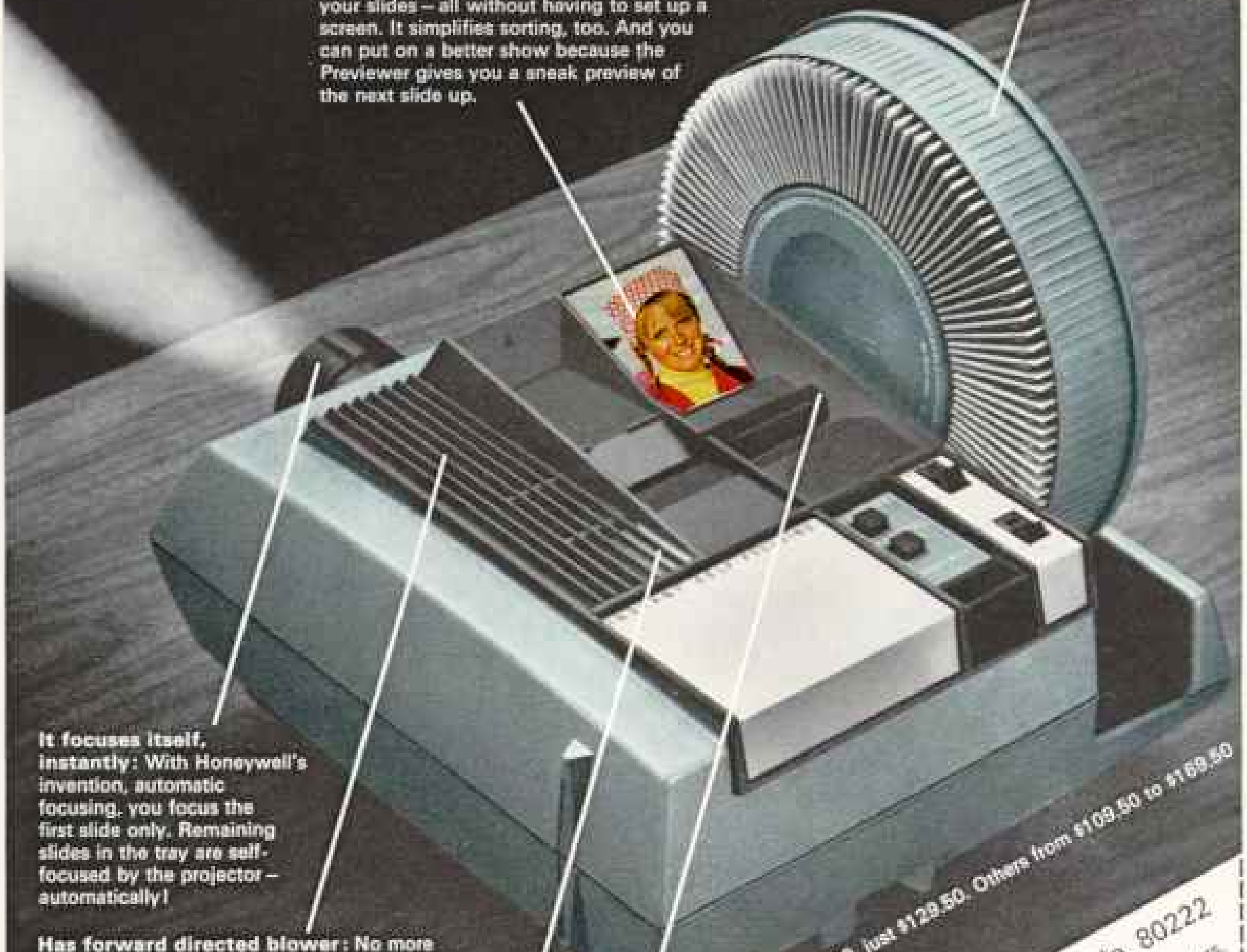

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When Jersey's scientists invented Butyl rubber more than thirty years ago, they never dreamed their invention would be used to line a reservoir. But already several hundred reservoirs have been lined this way. This one happens to be the biggest in the world.

You'll find it on the Hawaiian island of Molokai, where they have a water problem. It rains in the mountains. But, down where the pineapples grow, it doesn't rain enough. So they have to pipe the rain from the mountains and store it. Hence this mighty hole.

To give you some idea of scale, the area covered by the nylon-reinforced Butyl could hold a hundred football fields.

Mr. David Wisdom, president of Wisdom Rubber Industries, the company that lined the

reservoir.

reservoir, said that Butyl rubber was chosen by the state of Hawaii for good reasons. Compared with concrete it is inexpensive. Roughly a tenth the cost. Yet, as a water barrier, there's nothing to beat it.

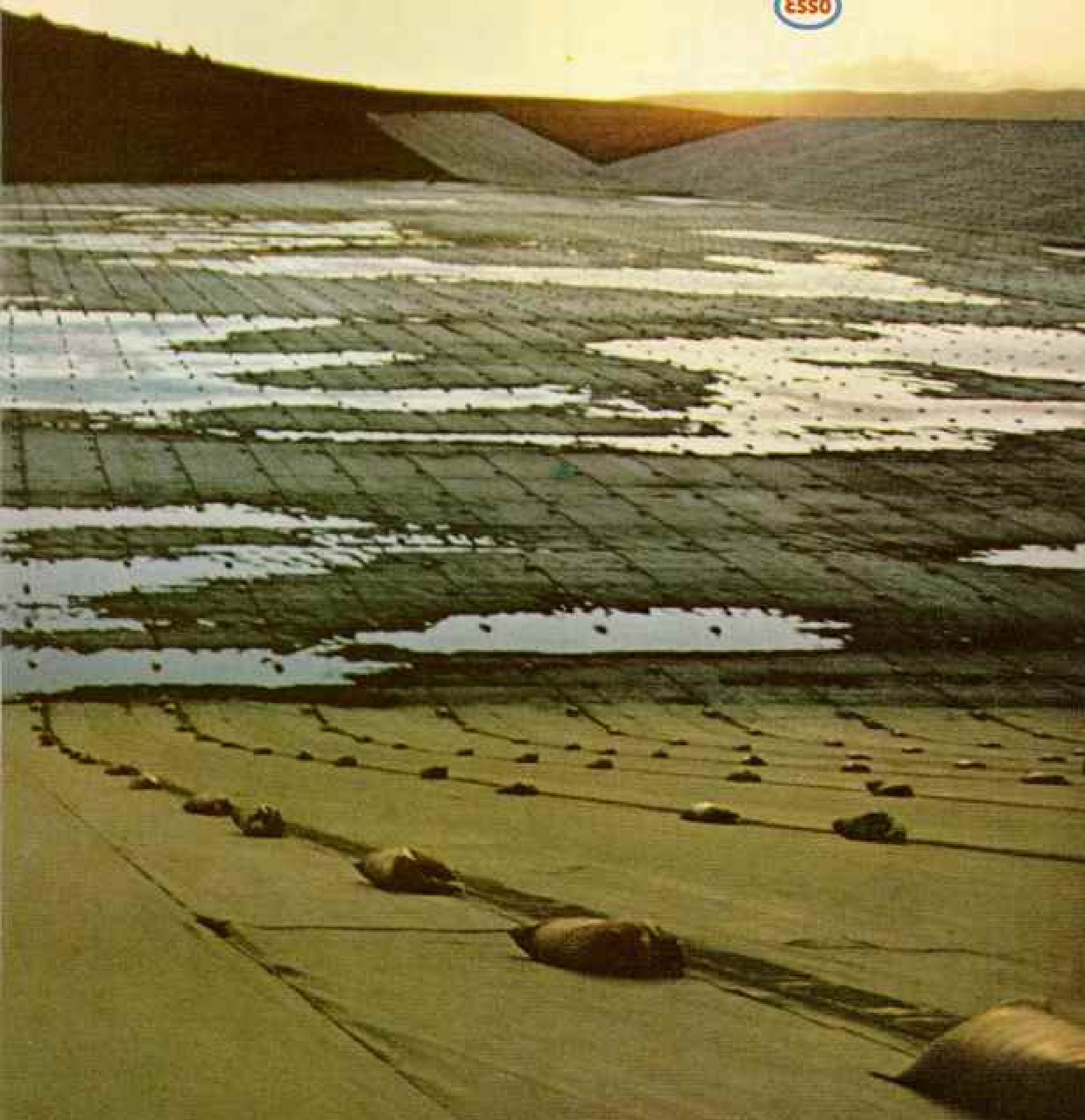
Installation is remarkably speedy. Seventy workers were trained in two weeks. They then lined the entire reservoir in seventy-four days. And Butyl is as tough as blazes. So tough that Mr. Wisdom has guaranteed his reservoir against deterioration for twenty years.

The effect of the reservoir on Molokai's economy will be considerable. It will irrigate some 18,000 acres of land, most of which will grow pineapples. But there is also a truck farming experiment in the area that may well turn Molokai into the breadbasket of the state.

Our scientists are proud that one of their inventions is being put to such good use.

Standard Oil Company
(New Jersey)

Esso



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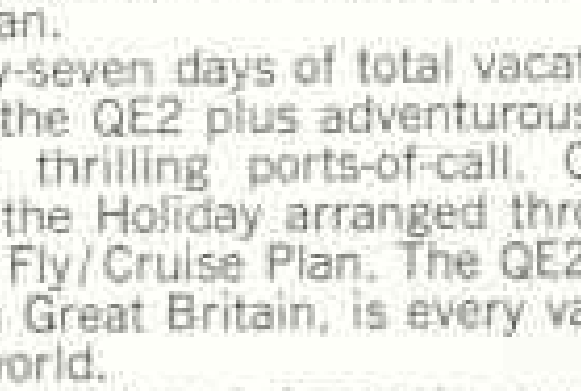

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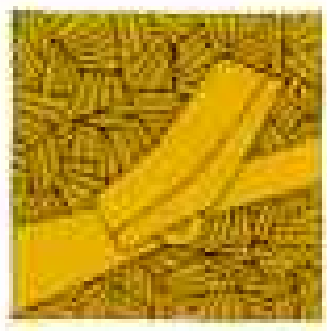

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Japan's most beautiful gardens blossom aboard the world's most spacious jet.

Starting this summer, during EXPO '70, the first of eight JAL 747 jets will cross the Pacific. Outside it will be the biggest commercial airliner ever developed. Inside it will feature the most extraordinary decor ever created.

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First Class will have the elegant Garden of Wisteria with an upstairs lounge called Teahouse of the Sky.

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There will be wide screen movies, stereo entertainment and the finest of international beverages and cuisine.

Best of all, there will be more of what legends are made of—our lovely hostesses in kimono who will pamper you throughout your flight. And introduce you to the subtle delights of Japanese comfort and hospitality.

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FACE TO FACE

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Cadillac '70

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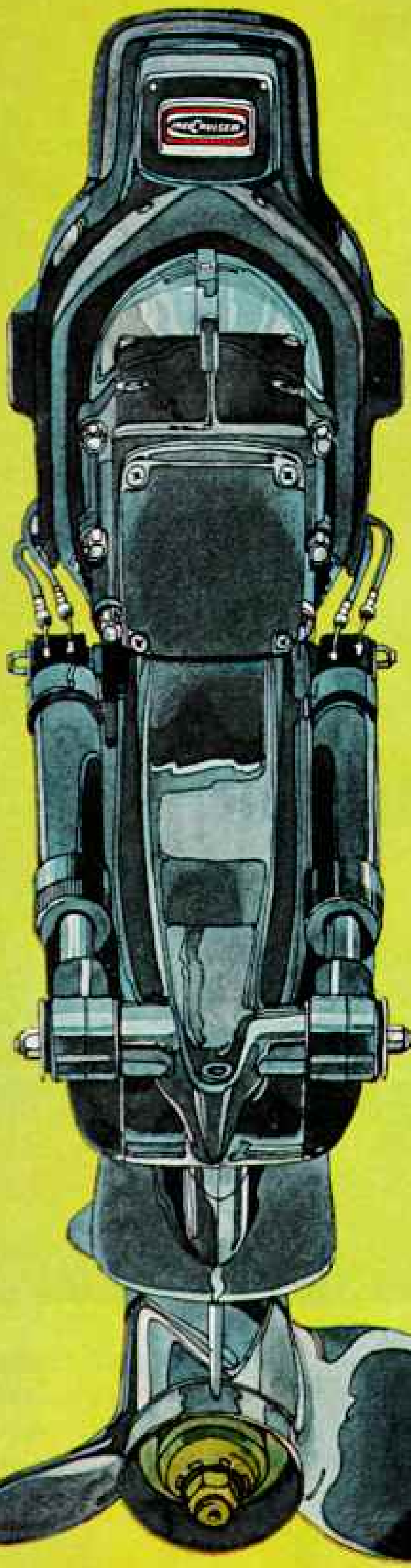

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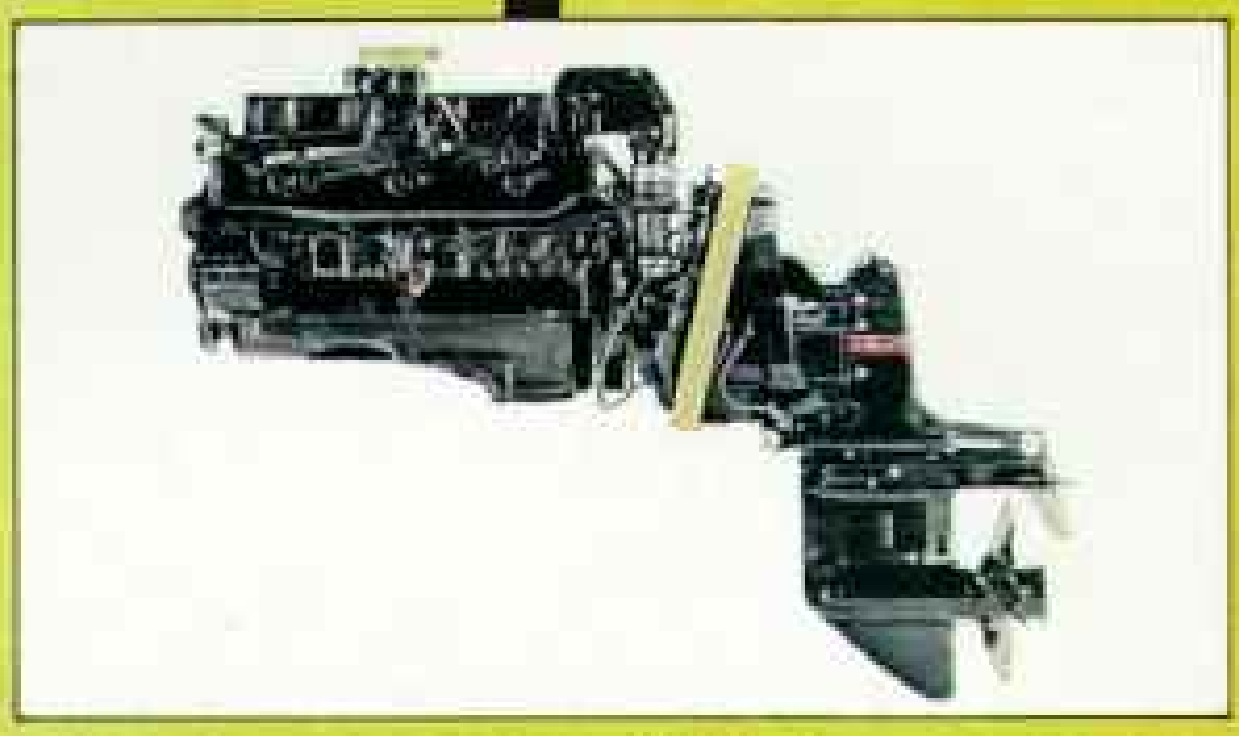

This sleek mechanism is a MerCruiser stern drive. The result of a perfect marriage between computer technology and experienced marine craftsmanship. Engine, drive, prop, even the controls—are designed for each other by Kiekhaefer Mercury engineers.

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MerCruiser is a complete marine propulsion system. Everything from prop to tach designed and matched for precision handling, maximum performance. Before you buy a new boat or repower the one you've got, get the INSIDE STORY on MerCruiser from your dealer. He can find the perfect match for you.

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関西 KANSAI

Japan's Historic Heartland

ARTICLE AND
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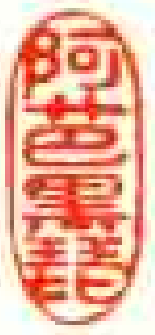
THOMAS J. ABERCROMBIE
National Geographic Foreign Editorial Staff



TO WESTERN EYES, Japan seems a topsy-turvy land. Entering a house, you take off your shoes, not your hat; you scrub yourself outside the bathtub, not in it. Japanese mourners wear white. "Footnotes" are printed at the top of the page; few gardens have flowers. Wine is heated, but fish is served raw. Cats have no tails, and women help men off with *their* coats. The island-bound Japanese, insulated from the rest of the world for centuries, have developed a culture distinctly their own.

Hundreds of thousands of foreigners will encounter that culture's pleasures and paradoxes this month when Expo '70, Asia's first world's fair, opens outside Osaka in the region known as Kansai. Here, thriving side by side in a heady blend of kimonos and computers, of geisha and Geiger counters, Buddha and Bach, is not one Japan, but two.

Recently I spent three months commuting between Japan past and Japan present. Each day brought new surprises. I remember one morning in Kyoto; it was after the Hollyhock Festival—and fresh spring had given way to the stillness of oppressive summer.

What woke me was the distant call of the Zen monks on their rounds, begging along the narrow street below. It was still early; the first light of morning barely outlined the rice-paper panes of my window. I reached for my *yukata*, a light cotton kimono, and padded barefoot across the room to peer out.

"*Oooeeee! Oooeeee!*" Louder now.

I caught a glimpse of a holy man as

Japanese characters at upper right, in Kanji script, denote the syllables *kan* and *sai*, for Kansai, the region "west of the barrier" (map, page 301). In the red seal, four stylized characters (top to bottom) make up the author's last name: *ah boo crow bee*.

Apprentice to tradition, a *maiko*, or geisha-in-training, strolls through the streets of Kyoto. Member of a famed but dwindling sorority of entertainers, she displays a beauty as delicate as a butterfly's wing, and a poise as polished and sure as a Samurai's sword. Living symbol of old Japan, she glows with an inner radiance not to be outshone by the electronic glitter around her.

Here in the area called Kansai, in west-central Honshu, Japan's main island, the future sweeps the present along in a furious rhythm of change. Expo '70, the Japan World Exposition, opening this month near Osaka, will focus a gigantic lens on this tumultuous transition. Yet, beneath the cacophony of progress, the pulse of the past misses not a beat. One need only pause for a moment to experience it—in the precision of a Japanese tea ceremony, in the tranquillity of a formal rock garden, in the depths of a geisha's eyes.

EKTACHROME © NATIONAL GEOGRAPHIC SOCIETY

he moved quickly from gate to gate, dressed in short black robe and rice-straw sandals. He carried his broad coolie hat in hand, baring a shaved skull. Around his neck he wore a cloth bag to carry his alms—50-yen coins or packets of boiled rice.

Downstairs I could hear my landlady, the widow Masumoto, rattling in the cupboards for her offering to the ascetics. There is little real begging in today's Japan; for these seekers after enlightenment it was merely an ancient ritual, one form of Zen discipline.

Elegance Created by Tasteful Simplicity

As I splashed morning drowsiness out of my eyes at the cold-water faucet down the hall, prayers floated up through the inner garden in soft monotones:

"*Kan Jizai Bosatsu, gyo jin hannya hara mitta.*" Mrs. Masumoto and Sumi-san, the maid, were chanting in unison before the small garden shrine. "Buddha came into this world to search for truth."

My room at the Masumoto *ryokan*, or inn, was delightfully Japanese: small, low, and somewhat Spartan by Western standards. But its very simplicity created an air of elegance. The cypress posts and the cedar planks had been chosen with care, fitted with precision, and polished with devotion. The floor was covered with *tatami*, stiff panels of tightly woven straw, untouched by shoes. Mine was a "six-mat room," an average size—about 9 by 12 feet. The absence of furniture, the paper doors—mere sliding screens that opened onto the garden below—made the room seem far larger than it really was.

The smell of green tea wafted in, followed by Sumi-san with a steaming cup.

"*Ohayo gozaimasu,*" she chirped, bowing outside the door. Her good-morning greeting was cheerful as the first sunlight.

The Masumoto ryokan stands in the heart of the quiet neighborhood called Okazaki, typical of many tucked away in Kyoto, Japan's fifth largest city. After breakfast I strolled appreciatively through this pleasant quarter, where traditional houses of weathered pine, roofed with gray tile, lined narrow lanes. Brown stucco walls and fences of bamboo screened the small gardens of ferns, miniature maples, and Japanese pines. An old man in a kimono click-clacked past on high wooden clogs, pulled along by his dog. Then, suddenly, I came to the end of Okazaki's old-fashioned enclave. I stepped out of old Japan onto a bustling street—Marutamachi Dori—and into another world!

Kadowaki-san—my friend and interpreter, young Kunio Kadowaki—was waiting at the curb in his Datsun Bluebird. With a honk we churned into the moving maze of streetcars, motorbikes, trailer trucks, sports cars, and tourist buses and swung left onto Kawaramachi Dori, Kyoto's main thoroughfare.

Slowly we inched along with the traffic, now bumper to bumper, door handle to door handle. Swarms of pedestrians choked the sidewalks as they hurried past the big department stores, bookshops, fashionable boutiques, coffeeshops, and through the crowded arcades crammed with cameras, color TV's, golf clubs, electronic calculators, the latest cassette tapes of Joan Baez, the Beatles, and Jefferson Airplane, and desk globes of the moon. This was the other Japan, the one in which the Westerner feels more at home.

Old and New Are Still Good Neighbors

Nowhere is Japan's split personality more apparent than in the Kansai region, which includes Nara, Osaka, and Kobe, as well as Kyoto. Kansai means "west of the barrier," and, indeed, it originally included all the main island of Honshu west of Mount Fuji. Its scope has narrowed to embrace only seven prefectures (map, page 301). Broad basins, fertile plains, and an important natural harbor characterize Kansai where, some 2,000 years ago, Japanese civilization was born. Today, booming industry thrives there amid temples and tradition.

Kyoto, my home for three months, was Japan's capital for more than a millennium. Though the government moved to Tokyo a hundred years ago, emperors are still crowned in Kyoto. The Buddhist temple of Horyuji, in a village near Nara, has the world's oldest wooden buildings. Both Nara, a religious center, and Kyoto lie within 30 miles of Japan's

Swinging in the rain, Japan's "now" generation invades Dotombori, a street in downtown Osaka lined with restaurants and places of amusement. The five-petaled cherry blossom emblem of Expo '70 competes for attention with a gaudy welter of neon signs flashing traditional characters.


づぼらや
とんぼり
明月館
平
質

second largest metropolis, Osaka, a sprawling commercial complex on the Inland Sea. Nearby, fast-growing Kobe challenges Yokohama as Japan's busiest seaport.

Each day, throughout Kansai, an interlacing system of subways, high-flying turnpikes, and the world's fastest scheduled trains speed eight million commuters from thundering mills and precision assembly lines to the tranquillity of small gardens, comfortable kimonos, and formal cups of tea. I joined the throng and headed down the Meishin Expressway to preview the half-billion-dollar Expo '70. Its 815-acre site lies 20 miles south of Kyoto and 9 miles north of Osaka (map, opposite).

Nearly Eighty Nations Participate

On arrival, I met Mr. Kazuo Akiyama, Expo's overseas information director. Decorating his desk was the familiar Expo '70 emblem: five circles representing petals of the cherry blossom.

"The flavor of Expo '70 is basically international, not Japanese," Mr. Akiyama explained. "Nations from six continents are represented. The plan, the architecture, and the exhibits all suggest a city of tomorrow."

Most visitors will arrive by express trains and expressways that dive underground to emerge at the main gate, set sensibly in the middle of the complex. Nearby stands the 200-foot-high "Tower of the Sun," Expo's theme building, thrusting up through an eight-acre transparent roof that shelters the Omatsuri Hiroba, or Festival Plaza. The tower, with escalator service, offers exciting exhibits on the evolution and future of mankind.

Fanning out from this hub, a monorail and miles of moving sidewalks will whisk visitors through a concatenation of glittering contrasts. Furukawa Electric Company has built the world's highest pagoda—of steel and concrete. A dragon-prowed royal barge floating on an artificial lake represents Burma.

More futuristic is the elliptical United States Pavilion, its translucent roof largely supported by forced air. The displays, covering 2½ acres, portray U. S. accomplishments ranging from the Apollo moon landings to sports history; from folk and fine arts to architecture. Another advanced design, from Australia, presents a building hung like a lampshade from a soaring cantilevered "skyhook."

"We're offering cosmopolitan entertainment," Mr. Akiyama said. "Greek drama, a Chicago fire brigade, 'Holiday on Ice,' the Japanese Feudal Lords' Parade, Frank Sinatra, 20 elephants from Thailand, and the Leningrad Philharmonic."

Expo '70, with its theme of "Progress and Harmony for Mankind," is expected to attract some 50,000,000 fairgoers during its six months of operation. Although the influx will strain the region's already saturated streets, trains, and hotels, officials feel that they can accommodate all visitors.

Political problems could complicate the situation, for this June the Mutual Security Treaty between Japan and the United States comes up for renewal. Although the U. S. has already agreed to return Okinawa* to Japan in 1972, some predict that student rioting this spring may be more violent than ever.

It was bad enough when I was there. Kyoto University was one of about seventy Japanese colleges and universities closed by student strikes during 1969. On one of my visits to the campus, I saw pro-Maoist students rallying in front of the administration building. Behind them, high on the clock tower, hung a portrait of Che Guevara, the Cuban Communist killed in Bolivia in October 1967 (page 306).

Across the street another student faction had barricaded the Faculty of Liberal Arts building with a wall of desks and chairs. Group leaders, wearing red crash helmets, shouted slogans through portable loudspeakers (page 307). I could catch a few of the words, like "Okinawa" and "*Beikokujin*"—literally, America people.

Students Focus on Many Grievances

Warily I approached a demonstrator passing out handbills. His youth was partly concealed by his long hair, square sunglasses, and wisp of a beard. He was quite cordial.

"Actually we are not condemning the Americans," he said. "Our fight is against the Mutual Security Treaty. American planes bombing Viet Nam are taking off from Okinawa. We want an end to the storing of nuclear weapons on Japanese soil, and we want Okinawa returned on our terms."

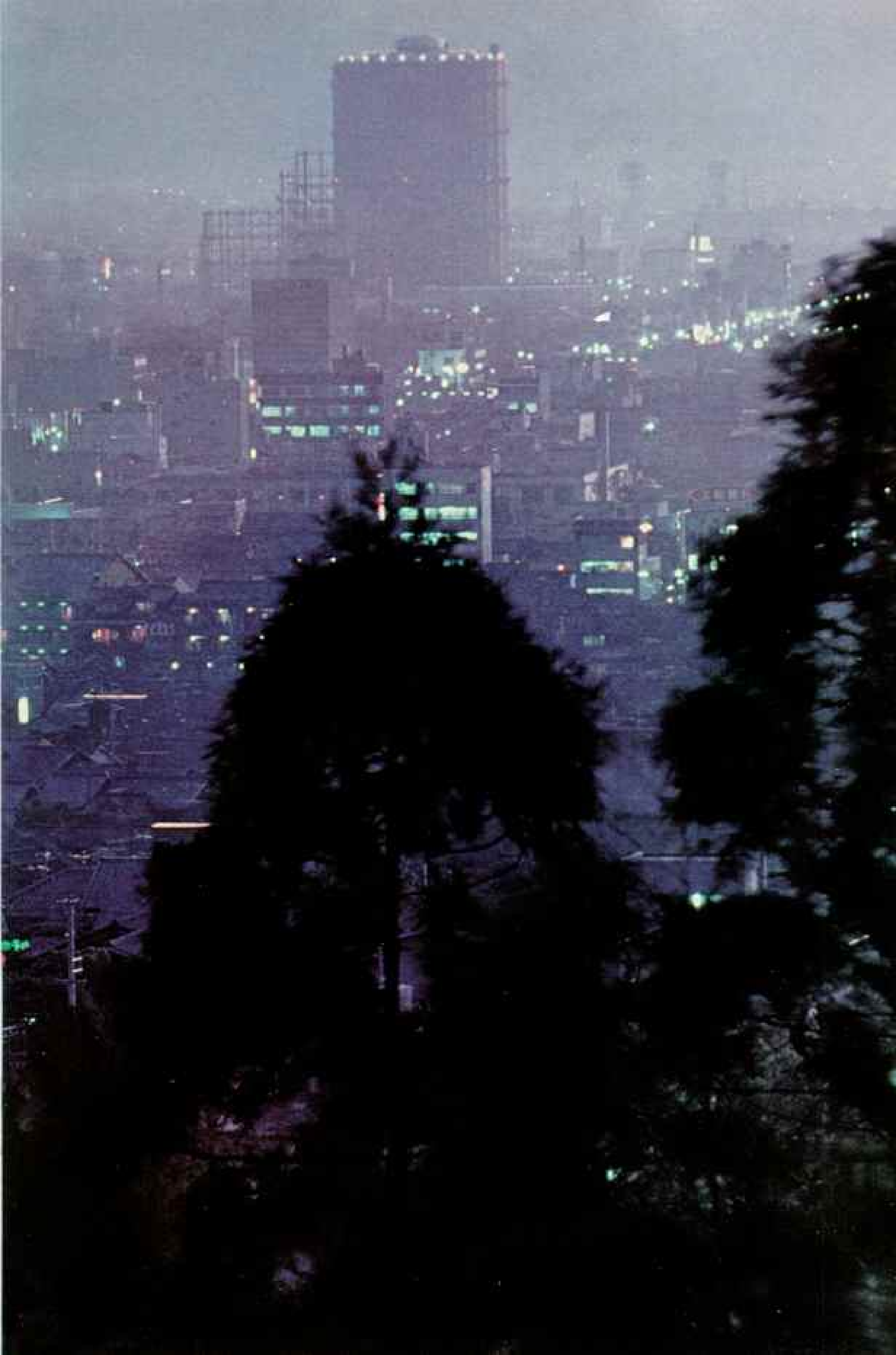
I wanted to tell him the war that brought us to Okinawa was not our idea, but he was too young, surely under 20. It wasn't his idea, either. His first point—on the storage of nuclear weapons—was understandable. The Japanese are the only people who have known the horror they can bring.

"We are protesting other wrongs within our own system," he added. "Why is it, we

*Jules B. Billard wrote of "Okinawa, the Island Without a Country," in the September 1969 GEOGRAPHIC.

Kaleidoscopic Kansai bottles the essence of Japan in an area about half the size of West Virginia. The word, meaning "west of the barrier," once denoted all the island of Honshu west of Mount Fuji; its scope has gradually narrowed to encompass only the region shown here.

Kyoto, the city of purple hills, recaptures the color of imperial splendor at dusk (following pages), but urban sprawl today paves most of its heights. Japan's capital for more than a millennium—from A.D. 794 to 1868—Kyoto remains the nation's spiritual hub, where emperors from Tokyo come to be crowned. Fifteenth-century Yasaka Pagoda, left, thrusts a five-storied silhouette into the lilac sky. OVERLEAF (FOLLOWING PAGES)



ask, that Japan, the third largest industrial power in the world, ranks twenty-first in its standard of living? Too much money and power cling to a few families, to the temples, and to the industrial combines."

He left to join the group forming in the street. Four abreast they marched away, banners waving, toward the Kyoto city hall.

I talked briefly with Professor Hidetoshi Kato in his office on campus. Dr. Kato teaches sociology, comparative education, and research for the future.

"Times are changing," Dr. Kato said, "and we must try to be ready, we must plan. It was a lack of dormitory space that started the student strike here in the first place, more than six months ago. Housing is a critical problem in all Japanese cities.

"The flow of people from the countryside is packing the cities," said Dr. Kato. "By 1980, if the trend continues, 70 percent of our population will be concentrated in a 300-mile-long belt between Tokyo and Osaka—one big megalopolis.

"In the United States you are concerned about the problems of traffic, pollution, smog. Think of Japan with a population density almost thirteen times that of your country."

Windows Crack When Crowds Pour In

I was reminded of that population density when I first visited Osaka with Kadowaki-san and rode a commuter train during a typical morning rush hour (pages 308-9). Part-time students, working as pushers, helped squeeze us into a car at Tsuruhashi. Never had I felt so tightly packed. But we made good time; fourteen minutes later we got off at Osaka Station, five miles away. As we funneled through the turnstile with the human

flood, I remarked that, although the train was crowded, we had all managed to fit in.

"True," Kadowaki-san nodded. "But of course in the winter. . . ."

"Winter?"

"Yes, the coats. They take up more room. In the squash we lose shoes and umbrellas. Sometimes even the train windows crack under the added pressure."

At Osaka's city hall, municipal planner Shigeo Ando unrolled a map of greater Osaka, with skeins of highways newly inked in.

"Everyone is working feverishly. Two new Western-style hotels have just opened; two others and many of the smaller Japanese inns have expanded," Mr. Ando said. "We have a broad new freeway and 30-minute train service from downtown to the Expo site."

All around the city new roadways were rising above the congested streets (pages 312-13). One in particular caught my eye—it ran across rooftops!

Mr. Ando explained. "Land prices have skyrocketed. A square yard can cost as much as 200,000 yen—close to $600. Cutting an expressway through the heart of the city was prohibitive, so first we followed along Osaka's many abandoned canals. We lifted later highways above the city. Now we've begun filling the spaces beneath them.

"This section of the new Chikko-Fukae crosstown expressway," he went on, pointing to the blueprint, "is 12 lanes wide and 60 feet high. It's supported by a four-story office building with the roadway on its roof and a 500-car parking garage in the basement."

Before leaving the city hall, I called on Osaka's Mayor Kaoru Chuma. The mayor, like his city, cut a thoroughly modern figure and exuded a vigor belying his 66 years.

"Commerce has been the lifeblood of Osaka for nearly five hundred years," Mayor Chuma assured me, rubbing his hands. "Expo '70 is sparking a new boom, but we're ready for it."

The city's way with yen is legend. Even Tokyo's hucksters defer to the shrewdness of the Osaka businessmen. Down in Semba, the wholesale textile district, old-timers still greet each other, not with the usual good morning, but with "*Mokari makka?*—How's business?"—before getting down to haggling over bright bolts of kimono cloth. Bargains are often struck with hardly a word, directly on the beads of a merchant's abacus.

Perhaps the best practitioner of the Osaka business acumen is Mr. Konosuke Matsushita, Chairman of the Board of Matsushita Electric Industrial Company, Ltd. We met at his office in Kadoma, one of Osaka's industrial suburbs. Mr. Matsushita had entered the business world at the ripe age of 10 as a bicycle merchant's apprentice. Later he worked for an Osaka utilities company.

In 1917 he quit to manufacture an invention of his own—a simple light socket—in his backyard workshop. Soon he had formed his own company, and added bicycle lights, electric heaters, and flatirons to the line, then radios and household appliances. As early as 1935 the firm was experimenting with television. It now ranks as one of the world's largest producers of TV sets.

Chairman Matsushita presides over an empire of some 50,000 employees in a hundred factories—some as far away as Puerto

Hostess to the future

A PRETTY guide models her Expo '70 uniform against a brilliant backdrop—flags of some of the nations represented at Asia's first world's fair. In its 815 acres, Expo's global village includes pavilions of 21 European countries, 23 Asian, and 14 African, plus New Zealand and Australia. Mexico and 16 other Latin American nations join with the United States and Canada to give wide-ranging representation to the Western Hemisphere.

The United States pavilion, with a roof supported by air pressure, presents exhibits proclaiming the variety of American life—from folk art and Baseball's Hall of Fame to the epic flight of Apollo 11.

KODACHROME © N.G.S.

Rico, East Africa, and Thailand. For his pains, Mr. Matsushita enjoys Japan's highest income, more than $2,000,000 a year.

"Big as we are," he said, "Matsushita Electric always tries to maintain a family spirit. During the hard times that followed the 1929 Depression, our factory worked only half days. So in the afternoon we hung up our smocks and went out—clerks, factory hands, and all—to help our sales force market what we had made.

"I have worked at every job in the shops: on the assembly lines, in the accounting office —even emptying trash cans," Mr. Matsushita said. "I believe in the value of practical experience. You can analyze chemically the taste of sugar—even write a book about it—but nothing beats taking a bite."

I toured the spotless ultramodern Matsushita radio plant nearby. Four miles of overhead conveyor belts fed 40 assembly lines where blue-smocked workers soldered together half a million transistor radios a month. Eighty percent of them were destined for export.

Dr. Yujiro Koike, Managing Director in charge of the Central Research Laboratory, unveiled some of Matsushita's new mini-miracles soon to be marketed.

"This is one of our new integrated circuits," he said, slipping a speck no bigger than the head of a match under a microscope. I could hardly believe my eyes.

"It's a complete amplifier," he explained, "the equivalent of a printed circuit board with some thirty parts attached."

With ultraminiature parts Matsushita builds a pill-size radio transmitter to broadcast information about conditions inside a person's stomach. Dr. Koike pulled a TV set from his pocket, and we watched a Samurai drama unfold. Even the "bad guys" looked harmless on the 1½-inch screen.

Campus chaos: Demonstrators and counterdemonstrators paralyze Kyoto University during a student strike. Red-helmeted militant (above) shouts anti-government and anti-U. S. slogans through a loudspeaker.

On the administration building clock tower (left), a portrait of the demonstrators' idol Che Guevara overlooks anti-Maoist students staging a protest against the protesters. High feelings focus on the Mutual Security Treaty—up for renewal this June—which gives the U. S. bases on Japanese soil.

Japan Ranks First in Shipbuilding

The Japanese have a gift for realizing perfection in very small things, but not everything they make is pocket-size. Japan ranks second only to the United States in the manufacture of automobiles. And in shipbuilding it leads the world.

At Sakai, just south of Osaka, I visited Hitachi Zosen, one of the world's largest shipyards. Mr. Hidefumi Ichimaru from the front office took me around.

"Ten years ago a ship of 50,000 deadweight tons was considered pretty good size," Mr. Ichimaru said as we walked past stockpiles of steel pipes and plates. Magnetic cranes hauled bundles of raw materials toward the dockside factory for subassembly.

"Today we are making tankers five times that big—and we are building them much faster," he said, raising his voice above the din. A cutting machine, programmed by computers, slashed through inch-thick plates of steel, four at a time, creating the first pieces of a giant ship. Farther along, workmen welded them together.

"Hitachi pioneered this construction technique for big ships," Mr. Ichimaru continued. We followed one of the 200-ton components —as large as a house—out of the hull shop to

the quarter-mile-long drydock in which a huge tanker was taking form (page 315).

"That's *Olympic Athlete,* 216,500 deadweight tons," said Mr. Ichimaru, "one of five ships we're building for Aristotle Onassis."

A rolling gantry crane straddling the basin hefted a 200-ton prefab section onto the nearly finished hull. Workers with torches swarmed over it like fireflies to weld it into place.

"What a gala affair the launching of one of these $14,000,000 giants must be," I said.

"We don't launch them," said Mr. Ichimaru. "They are too large to send splashing; we simply flood the drydock and float them out. Besides, building big ships—five or six a year—has become routine. No confetti, no champagne, just a quiet party on the bridge."

Eels and Seaweed Grace a Banquet

That evening I had scheduled a quiet party of my own. Kadowaki-san and I had reservations at the Kyo-Yamato restaurant, one of Kyoto's finest.

In Japan discriminating diners prefer to savor their meals in private, so the better restaurants provide a separate chamber for each party. Ours was named, in Japanese characters above the door, *So-Yo,* meaning "send the sun." Over tea, Kadowaki-san and I watched it set in a blaze behind nearby Yasaka Pagoda (page 302).

No less beautiful was the food, served on lacquered trays in small precise courses by waitresses in kimonos.

"Good food should please the eye as well as the palate," Kadowaki-san said, pointing his chopsticks with delight toward our first course, raw fish artistically garnished with seaweed and bean curd. A striking fish-and-mushroom soup followed, then a well-proportioned salad of pumpkin, fish, cucumber blossoms, and chestnut leaves.

I had to admit it was beautiful, but the glory of its taste so far escaped me.

"Ah, wait," Kadowaki-san insisted, nibbling a boiled eel, "we've only begun."

Next came sea bream roasted with onions and ginkgo nuts, and a basket of baby crabs the size of spiders. Following Kadowaki-san's example, I ate the crabs, basket and all.

"The basket is seaweed. This restaurant is famous for it," Kadowaki-san said. "They offer several different kinds." More seaweed was served, combined with cherries, peas, noodles, and potatoes. Vinegared carrots, pickles, and rice preceded dessert, a succulent melon from the island of Kyushu. It was a

Morning crush hour in Osaka dramatizes Japan's number-one problem: population density—almost 13 times that of the United

States. With job seekers from rural areas packing the cities even tighter, a single 300-mile-long megalopolis may stretch from Tokyo to Osaka by 1980. Meanwhile, the Kansai area braces for a human tidal wave of 50,000,000 fairgoers expected to converge on Expo '70 in the next six months.

Doing little things in a big way keeps Japan's economy whirring. Kansai-based Matsushita Electric Industrial Company, Ltd., one of the world's largest manufacturers of television sets, has great sales expectations for this pocket-size portable with a 1⅝-inch mini-screen. The words

magnificent meal, but Kadowaki noticed that my enthusiasm was less than total.

"Japanese food is like the Japanese language," he smiled. "It takes some study and some practice."

Kadowaki-san was a godsend. President of Kyoto's English Club, he spoke my language almost as fluently as his own.

"Frankly, Japanese is a difficult language—even for Japanese," he confided. "To pass a college entrance exam, we must know a minimum of 1,850 Kanji, the ancient Chinese characters that form the backbone of the language. We have two different scripts—one for Japanese and another for foreign words.

"On top of that, the social position of everyone in Japan is precisely defined, and each must use a style of language proper to his station. This leads to a profusion of correct forms. One etymologist listed 93 Japanese equivalents of the simple English pronoun 'I.'

"Much of the ancient system is logical enough," he explained, during one of my first lessons. "Take 木, for instance, 'tree,' and combine it with 日, 'sun.' Together 東, 'sun seen through the tree,' they form 'east' (pronounced toe)." I already knew 京 (pronounced keeo) meant capital. I had learned that on my way through 東京—To-kyo, translated as "eastern capital." Another word, that sounds much like toe, can also mean "capital," making Kyoto the "capital of capitals."

"Pronunciation is a little more complicated," Kadowaki-san admitted. In com-

"Made in Japan," once scoffed at by many, today earn increasing respect among quality-conscious buyers around the globe.

Bountiful assembly lines in Matsushita's plant at Ibaraki, near Osaka, pour out a steady torrent of color television sets—most for domestic use.

pounds, 東 is pronounced toe. But standing alone it's *higashi;* in certain family names it becomes *azuma.*

Despite the confusion, I continued with my mentor's patient coaching to chip away at the language barrier. I felt that some knowledge of the language was essential to an understanding of Japanese history and religion.

Religion has had a profound effect on Japanese culture. In the sixth century, Buddhism, imported from China, took root alongside native Shinto, an ancient animistic faith. Today the Japanese freely mix the two.

Most homes I visited displayed two altars, one honoring Buddha, the other dedicated to the mystic *kami,* or gods of Shinto. By tradition, funerals are conducted with Buddhist rites; births, marriages—happy occasions—are celebrated with Shinto ceremony.

Shinto, the more informal faith, acknowledges countless kami and associates many of them with the heavens and with the natural wonders of earth. Southeast of Kyoto, in the Grand Shrines of Ise (map, page 301), the sun goddess Amaterasu-omikami presides. It was her direct descendant, Emperor Jimmu, who became the first mortal ruler of Japan. Records at Ise show that the same dynasty has ruled the country down to the present emperor, Hirohito, the 124th in an unbroken line.

One of Japan's most beautiful shrines is Kumano-Nachi, built on a mountainside farther down the Pacific Coast, near the hot-spring resort of Katsuura. Within the shrine

Once called the Venice of the Orient because of its interlacing network of canals, Osaka today bears greater resemblance to such broad-shouldered industrial cities as Chicago and St. Louis. Many of its narrow old waterways, tributaries of the Yodo River, which slices through the heart

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of town, above, have been filled in or vaulted over by soaring expressways. Japan's second largest city, with more than 3,150,000 inhabitants, Osaka continues to grow at a staggering pace. With space at a premium, land values have skyrocketed in some areas to nearly $600 a square yard.

precincts is Nachi Fall, famous throughout Japan, a sparkling cascade more than 400 feet high.

I climbed the long flight of steps from the fall to the shrine's main hall. Under the shade of a gnarled camphor tree I met the abbot, the Reverend Shiro Shinohara, preparing his morning offerings.

"In private homes people make small daily offerings at their altars, to please the kami," the abbot said. "Usually salt, rice cakes, or water from a nearby sacred well. For larger shrines, of course, the gifts are more elaborate." He led me across the courtyard to Nachi's treasury.

"Here is a painting that was donated to us more than 600 years ago. It shows the Emperor Goshirakawa and his entourage visiting Kumano-Nachi in 1158," the abbot said.

Displayed around us were statues, bronze mirrors, tortoise-shell combs, and golden swords, representing a thousand years of Japanese craftsmanship. The porch outside was stacked with more recent donations: barrels of saki from a local distillery and six-packs of beer.

Before departing, I wanted to leave something myself. For a 5,000-yen donation ($14), I was told, I could offer a *kagura*, a form of sacred dance, performed by one of the shrine's *miko*, or vestal virgins.

A Maiden Dances For the Gods

A priest in formal dress—black-lacquered shoes of pawlonia wood and baggy turquoise pantaloons—purified the hall by waving a white-paper whisk. The miko appeared between the two lion-dog statues that guard the sanctuary. Her black tresses hung waist length down the back of a red kimono decorated with golden herons. She carried a baton with bells.

She began to dance to the music of flutes and drums. Her movements were slow and stately, almost hypnotic, from the beginning to the final bow. (Surely it pleased the kami—as it certainly did me.)

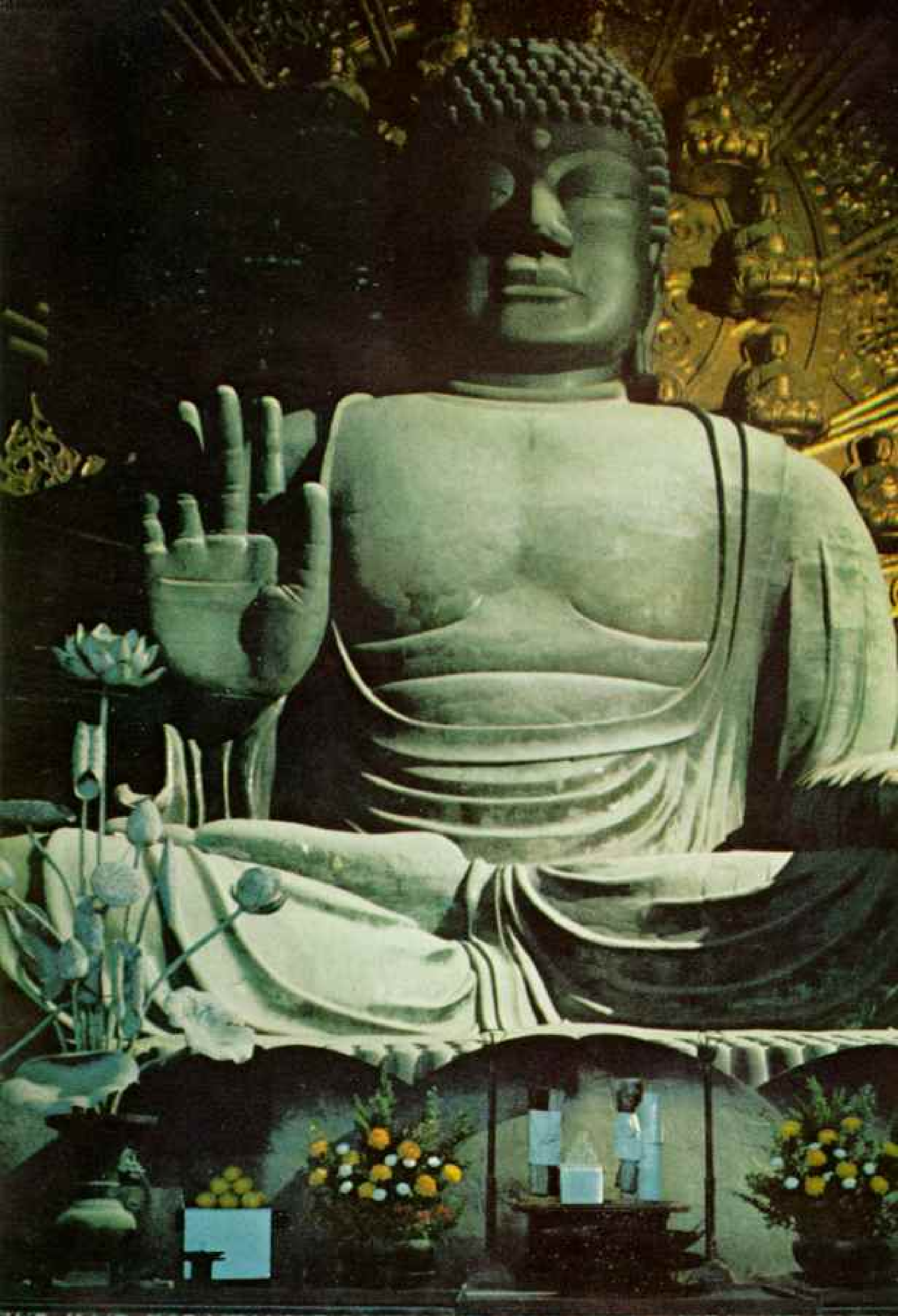
On the return drive to Kyoto, I purposely took back roads through the wilderness of Yoshino-Kumano National Park. For hours the road wound through the misty mountains. I saw little of civilization until I pulled over at the small lodge by the end of a park road on Mount Odaigahara.

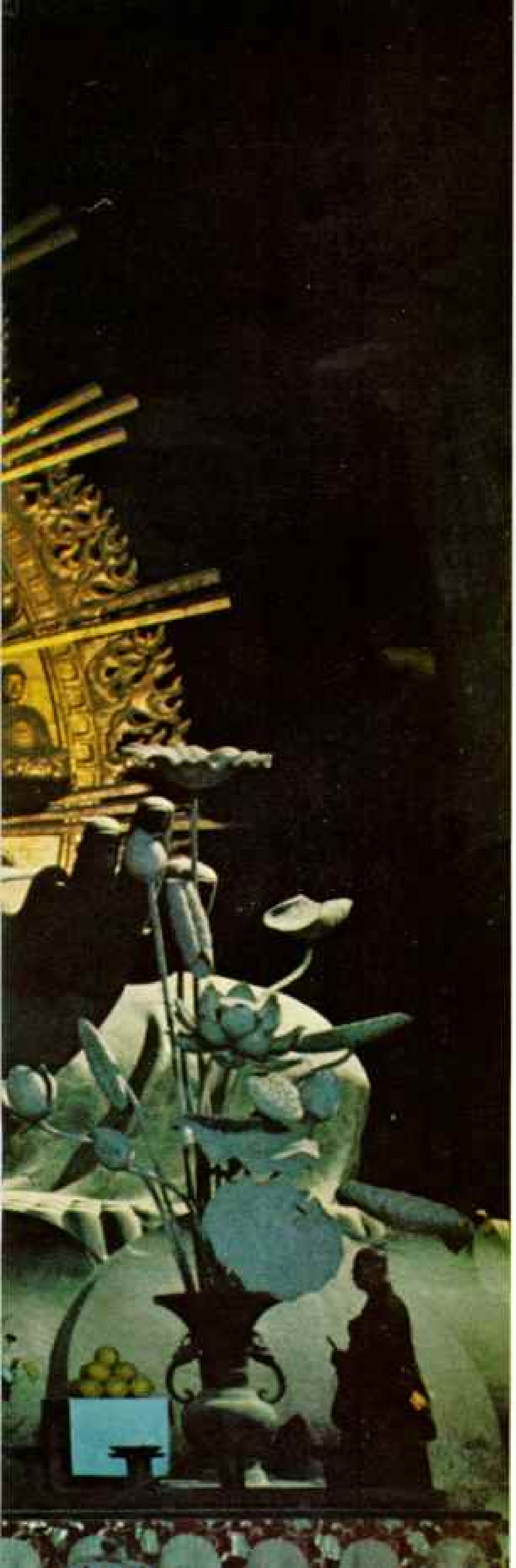
I ordered the simple lunch of noodles offered there; then, under a light drizzle, I hiked to the top of the mountain, which is more than a mile high. Near the summit birds flickered in a thicket of rhododendrons. Otherwise all

PHOTOGRAPHED © NATIONAL GEOGRAPHIC SOCIETY

Challenging the horizon, a 1,100-foot-long tanker receives finishing touches at the Hitachi Zosen shipyard near Osaka. Such monsters, too big for the Suez or Panama Canals (pages 406-10), cannot be launched in the usual way with a quick slide into the water. Instead, their dry-dock cradles are gently flooded, and the behemoths eased out. This one has already been floated. Steady output of such seagoing giants has made Japan the world's leading shipbuilder.

Sparks fly from an acetylene torch on a mammoth tanker-in-the-making. Use of huge prefabricated units helps cut costs.





was green and quiet. I sat for a moment, enjoying the setting and the solitude.

Suddenly I was startled by a tinkling sound, and out of the moss-carpeted forest an apparition materialized. He was a small wizened man with translucent skin, garbed in white linen trimmed with brocade suspenders, red pompons, and a boar-skin apron. He wore a coolie hat and fingerless white gloves, and carried a wand tipped with jingling brass rings (page 319).

From under his plastic raincoat he handed me his card. Then, bowing, he vanished down the mountain.

He was Inagaki, the card told me, one of the *yamabushi*, "mountain hermits," often seen around Kansai. Most are Shinto-Buddhist ascetics who seek enlightenment in the remotest parts of the wilderness.

Calmness Keynotes Japanese Culture

Few influences have left a stronger imprint on the Japanese way of life than the sect of Buddhism called Zen. The soldier who studies *bushido*, the way of the warrior, the carpenter who builds austere Japanese houses, the businessman whose hobby is archery, penmanship, incense, or tea, the judo teacher, the housewife arranging flowers—all perpetuate Zen's timeless precepts.

At Daitokuji Temple in Kyoto, headquarters of the Rinzai school of Zen Buddhism, I rang the small bronze bell outside the door of the Reverend Nanrei Kobori. A young Zen student slid the door open and ushered me into the abbot's study.

The Reverend Kobori was practicing *shodo*, or calligraphy, on rolls of white paper spread across the floor (page 323). He finished a line,

Buddha of Great Illumination, the 53-foot-high bronze Daibutsu at Nara sits eternally ensconced in the gloom of an enormous wooden temple. From here, Buddhists believe, he radiates divine light to the farthest precincts of the universe.

The monumental image, largest bronze statue in the world, dates from the eighth century, when Nara reigned as Japan's imperial capital. The city still glitters with reverently preserved temples and relics of that era.

Buddhism spread from China to Japan in the sixth century A.D., flowering alongside the native animistic Shinto religion. Altars to deities of both faiths often stand side by side in Japanese homes. DAISHOIN © N.G.S.

then laid aside his brush to greet me. A striking man, precise of movement, soft of speech, he seemed to possess the inner calm of a saint. He led me into his tea-ceremony room, motioned me to a small cushion before the *tokonoma*, or place of honor, and began to prepare a formal cup. The room, two-and-a-half mats in area, was bare except for a vase of flowers and one hanging scroll.

Tea was known to Japan as early as the eighth century. But it became popular in the 12th century, when Zen priests began using it as a stimulant to fortify themselves against the rigors of their strict discipline.

Few Westerners Master Zen's Challenge

"Europeans and Americans come to Daitokuji every year to approach the study of Zen," the Reverend Kobori said, setting the iron kettle over the charcoal. "Many even enter our monastery. But most find the austere life too much to bear; all are hampered by our language, food, and customs. Zen is a difficult subject, even for Japanese."

The abbot laid a small rice cake before me on a paper, then began to rinse the simple pottery tea bowl with pronounced care.

"In Zen we seek *satori*, or enlightenment, by seeing into our own true nature. Briefly, Zen is to grasp 'what I am' by uniting body and mind."

With slow, devoted movements he uncapped a lacquered box of powdered green tea and measured out a portion with a small bamboo scoop.

From the bubbling kettle he ladled hot water into the tea bowl, stirred the mixture with an intricate bamboo whisk, then handed me what a sage once called "the froth of liquid jade."

Bowing, and then carefully turning the bowl's design toward my host, I sipped the potion and found it pungent yet delicious, soothing yet stimulating.

"On the path toward enlightenment," continued the abbot, "each point along the way, each separate 'now,' is as important as our destination."

Each step of the tea ceremony had been a miniature experience in its own right, so perhaps I was on my way toward understanding the basic philosophy of Zen.

Easier to understand were the roar and fire of the Nadahama plant of Kobe Steel, Ltd., near the heart of the city of Kobe. I visited Nadahama with Mr. Seiichi Kojima, chief of the company's manufacturing section. He was wearing the same uniform as the workers: hard hat, tan cottons, white puttees, and black safety boots. Pinned above his pocket was a badge inscribed with Kanji characters which I recognized and smugly read aloud: "*An-zen-dai-ichi*—Tranquility all number one?" Somehow, in the din that surrounded me, it still wasn't quite clear.

"Safety first!" Mr. Kojima explained. "We stress it here. We are proud of our record."

Like most heavy industry in Japan, Kobe Steel imports its raw materials and exports finished products. The United States buys almost a tenth of the plant's 3,000,000-ton annual output, mostly wire and tubing.

Blast Furnace Heats Bath Water

Mr. Kojima led me up ladders through five stories of fireworks. On the top floor was a huge ladle glowing with molten steel. From an air-conditioned booth below, workmen controlled the flow through the molds as automatic torches at the bottom cut the still red-hot ribbons into bars and clanged them on toward the rolling mills (pages 326-7).

"Faster than casting the ingots separately, this new process increases production yield by 15 percent, and the quality of the finished steel is more uniform," Mr. Kojima said. "Then, too, the booths are far more comfortable for the workers."

Over at No. 3 Blast Furnace I joined a bunch of sweating men who still worked close to the inferno. Donning an asbestos apron and dark-green safety goggles, I sidestepped sparks while the furnace crew tapped the roaring caldron and guided the river of fire between banks of sand to a giant brick-lined vat. Leaning on his slag hoe amid acrid fumes and walls of flame, foreman Jiro Tamura looked like Satan himself.

After the three o'clock whistle I joined Tamura at the bath. We scoured the red

"Out of the moss-carpeted forest an apparition materialized," writes the author about this wraithlike gentleman who briefly interrupted his solitude on a mountaintop in Yoshino-Kumano National Park. The enigmatic figure, a hermit who seeks enlightenment in the wilderness, introduced himself with a calling card, then melted back into the mist.

PHOTOGRAPHED BY THOMAS J. ABERCROMBIE (C) N.G.S.

SEEN UPSIDE DOWN, *as prescribed by Japanese tradition, a tree-mantled spit of land at Amanohashidate, on the Sea of Japan, rewards the imaginative visitor with a vista of the "Bridge of Heaven." A chubby lad peeks between his legs to witness the mystical transformation of a beautiful but mundane scene into a zigzag pathway to paradise.*

dust out of our pores and settled neck deep into one of the seven communal tubs. By now I was quite accustomed to Japan's hot water, but this was positively scalding.

"Heat piped from the blast furnaces warms the bath," Mr. Tamura explained, passing me a bowl of cold water to douse my head.

The Japanese consider these big baths ideal places to relax and talk shop. Conversation flows freely. I asked Tamura about himself. He had started at the Nadahama plant at the age of 21, and helped build it up from the ruins of World War II.

"Things have changed for the better since those early days," he said. "I work a six-day week from seven to three in the afternoon. My base salary is 72,000 yen [$202] a month. But with overtime, family allowances, production incentives, midsummer and year-end bonuses—all standard here in Japan—I net about 90,000 yen [$252] per month. I have a wife and two children and own a small house only 15 minutes from the plant by motorbike."

Companies Foster a Family Feeling

The Japanese enjoy a standard of living far above the rest of Asia's peoples. Their income is effectively doubled by the fringe benefits standard in paternalistic Japanese industry. Many companies provide housing for as little as $10 a month, free medical care, and retirement plans. They build swimming pools, tea-ceremony rooms, baseball diamonds, and meeting halls for their employees, and even provide lessons in English, flower arranging, and Japanese swordsmanship.

Ties between a man and his company are strong. Job switching and corporate raiding are frowned upon, and outright firing practically unheard of. A man takes a job, as he would a bride, for life.

For all its heavy industry and orderly industrial society, Kobe—squeezed between mountains and sea—has special problems. One of these: the need for space to meet growing port demands.

From the control tower atop city hall I surveyed Kobe's fan-shaped harbor (pages 328-9). In 1868, when Japan began to open its ports to foreign trade, Kobe was little more than a string of fishing villages along a sandy beach.* Today it's a teeming metropolis of 1,228,000 people. Hundreds of small lighters jam its inner harbor. Larger ships line the quays and anchor out as far as the horizon.

"We have only 95 public berths—and just now there are 97 ships to unload," said Takuro Hatao, chief of the Port Affairs Section.

"Ship traffic increases every year," he continued. "Kobe is expanding to keep up—literally moving mountains."

I had seen the men and machines at work on one of the mountains, Takakura, six miles to the west. Conveyor belts, fed by fleets of 17-ton trucks, carried gravel to shoreside chutes a mile and a half away. From there barges shuttled it to a speck of land in the harbor.

"This is our most ambitious project: Port Island," said Mr. Hatao. "We are transplanting mountains at the rate of two tons per second. We've been at it since 1966, but the project will take five more years to complete."

When Port Island is finished, it will be practically a city in itself, with nearly two square miles of docks, warehouses, hotels, shopping centers, and theaters. A bridge already links it with Kobe.

Romeo and Juliet, Nippon Style

During centuries of isolation Japan developed some unique art forms and one of these, a vivid blend of stylized song and dance, is Kabuki (pages 332-3).†

Kadowaki-san and I spent an afternoon at the Minami-za, Japan's oldest Kabuki theater. It stands near the Kamo River in Kyoto at a spot where a Shinto priestess and her troupe are said to have danced the first Kabuki performance back in 1603. Though women popularized Kabuki, they were later banned from it because prostitutes became associated with the art. Since the early 1700's

*Ferdinand Kuhn wrote of "The Yankee Sailor Who Opened Japan," in the July 1953 GEOGRAPHIC.

†See in NATIONAL GEOGRAPHIC: "Japan, the Exquisite Enigma," by Franc Shor, December 1960.

The brush that moves of itself. Master calligrapher Nanrei Kobori, a Zen abbot at Daitokuji Temple in Kyoto, practices *shodo*, "the way of the brush." He tries not to draw each character deliberately but rather to allow it to draw itself, flowing effortlessly from the tip of his brush. He explains that a higher force called "Zen mind," not his own will, guides the brush. The poem he inscribes here relates that one's mind or heart must be as motionless as a stone wall if one is to enter upon the path to enlightenment.

"Die, O honorable dummy!" Practicing *kendo*—Japanese fencing—an eager youngster prepares to clout an inanimate foe. He wields his bamboo sword in a gymnasium specializing in the manly arts of *bushido*, the way of the warrior. Such skills, including jujitsu and karate, served for centuries to train young males of the Samurai. When this warrior class was shorn of power in 1868, the bushido arts were demoted to the status of sports. Today such time-honored pastimes have been largely eclipsed in popularity by soccer, tennis, table tennis, and of course *beisuboru*—baseball.

EKTACHROME (LEFT) AND KODACHROME © N.G.S.

All aquiver: A contestant, carrying arrows in a wood-fiber basket on his back, appears to be sprouting wings. He awaits his turn to compete in an archery tournament during Kyoto's Aoi Matsuri, or Hollyhock Festival. The event, staged each May, recalls the Heian Period—A.D. 794 to 1185—when Kyoto reached its zenith as the political, religious, and cultural center of Japan. This august sportsman wears an elaborate courtier's costume of that era. A hollyhock blossom bobs atop his headgear.

skillful female impersonators have played their roles.

We took a box under the first balcony and sat cross-legged on small cushions on the floor. Promptly at eleven in the morning the show began with Act III of *Imoseyama Onna Teikin*—the famous Yoshino River scene. The sound of hardwood blocks clacking together hushed the audience. A stagehand dressed in black hauled back the curtain, revealing a scene of cherry blossoms along a tinfoil river.

On each bank stood a Japanese mansion. A row of musicians, kneeling at the side of the stage, plucked vague melodies, and a chanter began to narrate the unfolding drama.

"The story is taken from Japanese history," Kadowaki-san explained. "Old Kiyozumi and Sadaka are fighting over a piece of land. But Kiyozumi's son Kuganosuke has fallen in love with Sadaka's beautiful daughter Hinadori—there she is, floating a message across the river.

"A tyrant, Iruka, orders Kiyozumi's son to work for

Keeping cool in an inferno

FROM THE REFUGE of an air-conditioned booth (right), a monitor at a steel mill in Kobe supervises activities on the plant's casting floor. Incandescent ribbons of steel (above) flow continuously from a source five stories up; remote-controlled torches operated by another monitor, rear right, spill cascades of sparks as they chop up the fiery bars.

Such ultramodern techniques have helped catapult Japan into the forefront of the world's industrial powers. After a phoenixlike rise from the ashes of World War II, the nation today trails only the United States and the Soviet Union in industrial output.

Harbor headache

MARITIME PARKING PROBLEMS keep traffic controllers busy (above) in Kobe. Notations on the comings and goings of some 8,500 deepwater ships a year are often jotted down in English, Japan's unofficial second language.

Armadas of sleeping lighters (left) frequently spring to life to unload cargoes of vessels that must anchor offshore because of jammed dockside berths.

The hill-hemmed port city plans to expand its real estate by creating an island of fill, nearly two square miles in area, at one end of the harbor. A bridge already connects the site to the mainland.

him, though he knows Kuganosuke is loyal to the emperor. Iruka also wants Hinadori for his mistress. . . ."

I gave up on the plot—it was close enough to *Romeo and Juliet* to follow in a general way—and concentrated on the sheer beauty of the dancing, the costumes, and the unusual stage effects.

Throughout the drama, the river "flowing" through the middle of the stage separated hero and heroine. Often the action took place on two auxiliary aisle stages called *hanamichi*, the flower path. The audience in between became, by extension, the river. But throughout the drama the hero and heroine never reached each other. Finally, she was killed; he committed *hara-kiri*.

But the show went on—with other plays. When a butterfly was required in one scene, a stagehand dressed and hooded in black came out with a giant paper insect dangling from a stick and line. Another black-garbed assistant worked a stuffed fox. Groups of these phantoms rushed out to straighten the beautiful but cumbersome brocade costumes. From long experience, Kabuki audiences never see these "invisible" helpers.

Movie Makers Feature the "Wild East"

Though Kabuki still plays to large audiences, the younger generation tends to seek its adventures at the local movie theater. Shoot-'em-up spy dramas, comedies, and love stories predominate, but the *jidai*, or period film, remains popular.

To learn more about the art of the celluloid Samurai, I visited the Kyoto studios of the Toei Company Ltd. Mr. Tuguo Sasaki, a studio publicity man, greeted me in his office papered with portraits of Toei's stars and action-packed posters of its latest releases.

"Japan is making more feature films than any other country in the world—more than 400 last year," Mr. Sasaki said. "But big films are in trouble and theater attendance has dropped. It's the competition from television. More than 90 percent of Japanese homes have sets."

Today, Toei produces both theater and TV films. We paused to watch a crew shooting at one of the outdoor sets, a small street of the Edo period complete with geisha teahouse, inn, and a blacksmith—a typical 19th-century "Wild East" town.

Prop and lighting men rushed to move rickshaws, trees, and giant reflectors amid bands of Samurai warriors with foreheads shaved back and hair done up in topknots. Each fighting man carried two swords in the sash of his kimono.

"We are shooting this TV serial in 13 parts," Mr. Sasaki explained. "It takes six days to film each hour-and-a-half installment."

At Studio 19, one of Toei's giant indoor sound stages, I bowed and spoke briefly with film star Miss Junko Miyazono, a demure woman with large eyes and silky black hair, wearing a simple blue-and-white cotton kimono for her role. At 27, she had already made more than 100 films. She offered me a fruit drop.

"Good for the voice," she said. "Mine always gives out first; we've been working since early this morning.

"This is our latest color release, *Onna Shikyaku Manji*, or *The Lady Avenger*. We're getting ready to shoot the climax. It's a beautiful story about a young woman who enlists a band of Samurai as vigilantes to avenge her honor. But the chief of the Samurai betrays her and. . . ."

"*Homban!*" Director Kosaku Yamashita shouted, "Rolling!"

We hushed. Miss Miyazono stepped on camera swinging wide a sword of her own. One after another, she slashed open the bellies of three traitors before the director, finally satisfied, shouted, "Cut!"

Festival Brings Out Giant Floats

During July much of Kyoto takes on the appearance of a period movie set as the city girds itself for the Gion Matsuri, one of Japan's most famous festivals. The celebration dates from the year 869. At that time, so the story goes, a deadly plague was sweeping the country.

To appease the gods and rid the ancient capital of the pestilence, the emperor commanded the priests of Kyoto's powerful Yasaka Shrine to stage a procession of its sacred idols through the streets of the city. Giant

Living woodblock print: A retired fisherman takes his napping grandchild on a leisurely stroll along a seaweed-strewn beach beside the Sea of Japan. The simplicity of sand and water create an effect reminiscent of countless Japanese works of art.

carriages were built for the occasion. The scheme worked and Kyoto was spared. Not only that, it was fun, so for 1,101 years the people of Kyoto have been re-enacting the ancient rite.

I marched along with one of the 29 floats that still take part in the parade. It was as big as a house and built of heavy beams lashed together with ropes. Rising some sixty feet through the roof, a tall mast in the shape of a halberd stabbed the sky. The crescent design at the top gave the float its name, Tsuki Hoko, or Moon Halberd.

A Shinto priest sprinkled salt over the wheels to purify the contraption. High up on the float a flute-and-gong orchestra struck up a wailing tune. A gang of some seventy men strained on thick rice-straw hawsers, and the juggernaut creaked forward. Down the street workmen unstrung streetcar wires and telephone lines to allow the giant to pass.

Rounding a corner was grueling work; the 12-ton floats were not equipped for steering. The crew spread sticks under the nine-foot oaken wheels and splashed them with buckets of water, while the draymen wrapped the heavy drawropes around the outside hub. Two men waving folding fans called the "heave-ho!" I found a hold on the hawser; others from the crowd nearby pitched in. Swaying and screeching, the monster skidded slowly around onto its new course.

Study in scarlet: A handcrafted Kyoto doll takes its stylized countenance from a character in a Kabuki play (right). Dollmaking, like flower arranging and the serving of tea, has been raised to the status of a fine art by the Japanese.

Swiveling their heads to follow the action, spectators at a Kabuki performance in Kyoto peer sidelong at an actor who has moved out onto an auxiliary aisle stage. As with theater-in-the-round, the audience thus achieves a sense of

Gion, Kyoto's famous pleasure quarter, today is the scene of booming Japan's one declining industry—the geisha. The very symbols of early Japan, there were once an estimated 500,000 of them on hand to brighten the Japanese evening. Only a few hundred exist today (pages 296-7). Many of them make their homes in Kyoto.

This is not to say that Japan has lost its perspective in matters of female companionship—there are still varied and amazing attractions for men with yen. But the traditional geisha is losing ground to the ubiquitous "bar hostess," the kimono to the mini-skirt.

Arranging a geisha party is not a simple affair, especially for a foreigner. Fortunately I had connections through my friend Tomoaki Naganawa in Osaka. His father-in-law, the famous Kyoto dollmaker Tokuzo Inoue, belonged to the same poetry-singing club as Fukushima-san, mistress of a Gion teahouse. The Naganawa family had entertained me often; now I saw a chance to return the favor.

Along one of Gion's narrow streets, hung with gay paper lanterns, I sought out Fukushima-san.

"For a small party," she advised, "three geisha would be ideal: One *tachikata*, or dancer, one *jikata*, or samisen player—and one young *maiko*. Maiko are only apprentice geisha, but their loveliness makes up for their inexperience. Because they are beautiful, they

EKTACHROME (ABOVE) AND KODACHROME © N.G.S.

intimacy with events portrayed. A dramatic blend of dance and song, Kabuki is thought to have originated when a Shinto priestess gave a series of impromptu dances to raise funds for a Kyoto shrine in 1603—about the time Shakespeare was writing his tragedies. Her performance inspired others, and a new form of theater came into being. Female players were later banned. Today all parts are played by men, some of whom specialize in female roles.

are always busy. These days there are only 29 left in Gion."

Still, with a few phone calls all was settled.

The night of the party was a wet one, well into the rainy season. At the appointed restaurant, the Nakamura-Ro, we left our shoes and umbrellas with the doorman.

"Most foreigners have the wrong idea about geisha," Mr. Inoue said, as we seated ourselves on tatami around the low lacquered table. "The word geisha means 'art person'—but it is an art few foreigners can understand." Then, smiling toward young Nagana-wa, "Even the new crop of Japanese men no longer appreciates them.

"Some say geisha are doomed. But I believe that, as long as there is a Japan, they will be with us."

The sliding door opened, and we fell silent. To the rustling of brocades, the three kimono-clad geisha glided into our midst with tiny, mincing steps, looking as beautiful and delicate as butterflies. One, the young *maiko*, alighted next to me.

She wore a purple kimono of rich silk patterned with iris, wrapped around the waist with a broad red and silver *obi*, or sash, tied behind in a giant bow. Her tiny, oval face was painted white as starch, setting off the blaze of carmine on her lips and eyes dark as a

Blazing pitch pine illumines a night-time fishing scene on the Oi River near Kyoto.

A fisherman pays out the lines of his great cormorants *(Phalacrocorax carbo)*, large water birds with gluttonous appetites for fish.

The birds swim frantically about, gulping troutlike *ayu*, which swarm toward the flame as moths to a lamp. Cords or metal rings around the cormorants' necks keep them from swallowing any but the smallest fish.

When a cormorant's gullet brims with fish, the keeper hauls the bird in, forces it to disgorge the still flapping ayu, rewards it with a small tidbit, then sends it out again.

Practiced for more than a thousand years, cormorant fishing today survives chiefly as a tourist attraction.

moonless night. Willow sprigs and silver hairpins crowned her coif, arranged in the traditional style of the maiko.

Her every motion was a delight to the eye, a study in grace. Behind the mask was undoubtedly a woman, but presented here was femininity as abstract art. As with any masterpiece, the first rule was: Don't touch!

Throughout the dinner she kept my cup filled while I asked personal questions. Her name was Toyochyo. She was 17 (page 338).

"I began dancing lessons at exactly six o'clock on June 6, after my sixth birthday," she said. "But only after finishing junior high school two years ago could I become a maiko.

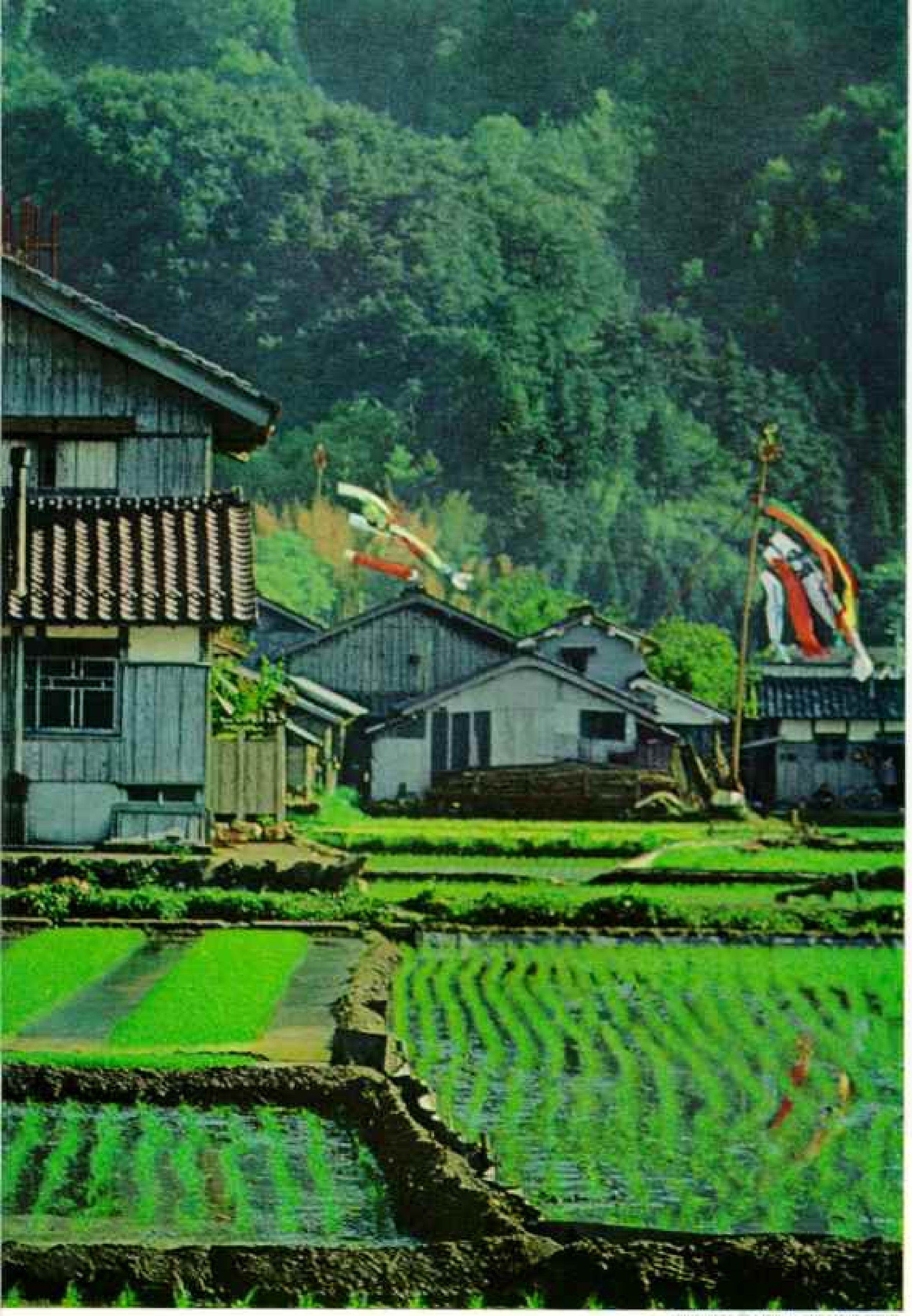
"Later I studied singing, flower arranging, and drama under the geisha master. The geisha house provides one set of kimonos, a brocade sash, and accessories costing half a million yen ($1,405). It takes us years to pay that back from our earnings.

"Still, I can make more in an evening than a secretary does in a month."

It seemed to me a heavy burden for a young girl to assume. True, it was a chance to meet rich and famous people; eventually most geisha find the security of a wealthy patron. But the schedule was demanding.

"I can always count on at least one day off a month," she said. "I look forward to the

Fish swim in the wind above a rice-farming village in the Kansai countryside north of Kyoto. On Children's Day, May 5, families deck the skies with cloth or paper streamers shaped like carp, one for each of their sons. The bigger the streamer, the older the son.



WATERCOLORS © NATIONAL GEOGRAPHIC SOCIETY

The carp, because of its prowess in swimming upstream, symbolizes strength and determination—qualities Japanese youths are urged to emulate. Women, left, transplant rice seedlings from tightly packed beds to paddies where they have more room to grow.

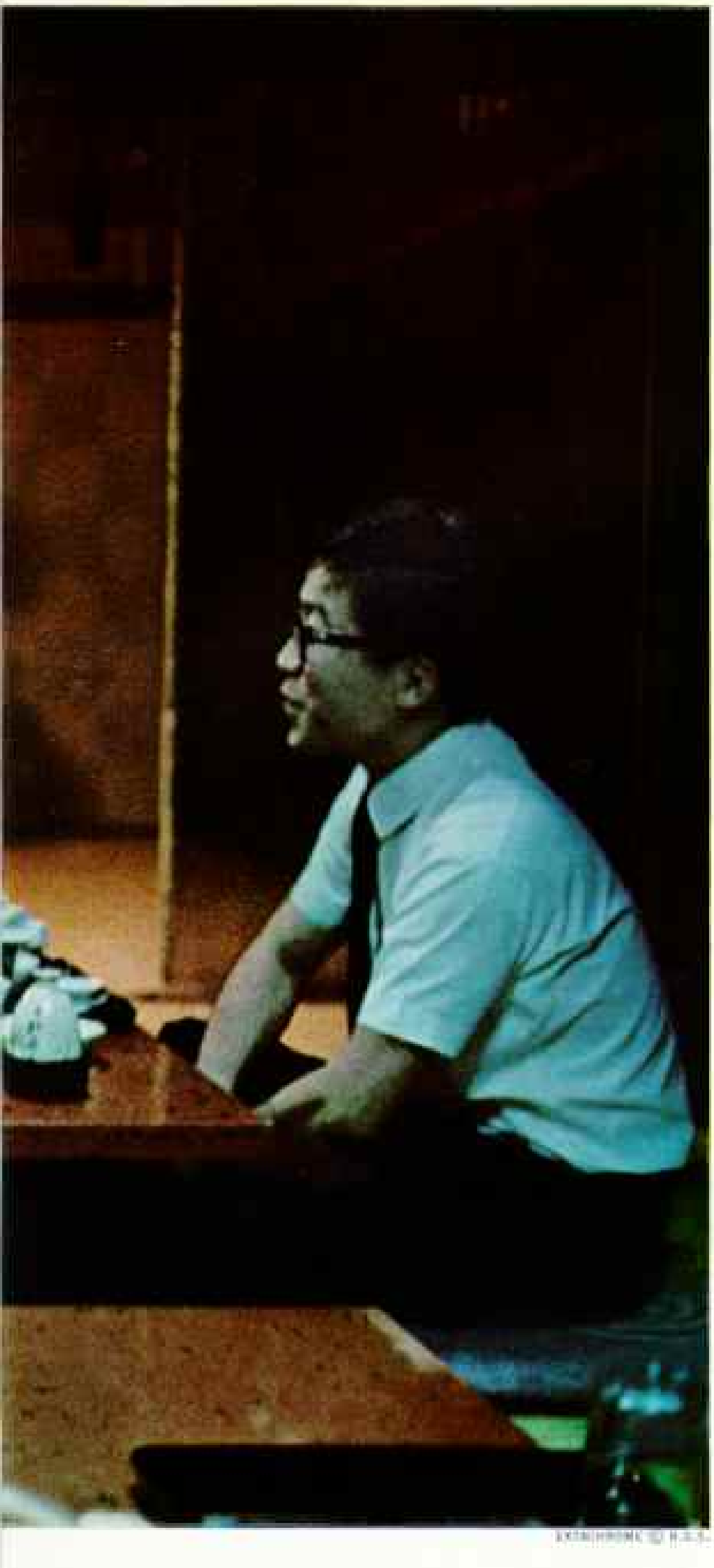
change of pace. I go bowling or to the movies. I find time for my records. I have a good collection of soul music and progressive rock.

"Normally I spend mornings at dancing practice or the hairdresser's," she said. "By midafternoon I must begin work. It takes nearly three hours to make up and dress. The *onagoshi-san*, the 'geisha dresser,' helps me get into the complicated costume—three kimonos, eleven belts and sashes."

Had she ever envied her competition, the bar hostess?

"I have friends who went to work in the cabarets," she said. "They can start with no training at all and a minimum investment in clothes. But theirs is only a job. Being a geisha is a career."

The older geisha knelt and started to play the samisen, a Japanese instrument similar to the banjo, and Toyochyo joined the other in



Perfect hostess: A geisha named Hisafumi serves saki, rice wine, at a Kyoto teahouse. At the far end of the table sits Toyochyo, the apprentice geisha encountered on page 296 on her way to this very appointment.

To these custodians of culture, immersed from childhood in traditional arts and customs, the simplest social amenity becomes an act of perfection. At banquets and social gatherings, they sing, dance, serve drinks, and enchant guests with their bright conversation and silvery laughter. Visitors seeking the best of both Japans will find in their company a haunting taste of the old and an ideal point of departure for the new.

the *beisuboru dansu*, the "baseball dance," a series of comic gyrations based on the sport which is as popular in Japan as it is in the United States. Then the music switched to the rhythm of the *Kyo-Odori*, a traditional dance of Kyoto. And the real world, beyond the curtain of rain outside, seemed very far away once more.

I was back driving through it all too soon, the rain intensifying the traffic. Suddenly a gray Toyota, weaving to avoid a truck, grazed my front fender. It was hardly a major accident, only a close call. Both of us immediately pulled over.

"*Sumimasen! Sumimasen!*" the other driver apologized, bowing nervously. "I am very sorry! Very sorry!"

Disarmed by his politeness, I admitted that no harm had been done. Still he handed me his card and offered to pay damages. I assured him it was not serious.

"Sumimasen," he backed away, excusing himself once more. "Then I must hurry. I am late for my tea lesson." And he sped away again into the downpour.

Where else in the world, I wondered, would anyone race through such traffic—and then spend an hour to prepare one cup of tea?

I was glad when I finally folded my umbrella under the eaves of my inn. I paused downstairs to watch the television for a while with Mrs. Masumoto.

High-pitched voices interrupted the news, shouting the virtues of Suntory beer, Mitsubishi cars, and Bon chewing gum. Sumi-san padded in quietly, bowed low, and announced that my bath was ready.

I soaped up, scrubbed down, and rinsed off outside the tub, as is the Japanese custom. Then I submerged myself in the steaming water to soak away the day's tensions. From the music teacher's room upstairs floated a subdued melody on the samisen, while a chorus of frogs in the garden sang bass. In the distance a temple bell sounded.

Here is a people, I thought, keeping up with the world in every respect—leading it in some. Yet they know full well that although the present is profitable, the past is priceless. And so, here in Kansai, they go right on living in the best of two worlds. THE END

Starfish Threaten

"ONCE they head down the windward side of the island, we'll lose them," the marine scientist shouted over the outboard's roar. "It's too rough out there for small boats."

Sounds like a sheriff leading his posse after a gang of outlaws, I thought, as we knifed along the northern coast of Guam. True, our quarry was "speeding" at only a few hundred feet a day, but otherwise the analogy fitted. For, in their way, the marauders we had come to kill were as dangerous as any human desperadoes. They were spine-covered, coral-killing starfish, and they were destroying the living reef that shelters Guam's coastline from the continual pounding of the sea.

Rare nocturnal predators only a decade ago, these spiny multipedes have undergone a mysterious population explosion and now, by day as well as by night, menace coral reefs in widely scattered areas of the Pacific.

Casualty List Spans Half an Ocean

The prickly starfish, known commonly as the crown-of-thorns and scientifically as *Acanthaster planci*, eats the tiny coral polyps that create such reefs (page 348). In a single day it can graze an area twice the size of its 6- to 12-inch central disk.

Acanthaster has killed more than 90 percent of the coral along 24 miles of Guam's 100-mile coastline in two and a half years. It has also invaded 300 miles of Australia's 1,250-mile-long Great Barrier Reef, the world's most extensive example of the creation of reefs and islands by the flowerlike little polyps. The list of other coral areas under

Spearing coral-killing marauders, a Truk Islander impales two crown-of-thorns starfish. The mysterious increase of the species threatens destruction of Pacific reefs that harbor fish life and protect islands against eroding waves. Because a starfish cut in two may become two starfish, the pests must either be poisoned (pages 342-3) or be speared, as here, and brought ashore for burial.

ARTICLE AND PHOTOGRAPHS BY JAMES A. SUGAR

Pacific Reefs

Hypodermic guns go into action off Guam, where herds of starfish have left bleached coral skeletons, center. Stripped of living polyps, the reefs lie prey to small sea animals that bore into and weaken these natural barriers against the sea's erosive action. Hands gloved against thorns that

EXPLORER © NATIONAL GEOGRAPHIC SOCIETY

can poison, a diver with a hose-fed syringe injects a starfish with a lethal dose of formaldehyde solution (left). A team of four can kill as many as 2,500 in four hours. A rare nocturnal creature until it began reaching plague numbers seven years ago, the crown-of-thorns now feeds at all hours.

assault by starfish has doubled and trebled: Malaysia, New Guinea, Palau, Saipan, Truk, Fiji, Tahiti, the Tuamotus (maps, opposite).

At last our scientist skipper, Dr. Richard H. Chesher of the University of Guam (right), shut down the engines. "The starfish have killed most of the coral back to Piti Bay," he said. "They're now moving at more than 2,000 feet a week, looking for live reef."

We strapped on scuba gear and started down. Each of us carried a special hypodermic syringe with which to inject a fatal dose of formaldehyde solution into our prey.

I soon spotted the sea stars sixty feet below me. Their dark multi-armed bodies stood out clearly against the pale sea floor. I could see scores of them traveling in a herd about ten yards wide and perhaps a hundred yards long. Their orderly formation reminded me of a parade moving to the cadence of a band. But I was sure that these starfish marched only to the beat of their own private drum.

I dropped down for a close look at one and was again reminded of the aptness of the name "crown-of-thorns." Dozens of sharp spines jut out from each of the animal's arms (below), as well as from the central disk. Besides simple pricking power, these thorns can poison; injuries from them sometimes cause swelling, pain, and even nausea.

I drew my knife and flipped a two-foot-wide creature onto its back. Its underside was covered with tiny yellow tube feet which enabled it to move in any direction (page 350).

Those tube feet, I soon discovered, function like suction cups. I lifted the star with my knife and tried to balance it on my underwater camera. It immediately wrapped its arms around the camera, enveloping everything but the strap. I used that to tow my living pincushion to the boat, where I had to use my knife again to break the grip of its arms and tube feet on the camera.

Spears Are the Answer on Small Atolls

Diver Mick Church bobbed to the surface. His air tank was empty, but he was full of predatory pride. He had killed 150 starfish with his formaldehyde gun.

"Man, I've never seen so many in one place before," Mick gasped as he tried to catch his breath. "They were all over the place, moving as if they were playing follow-the-leader. It looked like a scene from a science-fiction movie—an invasion from inner space."

"We can control the invasion here in Guam," said Dr. Chesher as we stowed our gear. "Not long ago our killer team destroyed 2,549 starfish in four hours. The trouble is, people on most of the outlying islands don't have all this equipment. We'll have to teach them to collect the starfish on spears [pages 340-41] and bury them on land. Just stabbing them isn't enough. A pierced star may not die. If you chop one in two, both halves may regenerate and become complete individuals."

Driving home from the dock, Dr. Chesher told me that people living on low-lying Pacific islands face real danger as a result of the starfish's depredations.

"When live coral is killed, reefs may break down," he said. "Then storm waves might eventually eat away shorelines. But before this could happen, islanders might be forced to leave or starve. They get almost all their protein from the sea. Once the reefs die, food fish go too."

The possibility that such a disaster might strike the Pacific Islands Trust Territory, administered by the United States, prompted the U. S. Department of the Interior to send out an international team of more than 60 scientists and divers to study the problem last summer. The project, managed by the Westinghouse Ocean Research Laboratory of

Menace on the march, a crown-of-thorns attacks a live coral head. Dozens of yellow-tipped feet flanked by blunt spines line the undersides of *Acanthaster planci*'s 12 to 19 arms. Most often it has 16, each of which may grow as long as six inches.

Suction cups on the ends of the feet carry feeding starfish up vertical reef walls. The predators, moving in narrow, irregular columns parallel to the shoreline, may migrate nearly half a mile a week.

Gearing up for a look at the invader, Dr. Richard H. Chesher adjusts air tanks. Chief scientist of an intensive United States Department of the Interior study, he seeks causes and effects of starfish proliferation.

Crown-of-thorns depredation was first reported a decade ago on Australia's 1,250-mile Great Barrier Reef (bottom), world's most awesome coral formation. Starfish were ravaging reef areas between Cooktown and Townsville in Queensland. Plague reports multiplied, reading like a Pacific war map of the 1940's: Malaysia, Borneo, Guam, Saipan, Tinian, Truk.

Starfish-killer teams armed with formaldehyde syringes think they have contained the plague on Guam (below). But *Acanthaster's* appetite threatens many small atolls, where scientists hope to teach islanders simpler extermination methods (pages 340-41).

Triton's searching tentacles set off a low-speed chase

PROBING FOR A MEAL which the author placed nearby, a Pacific triton (above) sends a crown-of-thorns fleeing over a coral head at 12 inches a minute. The race ends with the starfish locked between the attacker's foot and its algae-flecked shell (right).

Its prey immobilized, this triton rolls over, flipping the starfish on its back (opposite, below). Then the mollusk tears it to shreds with its filelike radula and digests it. Sometimes a half-eaten starfish skitters away at mid-meal; eventually its amputated portions may regenerate. Some scientists blame *Acanthaster*'s increase on collectors who pay $35 or more for spiraled triton shells. Australia hopes to raise the giant mollusks for release on starfish-infested reefs.

San Diego, California, was set up to survey the damage caused by *Acanthaster*.

But the team also studied the animal's behavior, particularly its eating habits. Dr. Ralph W. Brauer, of the Wrightsville Marine Bio-Medical Laboratory in North Carolina, collected starfish which he kept in aquariums at the University of Guam, where he could observe them closely (page 350).

I accompanied Dr. Brauer and his two colleagues, David Barnes and Mike Jordan, on a collecting expedition to an infested reef along Guam's western coast. In an outboard-propelled rubber raft, loaded with diving equipment and large buckets for holding the starfish, we rode to a spot where I had seen starfish feeding a few days earlier. We located a cluster of the creatures, dropped anchor, and put on our gear.

"Be careful when you handle these critters," Dr. Brauer warned us. "I don't want you to damage the animals or yourselves. Watch out for their spines!"

We headed for the bottom. Here the sea floor was covered with coral heads of all shapes and sizes. Only a few *Acanthaster* were feeding on top of the heads. Most of them were well hidden under the coral, to which they held firmly with their arms and tube feet. To remove the starfish, I used my knife with the care of a surgeon, heeding Dr. Brauer's warning as I worked.

Spines Can Cause Painful Wounds

The four of us shuttled back and forth between the raft and the coral heads on the bottom. On each trip up we brought one starfish to the surface, put it in a bucket on the raft, and headed back down for another.

On Mike's last trip to the surface, he handed

a starfish to David, who was in the raft. A spine brushed David's finger. Light as the touch was, it gashed his skin.

David yelped.

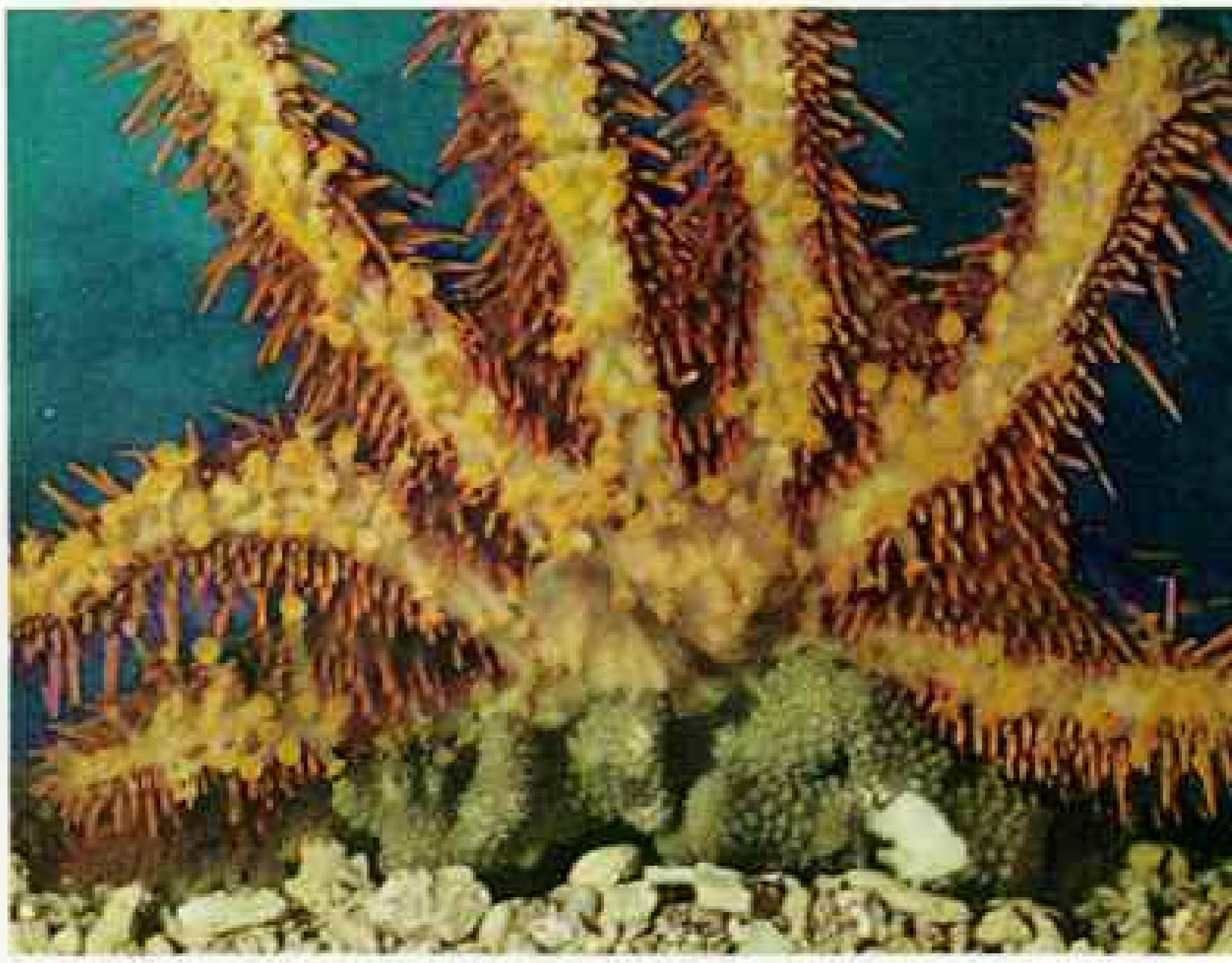
"Force the cut to bleed," Dr. Brauer told him. "Get the stuff out of the wound. If you do it right away, you'll have less pain later."

When we released our starfish in glass-walled tanks at the university, Dr. Brauer ran sea water over some living coral, filled a hypodermic syringe with the polyp-flavored water, and squirted it under a starfish creeping up the glass wall.

Mistaking the coral taste for live coral, the starfish opened its mouth (located in the center of its underside) and everted its stomach. The fleshy digestive sac covered an area larger than a man's palm (pages 350-51).

Next Dr. Brauer placed a hungry starfish on a piece of living coral. Out came the

The quick and the dead: Flowerlike coral polyps (left), enlarged 7½ times, were long mistaken for plants. Simple, stationary animals, they attach themselves to the skeletons of their ancestors and exude calcium carbonate to build a home around themselves. Withdrawn into their limey cups by day, polyps unfold tentacles at night to feed on microscopic sea life. In one of nature's strangest vendettas, they devour millions of starfish in the larval stage. Thus man's destruction of coral reefs by blasting and dredging channels may contribute to the growth in starfish population. Desolation invades oceanic gardens of Guam (above) in *Acanthaster*'s wake. Thick fuzz of algae quickly covers dead coral, preventing new growth.



A stomach goes out to lunch

WIELDING A SYRINGE, Dr. Ralph Brauer squirts coral-flavored sea water along the underside of a captive starfish at the University of Guam (above). The stimulated *Acanthaster* hungrily opens its mouth in an experiment that demonstrates the creature's feeding behavior.

Live polyps placed on the tank bottom attract the predator (above right). It moves its tube feet excitedly and begins to evert its gastric sac, a billowy membrane which, when fully extended, covers an area larger than its central disk. "It tumbled around the coral like a collapsed parachute," observed author Sugar.

As the membrane—enlarged three times at right—drapes over the polyps, digestive juices pour from the body to dissolve the food into semifluid strands of tissue. The starfish then absorbs its meal, though scientists do not yet know exactly how. Within eight hours all coral covered by the stomach area will shine bone white—shorn of life.

stomach. It spread over the coral polyps, and its digestive juices began to dissolve them inside their limey shelters. After an hour, the polyps were reduced to semifluid shreds. Where colonies of colorful little animals had lived, there remained only a bleached white skeleton.

"In a single night," Dr. Brauer told me, "an adult starfish can clear off a coral head that might have taken fifty years to grow."

Giant Tritons Prey on Stars

While such studies of the sea star's habits may lead eventually to a means of controlling the present plague, some scientists are seeking more immediate solutions. Australian biologists, concerned about the threat to the Great Barrier Reef, plan to attack the stars with armies of their natural enemies, giant tritons. They believe that man has upset the delicate ecological balance of the reef by collecting too many of these mollusks for their handsome spiral shells, permitting the stars to multiply abnormally.

"I have calculated that shell collectors took at least 100,000 tritons from the Great Barrier Reef between 1949 and 1959," says Dr. Robert Endean of the University of Queensland. "We are trying to find out whether it's possible to grow these animals on a special triton farm. If it is, we'll seed them as adults along the Great Barrier Reef."

Having once watched a giant triton devour an *Acanthaster*, I can vouch for its voraciousness. The triton first located the star with its two tentacles. The threatened starfish tried to creep away, but its pursuer chased it across a coral head and caught it. The mollusk first seized the starfish, holding it between shell and foot, then began to tear it to shreds and eat it (pages 346-7). Several hours later, it ejected the spines.

If isolated or somehow contained within a given coral area, the crown-of-thorns soon curbs its own population explosion—at the cost of a totally dead reef. "*Acanthaster* become so numerous they eat themselves out of house and home," explained Richard Randall, an expert on the corals of the Marianas.

While I browsed through the dozens of coral-laden racks in his house on Guam, Mr. Randall pointed out that the devastation of a reef leads to starvation of the starfish—though only after it has led to the starvation of other reef creatures, and perhaps humans as well.

Man May Have Set Off the Plague

Can a reef recover from a starfish attack? Mr. Randall is trying to find out.

Coral regeneration is difficult because the porous skeleton of a ruined reef is soon covered with algae which prevent new growth. Within two or three days the white skeleton becomes a dismal gray, coated with fuzz (page 349) or festooned with long green strands.

No single theory offered to date has adequately explained the starfish plague and its wide distribution. Some scientists speculate that the population explosion has no unusual cause but is only a natural periodic phenomenon. Other theories seem valid for certain areas but not for others. Many Australian scientists are convinced that over-collection of giant tritons created the plague on the Great Barrier Reef. But lack of intensive shell collecting in remote island areas, now equally star-infested, indicates other causes as well as triton harvesting.

In his office at the University of Guam, Dr. Chesher told me that man may be responsible in another way for the invasion. "By killing coral in the process of blasting channels or dynamiting for fish," Dr. Chesher said, "he has perhaps altered the underwater environment in favor of the sea-star's survival."

Dr. Chesher explained that under normal conditions only a tiny percentage of the millions of eggs spawned by the female *Acanthaster* ever reach adulthood. Many of the floating starfish larvae are devoured by living coral polyps. But when an area of reef is killed by man, the vulnerable larvae can settle upon it and mature in safety.

Because there is usually living coral immediately adjacent to the dead reef, the young adults have a ready food source once they begin to eat polyps. As the adult starfish destroy even more of the reef, they enlarge the sanctuary for their young. The result of the chain reaction is a population explosion.

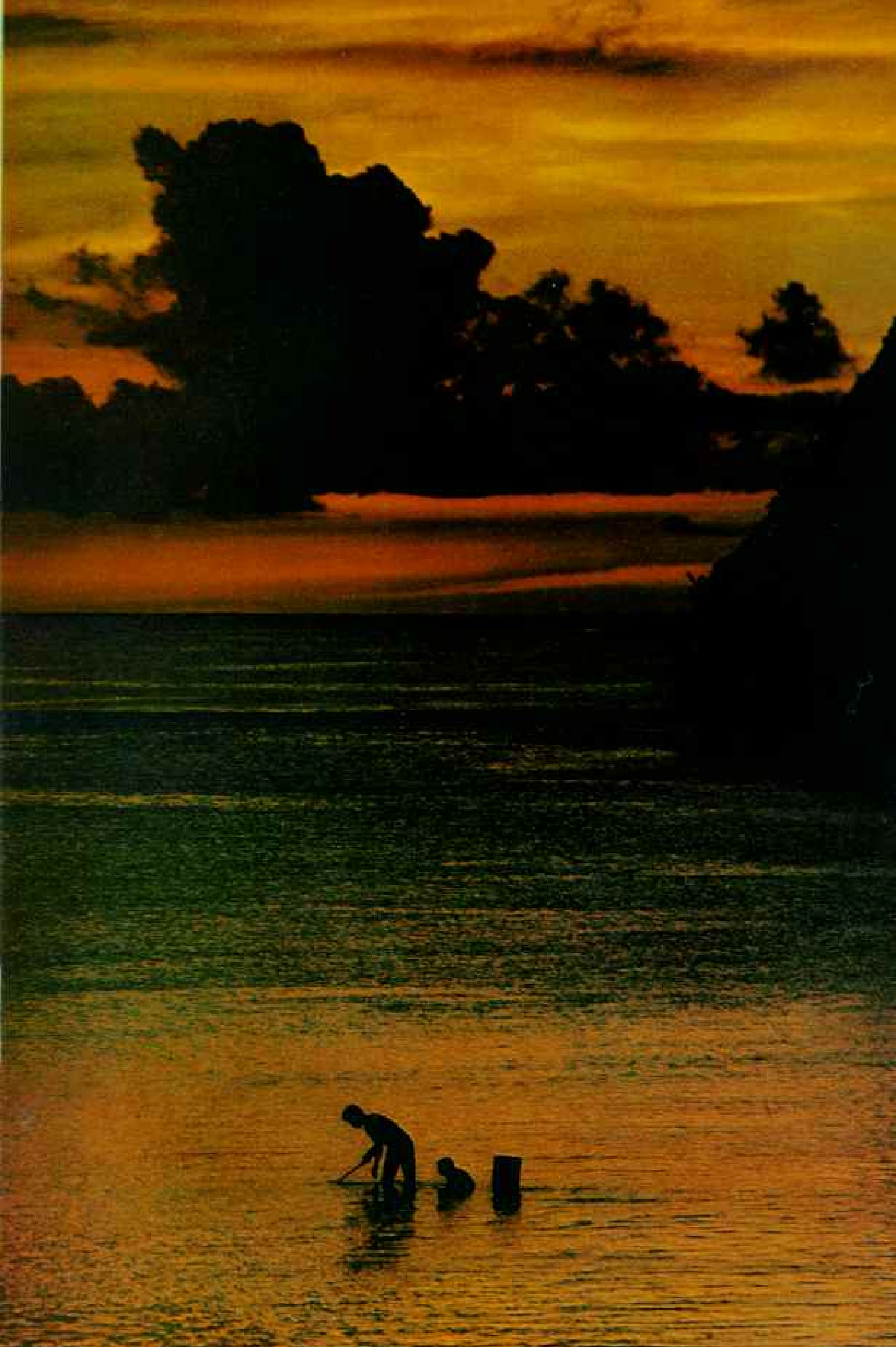
"Support for my hypothesis," Dr. Chesher pointed out, "comes from the fact that infestations in Guam, Rota, and Ponape were first discovered near blasting or dredging sites."

Others have wondered whether the imbalance in reef life might have been caused by the testing of nuclear weapons, or by pesticide residues washed into the oceans from the land. Whatever the cause may prove to be, all the theories advanced so far—except that of natural periodic population growth—point to the activities of man. Whether by dredging, or shell collecting, or pollution, this latest disturbance of the balance of nature seems to be a further example of man's disruption of his world.

THE END

Deadly embrace dooms a prong of staghorn coral. Nearby, a whitened branch stands stripped of polyps like an ear of corn denuded of its kernels. Among the reef-building corals, few varieties enjoy immunity from the starfish.

Paradise in peril: Plagues seem far from mind as two islanders at Guam fish with dip net and bucket through a serene dusk. But scientists fear their way of life may vanish if the crown-of-thorns goes unchecked and the underwater ecology continues to change.



Indian Shangri-La of the Grand Canyon

By JAY JOHNSTON Senior Editorial Staff

Photographs by TERRY EILER

"People of the Blue-green Water," young Indians frolic in the luminous stream from which, long ago, their tribe took its poetic name. School-age Havasupai like Delmer Uqualla (above) must spend nine months of the year at boarding school, far from their idyllic valley. Mooney Falls, one of three major cataracts on Havasu Creek, drops its feathery plume a total of 196 feet.

MAIN STREET, the only street, is a narrow trail ankle-deep in dust. The fifty-odd homes have no electricity. There are no cars, no newspapers, no television, and no air conditioning, though summer temperatures often soar past 100° F. Yet 15,000 visitors a year come to the village of Supai, reachable only by chartered helicopter or steep and rugged trail.

Supai nestles in Havasu Canyon, 2,400 feet below the South Rim of the Grand Canyon and more than 1,300 feet above its depths (maps, page 361). The village is the heart of an Indian reservation, one of the smallest and certainly the most isolated in the United States. Here dwells the Havasupai tribe—some 300 men, women, and children—the People of the Blue-green Water (from *Havasu*, blue-green water, and *pai*, meaning people).

Through Havasu Canyon courses the spring-fed creek—clear bluish-green—that gives the tribe its name. It makes the narrow valley verdant and fertile, unlike other side canyons plunging into the Grand Canyon. A mile and a half below the village, the life-giving stream, Havasu Creek, cascades over the first of three major waterfalls (opposite and page 372). Colossal ramparts of red rock wall the canyon and the village in its midst.

I found it a bit expensive to fly into Havasu by helicopter, so I traveled there the way most visitors do. Six miles east of Peach Springs, Arizona, I turned my car off the asphalt ribbon of U. S. 66 onto a rutted road. Sixty miles ahead, across gray-green plains and hills crowned with junipers and piñon pines, lay Hualapai Hilltop, a lonely turnaround where the trail down to Supai begins.

I had arranged for a Havasupai packer to meet me at 9 a.m., and I was on time, but there was no sign of Indian or horses. I walked to the edge of the cliff. Three hairpin turns below me I spied a man with three horses coming up the trail. When he reached the last turn, he dismounted and went to a pole with a box on it. It contained a telephone, I realized, as he turned a hand crank and began to speak. I later found that the phone connects with Supai Village.

"Hello, hello! This is Bufford," he shouted. "I forgot the name of the man I'm supposed to meet up here. What's that? Johnston?" He turned and called up to me, "Hey, your name Johnston?"

Barrel-chested Bufford Paya, not yet 17, was as absent-minded as my own teen-age son. He wore jeans, a blue shirt, a bright-red vest, and a yellow headband around his jet-black hair. Keen brown eyes brightened his full-moon face. He told me to climb on Black Knight—his best horse, he informed me as he strapped my heavy canvas carryall atop a packhorse.

The first mile of the seven-mile trail to Supai is a dizzying series of switchbacks. I glued one hand to the reins and the other to the saddle horn.

Land Changes Color Like a Chameleon

On the floor of Hualapai Canyon, a thousand feet below Hilltop, the trail straightened and followed a dry wash between towering sandstone cliffs. At the "Ladder," a narrow defile, the walls closed in until it seemed I could touch both sides at once.

Then, suddenly, we were in a clearing, and the arid red-brown landscape burst into green—a canopy of cottonwoods and willows nourished by gushing springs. We had reached Havasu Canyon and its tiny stream.

Within a few hundred yards Havasu Creek had swollen to a width of 15 feet. We forded it, topped a rise, and I saw spread below me the lovely land of the Havasupai. Above fields of alfalfa and corn, twin pinnacles of red sandstone stood sentinel: the Wigleeva rocks (pages 360-61). When they topple, the Indians say, the tribe will perish.

Supai may be remote, but it has a tourist office, and it was there that Bufford delivered me, just a little more than three hours after leaving Hilltop. A brisk young representative of the tribal council assigned me to the one-story lodge next door. He guessed that I would want to rest from the trip, but I was too eager to see Supai. I tossed my bag on the porch of the lodge, turned, and bumped into a John Wayne with silver hair.

"Welcome to Supai," said Bill Willoughby, resident agent of the Bureau of Indian Affairs. Broad-shouldered and lean-hipped, he seemed a typical Westerner. Actually, I found, he was born in England 56 years ago, but had spent most of his life in the American West. Before taking the Supai post, he lived on the Navajo Reservation in northeastern Arizona.

"I'm on my way to see the chairman of the tribal council," he said. "Take a walk with me."

Where Time Falls Out of Focus

We headed up Main Street. Cottonwoods lined the lane (pages 358-9), and on both sides stood Havasupai homes of wood, stone, and sheet metal, many with but a single room. Beneath shade pavilions of branches, families cooked and ate their noonday meal. In every yard horses browsed.

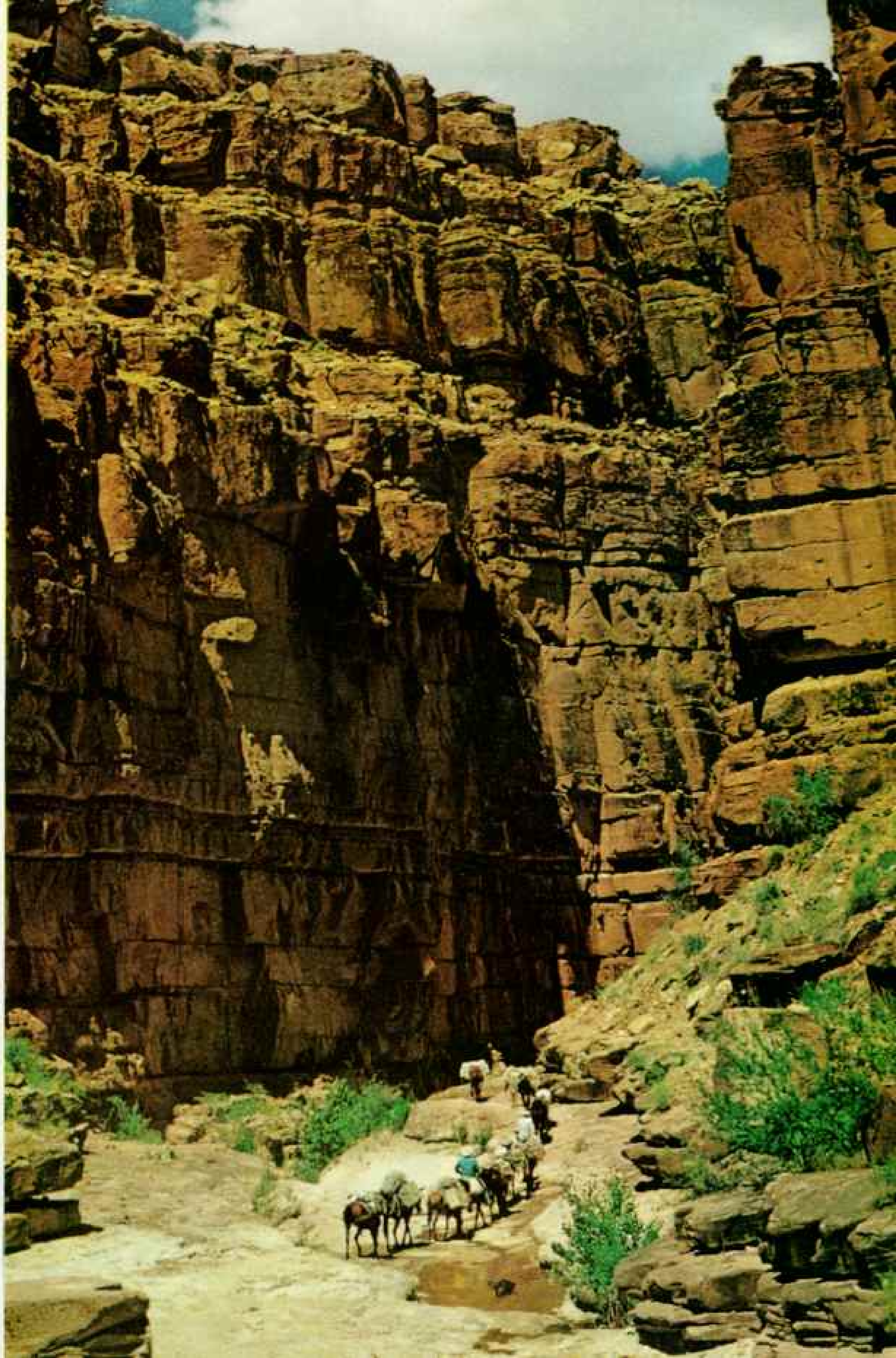
"You'll soon learn that happiness is spelled horses in Supai," said Bill. "The men and boys are good horsemen. They'll ride rather than walk when visiting only two houses away."

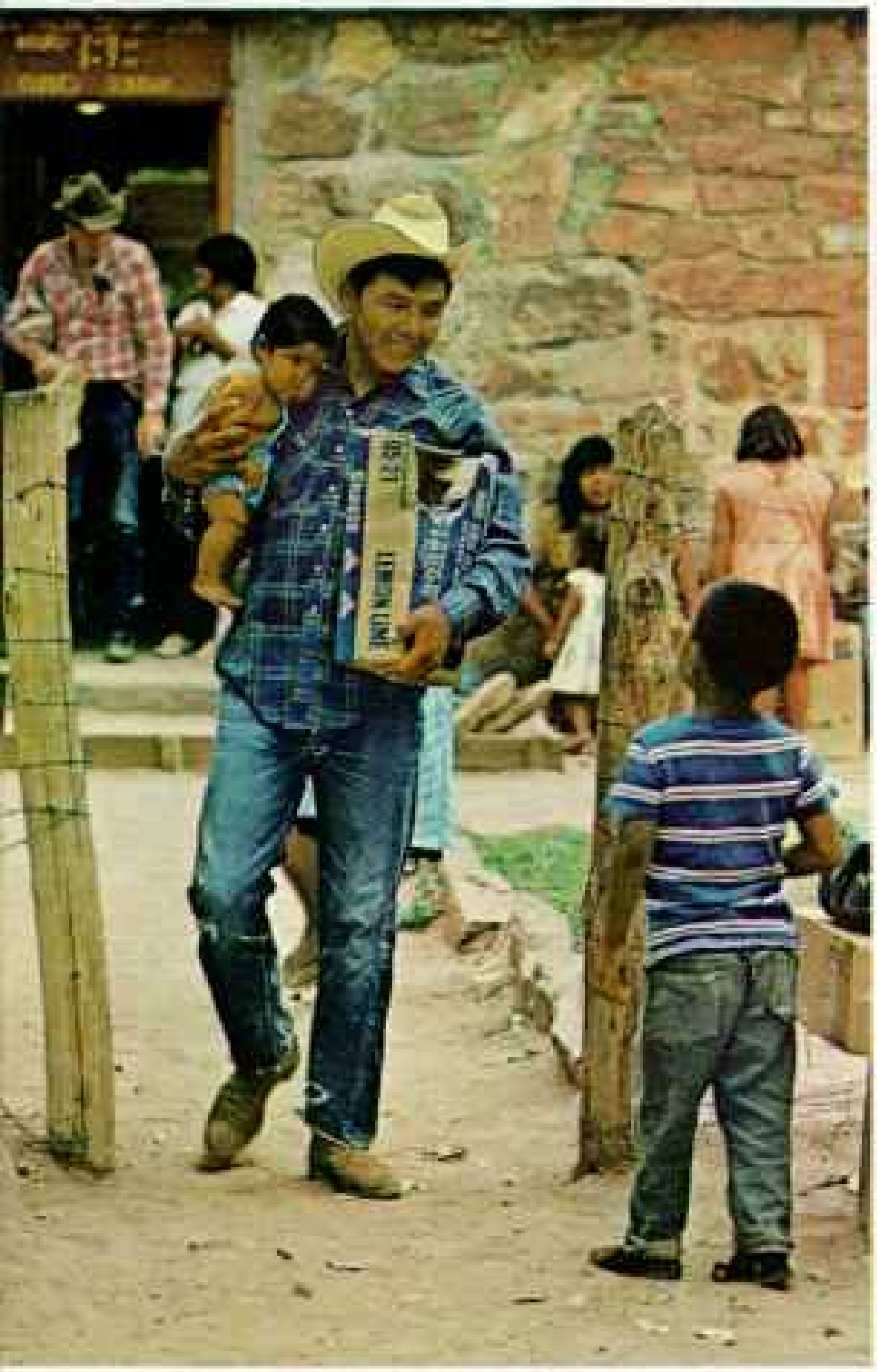
Some tribesmen own as many as forty horses, Bill added, and earn most of their income with their animals. The charge for a riding horse or packhorse in and out of the canyon is $18, round trip. The owner gets $13; the other $5 goes into the tribal fund.

Leaving Bill at the chairman's home, I retraced my steps to the village store, next door to the tourist office. On benches at the entrance sat several women and a few men, chatting and sipping the canned soda pop relished by all Havasupai (page 358). Almost everyone in Supai, it seems, shops daily. Marketing provides a break in routine, and the store serves as a meeting place.

Prices, I noted, reflected the long and costly journey from Peach Springs. A pound of

Down, down, down between towering red cliffs winds the seven-mile trail from the rim of the Grand Canyon to remote Havasu Canyon, a three-hour trip. A packtrain, picking its way along the narrow, rock-strewn path, transports mail and supplies to the tiny village of Supai, one of the last post offices in the Nation to receive its letters by mule train.





An armful of son, another of soda pop burden an Indian heading home from Supai's only store. Prices run higher than on the outside, especially for heavier items, reflecting the long journey by truck and trail from Peach Springs, Arizona. But profits from the store go into a tribal fund for community improvements. Though the tribe's 300 members grow a few melons and some vegetables and fruit, they utilize most of their irrigated acres for alfalfa and as pasture for their horses and mules.

The winner: Black Knight! Galloping down Supai's dusty Main Street, the only thoroughfare, Bufford Paya wins an impromptu race. Born to the saddle, Havasupai men and boys earn most of their income by packing visitors in and out of the canyon —at $18 a round trip.

coffee cost $1.65. The heavier the item, the greater the increase in price. A bag of cement that cost $1.35 in the world outside sold for $4.00 down here.

High prices aside, there is an undeniable charm to the languid pace that prevails in Supai. In the days that followed, I found myself adjusting to it with surprising ease.

Louis Bruce, a Sioux-Mohawk who serves as Commissioner of the Bureau of Indian Affairs, has said that most tribes do not have a word for precise divisions of time. In Supai there is really no need for one. Tuesday is almost indistinguishable from Friday, except that Friday is a mail day, as are Monday and Wednesday, in the last post office in the Southwest served by mule train.

But some days in the land of the Havasupai are identified by events:

- The day the valley's generator broke down, and there were no lights in the school, the store, or the tourist office.
- The even gloomier day when the supply of soda pop ran out.

• The day the helicopter flew in new irrigation pipes. On one flight the chopper dropped three of the heavy cylinders, nicknamed "tin whistles" by the Havasupai, that narrowly missed striking Viola Crook and her daughter as they walked in on the trail.

• The day the village got new phones to link it with the outside. They replaced the old "yell-ophone," so named because you had to shout into the mouthpiece.

• The day two mechanics flew in and fixed the tribe's lone bulldozer, which had lain unused in a field for a year.

• The day 16-year-old Webb Jones was stung on the hand while working in the warehouse behind the store. The room was so dark he couldn't see whether it was a scorpion, a black widow spider, or perhaps even a rattlesnake, though no one ever recalls seeing a rattler in the village proper. Within an hour, the numbness in Webb's hand spread up his arm and down into his chest. He began retching and having chills.

Alerted by phone, the Public Health Service clinic in Peach Springs dispatched a helicopter and lifted the youth to the hospital in Grand Canyon Village. The poison—doctors believed it to be from a scorpion—had already started to affect Webb's nervous system, but prompt treatment had him back in the village three days later.

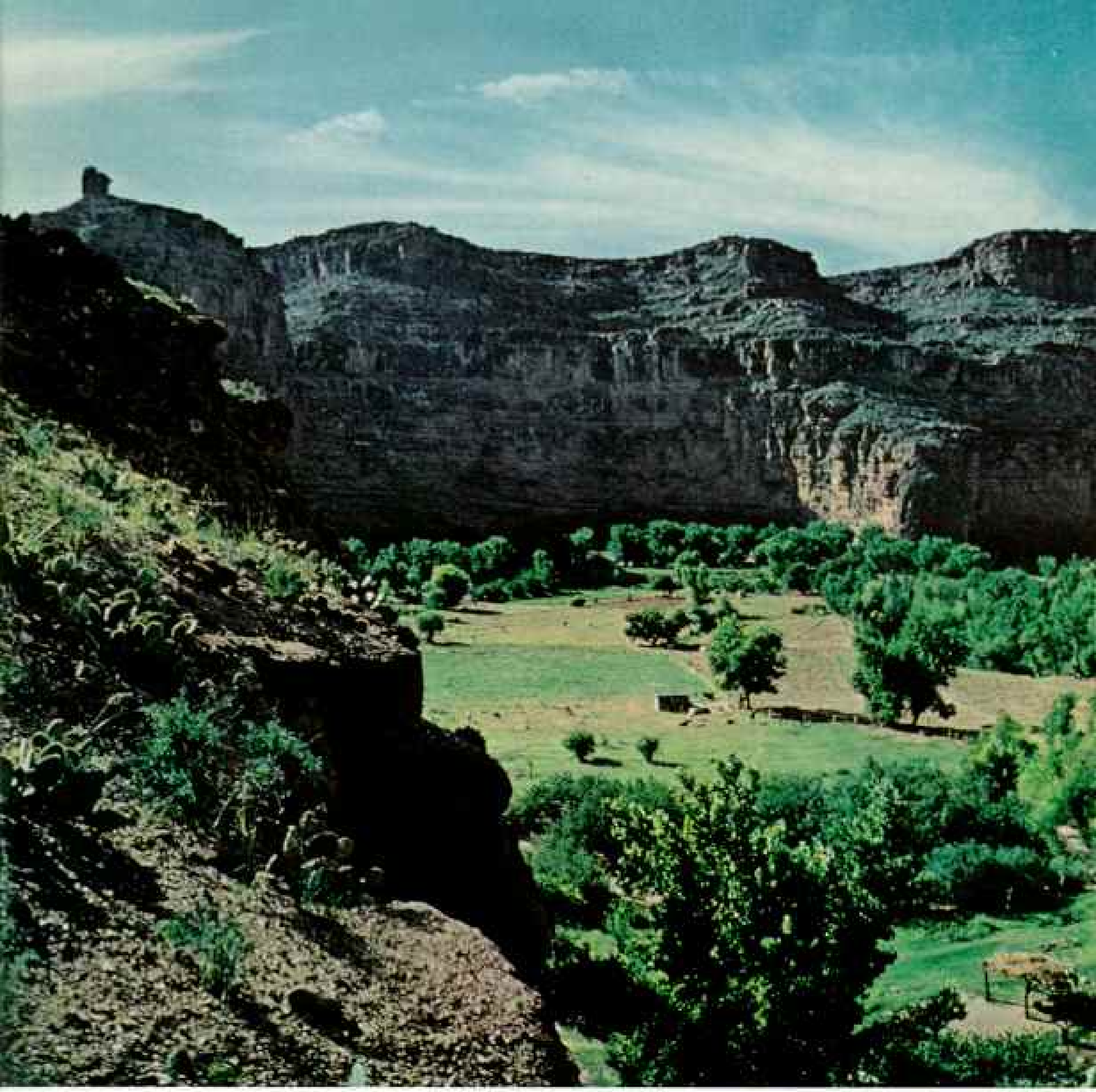
I carefully shook my boots out each morning thereafter.

Lush Grass Sprouts by a Churning Pool

Often I walked down from the village to see the magnificent falls, alone worth the arduous trip into the canyon. I never tired of those plummeting waters, and frequently I swam below the falls, in pools a refreshing 70° F. even in the hottest weather.

Navajo Falls lies less than two miles below the village. Behind and beside the 75-foot falls hang apronlike crusts of travertine, twenty feet long and more than five feet broad. They are proof of the creek's rich quota of water-soluble minerals, especially carbonates.

At the falls the mineral-saturated waters



aerate as they tumble, and the color changes from palest blue to rich blue green—as if, one observer noted, nature had poured bluing into her rinse water.

From Navajo Falls the trail descends, then climbs again, to land that is part of Grand Canyon National Park.* Hugging the cliffside, the trail climbs higher still to a promontory that affords a superb view of the second falls, Havasu, tumbling 125 feet into a circular pool misted with spray (page 372).

Maidenhair ferns sprout from rocks at the base of the falls, and lush grass, like a putting green, carpets the banks. Beyond the 20-foot-deep lagoon the water shallows and swirls in a series of travertine tubs, shaped like lily pads and floored with pink and white sand.

Less than a mile below Havasu sparkles Mooney Falls, at

Like a desert mirage, Havasu Canyon spreads an emerald counterpane in the midst of an arid land. Irrigated by springs that swell to a creek, the valley blooms with willows and lofty cottonwoods. In this view to the southwest, the village of Supai, including Main Street, lies hidden behind the 800-foot-high rampart at left. Across the vale rise twin sandstone pinnacles, the Wigleeva rocks. Should they topple, Havasupai say, the tribe would die. Maps at right pinpoint the Indian reservation.

*See "Retracing John Wesley Powell's Historic Voyage Down the Grand Canyon," by Joseph Judge, GEOGRAPHIC, May 1969.

KODACHROME BY TERRY EILER © NATIONAL GEOGRAPHIC SOCIETY

Havasupai holiday, the annual Peach Festival in late August originally celebrated a time of harvesting. But few fruit trees survive now, and the Indians have turned the fete into a farewell party for the village's 9- to 19-year-olds, who must soon leave for school.

Havasupai men butchered a steer for the open-air buffet, roasted it over an open pit, and served it with potato salad, beans, and cole slaw.

"Hands off the horn!" Fellow tribesmen shout the admonition to a bronc rider performing at the Peach Festival.

A pure case of puppy love. Like children the world over, Harjo Paya succumbs to the charm of a new arrival. This dog must learn independence early; Havasupai do not believe in pampering pets.

196 feet the highest of Supai's three cataracts, and the one that speaks with the loudest voice (page 354). This is the end of the line for horsemen, because the trail here becomes a series of hand- and footholds down the face of the steep cliff flanking the falls. Long ago lead and zinc miners hacked out steps in the rock and inserted iron pegs for handholds. The cascade is named for an ex-sailor turned prospector, who fell to his death here in the early 1880's.

Warning Recalled During Lonely Climb

Bound for Mooney and a swim in its lagoon one late September afternoon, I crossed a park campground, now devoid of visitors. Here the valley was no wider than 500 feet and in places less than 100. From every empty tent site the music of the creek could be heard as it rippled beneath limestone cliffs.

But now it was music for me alone. Only lizards and chipmunks kept me company. Canyon wrens, darting in and out of the mesquite, sang their startling but melodious song.

Cautiously, I worked my way down the cliff. A few minutes later I was contentedly swimming in my private pool and munching on the watercress that fringes the banks.

When the sun sank behind the western wall, I dried and dressed and began to scale the cliff. It was only then I remembered being cautioned not to go alone to the bottom of Mooney Falls. Should I slip and fall, as did the ill-fated Mooney, I might lie for hours—or days—before being found. I took extra care in the ascent.

Halfway through the campground, I heard the sound of hoofs. Bufford Paya on Black Knight rounded a clump of thornbushes in a flurry of dust. He reined his mount to a halt, and the thought occurred to me that Bufford, learning I had come down alone, was checking on me. Was that so, I asked?

"No, just riding," said Bufford rather offhandedly. But I wasn't convinced.

Next morning I was strolling beside the

Home life moves out of doors as summer temperatures climb past 100° F. and the small, cramped houses become too hot for comfort. Earl and Lillian Paya cook, eat, and

ESTACHONE © NATIONAL GEOGRAPHIC SOCIETY

sleep in the open from May to November. Shaded by a venerable cottonwood, Lillian prepares flatbread from wheat flour, as cabbage and baked beans simmer on the grill.

creek above the village, not far from the Wigleeva rocks, when I encountered Bufford again. He stood beside ever-present Black Knight, and he wore only undershorts.

"We're going to take a sweat bath," he said, and pointed to a conical hut about four feet high, set partly in and partly out of the ground (pages 370-71). Havasupai men in breechcloths were heating stones in a fire and shoveling them into the sweat lodge.

"Join us if you like," Bufford added.

Primitive Sauna Bakes Out Miseries

I quickly stripped down to the swimming trunks under my jeans, crawled in, and sat on the dirt floor with Bufford, his uncle Earl Paya (page 364), and Daniel Kaska, tribal council chairman. Unseen hands closed the canvas flap tightly over the entrance.

Inside, other hands splashed water on the rocks. A wave of intense heat struck my body. We sat wedged together, legs crossed, heads bent, in the low pitch-dark enclosure.

"If you get too hot, put your head lower between your legs," instructed Earl Paya.

His father, Earl explained, always sang four songs while in the sweat house, and the time it took to sing them determined the length of the bath. He regretted, Earl said, that he did not know the words of the songs, so he could not chant for us.

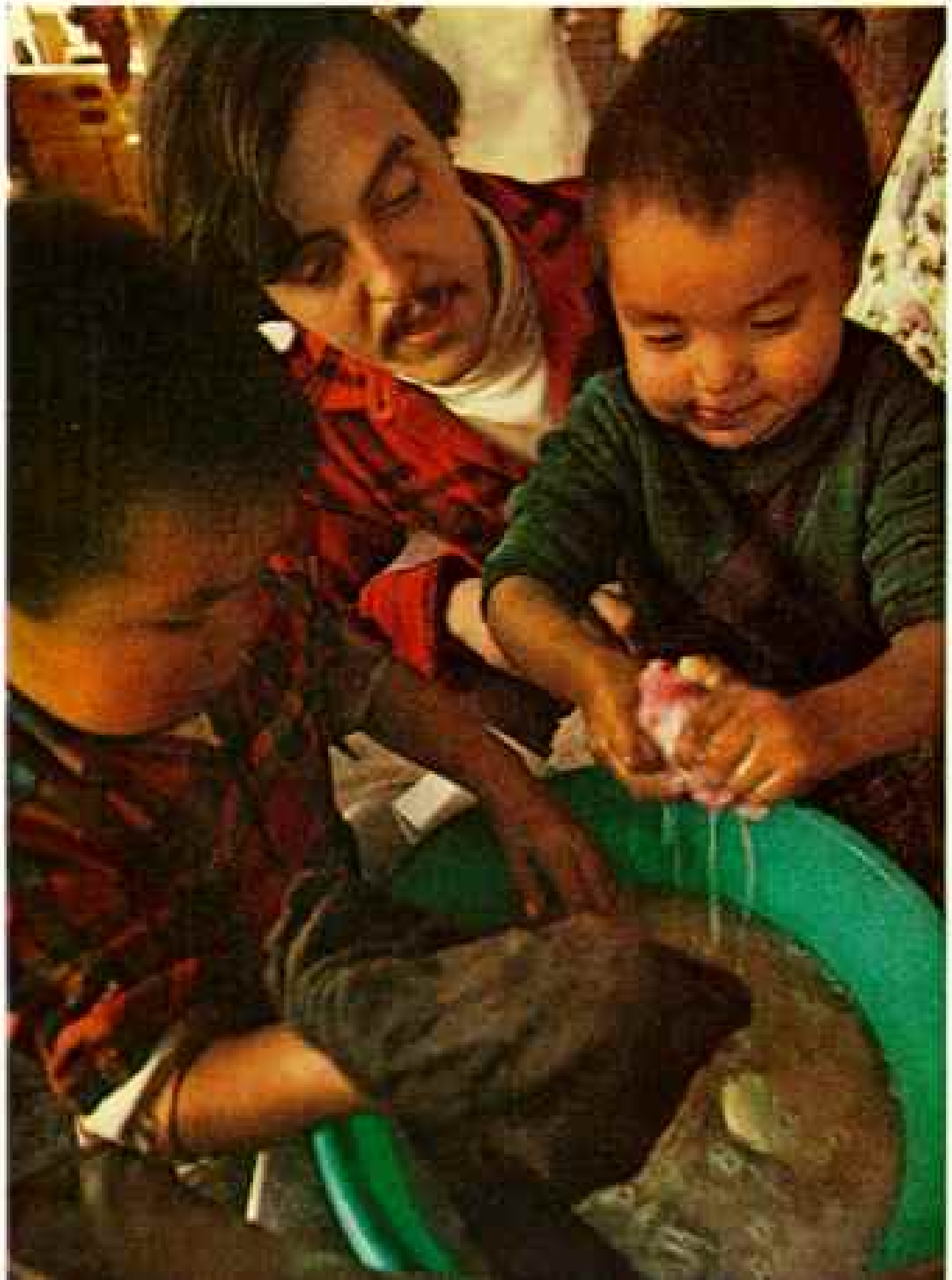
"We will just talk," he said, and talk we did—the equivalent of at least 400 songs, or so it seemed.

Sweat baths cure colds, wounds, arthritis, even broken bones, Earl explained. "You must blow on the sick spots," he said, "and they will be better." My companions were all blowing, and though I had no particular aches or pains, I followed their example. My breath felt like a red-hot knife.

"Han-e-ga! Han-e-ga!" The Havasupai word for "good" rang out each time water was splashed on the rocks. Then Earl shouted some words that miraculously opened the flap from outside.

I crawled out and flopped in the sand by the creek. I yearned to jump into the cool water, but Lemuel Paya, Earl's father, said no. I would go crazy if I went in too soon. So I was

Lesson No. 1—cleanliness. Terry Eiler, director of Supai's Head Start school, teaches toddlers the fun of washing clothes.



On a nature walk, Head Start pupils stroll down Main Street.

still sprawled on the sand when Earl told me, "You know it is bad luck if you do not go into the bath in numbers of two."

"You mean two people at a time?" I asked, knowing well he did not mean that.

"No, two times in," he said.

Once more back into the searing darkness.

I have been in many saunas and Turkish baths, but I have never been so thoroughly parboiled. What I did not know at the time was that I was being singularly honored. Not one of the four non-Indian men then living in Supai had been invited into a sweat lodge —though none of them was complaining!

And then once again the flap opened, and we were lying in the sand and, at long last, soaking in the creek.

Tribal Arts Vanish With the Years

The sweat bath is a vestige of a fading culture. Unlike the Navajo and the Hopi, the Havasupai have never been renowned as makers of pottery or jewelry. A few women weave baskets, but even that craft is dying out.

Anthropologists agree that the Havasupai are of Yuman affiliation, culturally one with their hilltop neighbors, the Hualapai. But the two leading authorities on Indian cultures in the Grand Canyon differ on the settlement date of Havasu Canyon.

Dr. Douglas W. Schwartz, Director of the School of American Research in Santa Fe, New Mexico, believes the canyon dwellers are descendants of the Cohonina, who lived on the plateau south of the Grand Canyon as early as A.D. 600. He theorizes that climatic changes or raids by other tribes caused bands of the Cohonina to descend into the canyon sometime between 900 and 1100.

Dr. Robert C. Euler, head of the Center for Anthropological Studies at Arizona's Prescott College, thinks the Havasupai were a separate tribe from the west, and that they moved into Havasu around 1150.

The first white man to visit the canyon was Father Francisco Garcés, a Spanish mission priest, who in 1776 found 34 families living there. They wore red cloth and had horses and cattle obtained in trade with the Hopi. In the century that followed, a few pioneers and

under the guidance of teacher Lyntha Eiler, carrying a bag of camera gear and accompanied by her Indian teacher's aides. The author stayed in the four-room visitor's lodge at left.

prospectors called on the Havasupai. In 1880 the United States Government made their remote home a reservation.

Without question, the reservation is a scenic Shangri-La, but even a paradise can have its problems. In the fictional Shangri-La of James Hilton's *Lost Horizon*, the people had learned to prolong their youth—but it worked only if they remained in their secluded vale.

The Havasupai pay an even more formidable price to live an isolated life in an idyllic setting. Their little valley school teaches only through the second grade. Students from third grade through high school are shuttled off in early September to distant Indian boarding schools. Except for Christmas, they do not return until late May.

Officials of the Bureau of Indian Affairs have discussed with the tribe the enlargement of the school at Supai. It would, of course, please the parents to have their children with them the year around. Yet it would work hardships as well.

"Where would the children live in winter?" Bill Willoughby asked. "The houses are overcrowded now. Some have 11 in two rooms. They can't live outdoors as they do in summer.

"Then there's the food problem. Even without the children, it is hard to feed the family in winter.

"Consider this, too," Bill Willoughby went on. "Is it not best to acclimate the young people to the world above their canyon?"

It is an unfortunate fact, though, that most Havasupai parents feel that "if it's good enough for me, it's good enough for my kids. There are too many frustrations up on top." This sort of rationalization is passed on to the youngsters, and it shows up in the large number of dropouts, especially among the boys in Supai. Few finish high school. None is currently in college. Not one has ever graduated from college.

PATACHROME BY TERRY EILER © NATIONAL GEOGRAPHIC SOCIETY

The Havasupai's problems are but one aspect of a dilemma that grips all Indian tribes in the United States.

"The whole concept of Indian reservations may be outmoded," a housing expert called in to advise the Havasupai suggested to me during a visit he made there. "Granted they were necessary back in the days when settlers were swarming over the lands of the red man. But today a reservation can be like a cave. The Indians get inside and roll the stone up against

New twist to the old ABC's

FREE-LANCE photographer Terry Eiler first visited Havasu Canyon and met the Havasupai when he undertook this pictorial assignment for the GEOGRAPHIC. Both the place and the people fascinated him.

After completing his studies for a master's degree at Ohio University, Terry accepted a post as director of the Supai Head Start program. With Lyntha, his bride of a year, Terry rode into the canyon last August for a year's tour of duty.

The Head Start project for deprived areas, sponsored by the Federal Government, teaches basic principles of education to 3- to 6-year-olds to prepare them for the elementary grades.

The Eilers, both of whom had been summer trainees in the National Geographic Society's photographic department, added a new dimension to the curriculum in Supai. In response to their request, the Polaroid Corporation dispatched 25 Polaroid Land cameras, one for each pupil, and 250 packs of film.

No amateur photographers ever enjoyed making pictures more (left). Despite fingers covering lenses, unsteady aim, and frequent attacks of giggles, they filmed one another, parents, and pets, acquiring their own visual aids to help them learn English as a second language after Havasupai.

"Recess Time," by Claude Watahomigie, 3.

"Mule," by Jay Hamidreek, 3.

"Classmates and Teacher," by Paula Sue Watahomigie, 4.

the door. They fear the reservation system may end, taking with it their last hold on their way of life. So they cling to the land, whether it can support them or not.

"But there are signs of progress," he added. "Tribal councils—including the Havasupai's—are taking more initiative in developing their own programs.

"The Havasupai's tribal council has discussed setting up a corporation to administer economic affairs. Eventually prefab houses will be flown in for everyone. Electricity may reach the valley in a couple of years, and the tribe has approved the building of a new tourist hotel and restaurant."

Later I learned that the Havasupai have won a judgment of $1,240,000 in a land-claim case dating back to the early days of their reservation. That sum, used wisely, could go far toward solving Havasupai problems.

While life in Supai is tinged with timelessness, an exception is Saturday night—movie night. "I hope they like the one we're showing today," remarked Jacqueline Willoughby, Bill's wife, who teaches school in Supai and doubles as projectionist. "They like Westerns and action stories. They don't like love stories. Too boring."

The weekly film arrived on the mule train. The recreation hall was crowded for the movie, which proved to be a comedy about a poker game in the Old West. Regrettably, it was not to the Havasupai's liking. It started well enough, with stagecoaches racing across plains, but then the action shifted to a gaming table, and to understand the complexities of the plot required a knowledge of poker. The adults stirred restlessly; children curled up on the concrete floor.

Church services the next morning began at "Supai Time," a phrase defined by the Reverend John Greenfield, director of the Bible

Grandmothers of Supai, like their counterparts the world over, excel at the chore of baby-sitting. Lillian Paya tends her granddaughter, laced tightly to a cradleboard, while the child's mother works as a teacher's aide at Head Start.

Cure for all ailments—or so say the Havasupai of their saunalike bath. In the intense heat and total darkness of the half-buried lodge, tribesmen squeeze together, singing and talking as they "sweat out" their miseries. Now and then they crawl out and flop onto the sand for several minutes' respite. Finally they cool off in nearby Havasu Creek.

Mission, as "whenever the Indians get here." He rang the bell at 10, 10:15, 10:30, and 10:45. The opening hymn, "He Leadeth Me," started a few minutes after 11, with only seven adults and seven children present.

After the service John Greenfeld invited me to his small white cottage behind the chapel. His wife Rie supervises the Public Health clinic, without pay. Once a month a doctor rides down from the Peach Springs clinic to treat the ailing.

"Last time he was here," Rie told me, "he treated 102 patients in a single day."

Desert Land Breeds a Proud Sailor

The next day was "fresh-meat day" at the store, and after purchasing my ground beef, I waited until Earl Paya filled his order: short ribs, bread, canned peaches, coffee, and—surprisingly—butter. Oleomargarine could be purchased at a quarter the price, but Havasupai prefer butter.

Earl had invited me to his house. He wanted to show me something, he said, and we walked down Main Street and across the fields to Earl's home. Continually we ducked under, climbed between, or stepped over

strands of barbed wire that mark off individual Indians' jealously held plots of land.

Earl's wife, Lillian, wearing a calico dress, sat on a bench outside their house. She was pulling apart juicy figs and spreading them on trays to sun-dry on the roof.

A fresh coat of whitewash brightened the Paya home. Inside, Earl showed me the new wallboard he had recently put up. There were two rooms of equal size, 15 by 20 feet. Each held a double bed and a heating stove. The cookstove, now outside, would be moved in when cold weather came. Cardboard boxes of belongings were piled in every corner.

"Look here," he said, pointing to the one framed object that adorned the walls. I looked and read. Earl Paya, it certified, had been aboard a Navy cargo carrier in Tokyo Bay on September 2, 1945, when the Japanese Empire formally surrendered to the Allies.

"I am very proud of that," Earl said. "I served in the United States Navy for two and a half years."

Wills Deed Land—and Firewood Trees

As is customary in summer, all the chairs had been moved into the yard, so we went outside to sit (pages 364-5). Next door Earl's father Lemuel relaxed on a bed under a pomegranate tree he had planted as a youth and that now was laden with red-ripe fruit.

I asked Earl if his father had given him this land when he married.

"No," he said, "the property belonged to Stanley Manakaja. Wait, and I will show you."

He entered the house and returned with a sheet of legal-size paper. It was a typed will dated February 11, 1942, and in it Stanley Manakaja deeded to Earl Paya "the plot on which Earl has built a house." Other beneficiaries would inherit a "plot west of 50-foot falls," "the plot east of six-foot falls," "the plot where east irrigation ditch meets river." At the bottom of the document was Stanley Manakaja's mark, his thumbprint.

"There are many who die without leaving wills," Earl said, "and there is much argument over who gets what. There is argument over cottonwood trees as well as land, for we top the trees for our firewood, you know."

We were seated beneath one of those trees. Peering out through the leafy limbs, I noticed that the sun had already sunk behind the west wall. Knowing that the Payas would want to cook and eat supper before dark, I said good evening to Lillian and Earl.

To say that Supai after dark is a quiet place is a monumental understatement. After night envelops the canyon—between 5 and 7 p.m., depending on the season—Havasupai rarely leave their homes.

Often at night I walked through the village with a flashlight to guide me. Dogs would run out to the trail and bark ferociously.

On moonless nights the rock walls loomed like jagged cutouts, backdropping the valley at all points of the compass. In a few houses kerosene lamps provided a feeble light for women sewing and men reading. But most cottages were already dark.

Except on movie night, I saw no Indians about. When I asked tribal general manager Buddy Jones about this, he came back with a question: "Aren't you afraid of ghosts?"

"No," I answered. "Are you?"

"I don't like to walk around at night," he said evasively.

But from his question I knew the Indians believe that Supai literally becomes a ghost town after dark.

Farewells Mark the End of Summer

One morning a cold front moved through the valley. Though the sky was cloudless, fierce winds raised a blizzard of dust. Autumn was coming in; it was time for me to be going out. I said goodbye to friends in the village and packed my bag.

Bufford Paya waited for me at the front gate, and I climbed on Black Knight. It was nearing 9 a.m., but shadow still held Main Street; the sun had not yet climbed above the high east wall.

When we reached the rise where I had first gazed down at the valley on the way in, I turned in the saddle for one final look. Tasseled corn and cottonwoods rustled in the breeze. Smoke from cooking fires curled skyward. Another Tuesday had begun in Supai.

Or was it Thursday? THE END

Twin torrents of silver cascading 125 feet into an azure pool, Havasu Falls pours over curtains of travertine. Havasu Canyon's three magnificent waterfalls help draw 15,000 visitors a year. Tribesmen have mixed feelings about a proposed aerial tramway to swell the tourist flow. They love their oasislike valley and fear too much modernization.

NORTH FOR OIL

Manhattan Makes the Historic Northwest Passage

By BERN KEATING

Photographs by TOMAS SENNETT

CREWMEN CALLED IT A BAPTISM, and indeed it was—with hard water. On September 2, 1969, the newly modified S.S. *Manhattan*, largest icebreaking vessel ever built, turned her huge armored prow toward Baffin Island, into the teeth of the notorious pack ice that has doomed so many ships.

All off-watch hands crowded the rails as we entered the pack. By the rule that five to seven times as much ice lies below the surface as above, we estimated the floes ahead as at least fourteen feet thick.

The massive *Manhattan*—a remarkable vessel that had been converted from a tanker to an icebreaker research ship—bit into the first floe with her Viking bow of steel. It cracked off a half-acre chunk. Tilting it aside with a roaring cascade of green water, the *Manhattan* sailed on without a quiver.

Smashing Straight Into a Mile of Ice

As the blocks ahead grew larger, Capt. Roger A. Steward poured on more speed. Gigantic floes cracked and heaved before our charge, huge fragments roaring and plunging as they spun away from our sides. Now we bore down on a massive sheet of ice sixty feet thick and a mile across. The captain called for 10 knots.

"They'd better slow down, or they'll punch a hole in her," said U. S. Coast Guard Capt. F. S. Goettel. A veteran of ice patrols near Greenland, he was one of the liaison officers aboard from the United States and Canadian icebreaking services.

We gripped the deck rail hard and awaited the shock.

The armored bow struck, and a plume of salt spray shot sixty feet into the air. Chunks of ice as big as bulls' heads soared in wide arcs like mortar shells. There was a deafening explosion as the great floe shattered; blocks the size of bungalows turned over and scraped along the ship with agonizing shrieks. Incredibly, the *Manhattan* trembled less than a city sidewalk when a loaded truck passes.

Martti Saarikangas, design engineer of Finland's largest icebreaker shipyard, pointed to the shattered floe grinding by.

"This ship," he said, "just broke thicker ice than any ship in history. But before you start planning parties in Alaska, remember that an isolated floe—even a huge one like this—is child's play compared to pack ice under heavy wind pressure. When we get to the western reaches of the Canadian archipelago—that'll be the test."

Brief captive in a vise of ice, the United States tanker *Manhattan* lies locked in the Northwest Passage above the Arctic Circle. Her bow nudges a deceptive "melt pond"—ice that softened into a puddle, then refroze to resemble open water.

Mere specks beside the 1,005-foot ship, scientists study the ice pack on foot. Astern, the Canadian icebreaker *John A. Macdonald* batters her way up to free the tanker. Converted into an icebreaker, *Manhattan* embarked last summer on one of the epic challenges of all time: to blaze a commercial shipping lane across the top of North America to rich Alaskan oil fields. Doggedly butting her way through, she realized a dream of centuries and joined history's maritime immortals.

That way lay our course, across the fabled and feared Northwest Passage, by way of Lancaster Sound, Viscount Melville Sound, and M'Clure Strait to the Arctic Ocean and our destination, the oil fields near Prudhoe Bay, Alaska (foldout map, opposite). For centuries this tangle of frozen channels across the roof of North America had lured explorers and empire builders to an icy graveyard. No commercial ship had ever made the voyage, though many had tried and failed.

Rich Oil Strike Inspires Voyage

But the *Manhattan* was no ordinary ship, and the voyage was no ordinary project. In 1968 a vast underground lake of oil—ten billion or more barrels, the largest strike ever made in North America—had been discovered under Alaska's forbidding North Slope. Plans were quickly drawn for a pipeline across Alaska to the open-water port of Valdez to supply the U. S. West Coast.

The huge problem of moving the crude to the oil-thirsty East Coast market challenged the Humble Oil & Refining Company. It estimated that using special tankers to break through the frozen Northwest Passage could save up to $600,000 a day, as compared to the cost of building and operating a transcontinental pipeline. All that was needed was a tanker tough enough to make the passage.

Humble was ready to gamble, betting an initial $39,000,000 on the project. Atlantic Richfield Company and BP Oil Corporation each contributed $2,000,000 more. So the mighty icebreaker came into being.

I first saw her on an August afternoon in a shipyard dock at Chester, Pennsylvania. I climbed a ladder six stories high to her deck and reported on as a member of the crew. The vast expanse that would be my front yard and home for the next two months stunned me—three acres of weather deck, 1,005 feet long, as big as three football fields.

Captain Steward, a powerfully built man with a weathered face (page 384), was standing forward watching the armored prow being joined to the reinforced bow section. The prow gave the ship graceful forward lines like those of the bowsprit of a Yankee clipper.

"This is the largest merchant vessel ever registered under the United States flag," the captain told me. "The job of converting her into an icebreaking research ship was literally too big to be done in one place. The tanker was cut into parts here, and two parts were sent to shipyards in Newport News, Virginia, and Mobile, Alabama, to be fitted for the rugged duty in the northern ice pack. That huge prow was floated down from Bath, Maine [diagram, foldout]. Look over here."

We looked down and along the sides where nine-foot-wide armored "blisters" had been welded to protect the thin-skinned inner hull from polar ice. They gave the vessel the clumsy bulk of a plunging fullback.

"The theory is simple," the captain went on. "*Manhattan* has 43,000 horsepower, twice that of any other tanker her size. Fully loaded, she weighs 150,000 tons, nine times as much as the next largest icebreaker, the USSR's *Lenin*. We are hoping that all that horsepower will drive all that weight up onto the polar ice and break it down."

After that first contest with the floes near Baffin Island, few doubted that the theory was valid. Still, to temper our elation, there was Martti Saarikangas's warning of what lay ahead, as well as some disturbing news from below. The hideous uproar as two 22-foot-wide propellers battered those enormous chunks of the broken floe had almost chased the engine watch up the ladders.

"When that ice hits the props, I feel like a squirrel trapped in a concrete mixer," Third Engineer Al Burns told me.

Icebreaker Sails With Mighty Tanker

Worried about what might have happened to our propellers, we proceeded cautiously to Thule in Greenland, accompanied by the Canadian Department of Transport icebreaker *John A. Macdonald*, which had joined us the night before. The *Macdonald* carried a team of scuba divers, who promptly went down to inspect our screws for damage. They happily reported that the blades had come through the terrible battering unscathed.

Convinced of his craft's ice-worthiness, Captain Steward headed *Manhattan* across the northern end of Baffin Bay for Lancaster Sound, eastern reach of the frozen pass through the Canadian Arctic archipelago.

The first explorers into these waters were also merchant-adventurers, beginning in 1497 and 1498 with John Cabot, who twice probed toward the Arctic Circle before he disappeared. Seeking the passage to the Indies over the world's roof, others followed and failed for more than 350 years.

Many brave captains came to grief, as did Henry Hudson when he groped for the passage in the *Discovery* in 1610. In the bay that now bears his name, a mutinous crew set

OPPOSITE PAGE FOLDS OUT

SEADRAGON, 267 FEET
Probing little-charted depths, Lt. Comdr. George P. Steele, USN, captained the nuclear submarine U.S.S. Seadragon through the Northwest Passage via M'Clure Strait, then sailed on to the North Pole.

INVESTIGATOR, 118 FEET
In the search for Franklin, Robert McClure approached from the west, to be stopped at Mercy Bay. For a year and a half the ice held him captive. Finally he and his crew trekked eastward to rescue ships at Beechey Island, becoming the first known party to traverse the passage.

EREBUS, 105 FEET
Attempting the Northwest Passage, England's Sir John Franklin sailed the bark Erebus, accompanied by the Terror, to disaster. The ships became icebound in Victoria Strait; Franklin died, and the crew abandoned the barks and finally perished. A decade of fruitless search for him and his crew of 129 resulted in exploration of much of the Canadian Arctic.

GJOA, 70 FEET
Challenging the ice in a converted herring sloop, Norwegian explorer Roald Amundsen spent three winters en route, making scientific observations. Skirting the Canadian mainland, he was the first to navigate the Northwest Passage.

MANHATTAN, 1,005 FEET
Only formidable pack ice clogging M'Clure Strait rebuffed the Manhattan as she became the first commercial ship to thread the passage. Stopping at Prudhoe Bay, the tanker went on to Barrow. Then refueled by much the same route.

Manhattan's route, 1969
DEW line station
Franklin (Erebus), 1845–1848
McClure (Investigator), 1850–54
80–100% ice cover
50–80% ice cover
Amundsen (Gjoa), 1903–06
Steele (Seadragon), 1960

Forbidding realm of ice and tundra, the North American Arctic and its fabled Northwest Passage have challenged mariners for centuries.

Spurred by oil strikes on Alaska's North Slope in 1968, Humble Oil & Refining Company launched the daring *Manhattan* program. Its goal: to determine whether specially built tankers could not only negotiate the passage but ply it year round as a floating pipeline to Eastern markets.

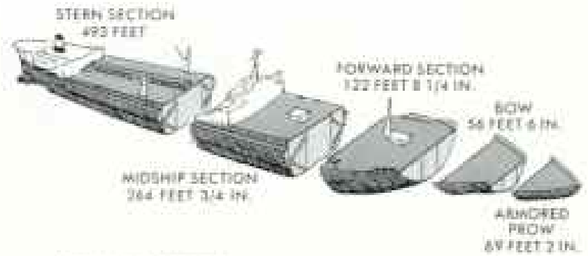
To manage the $43,000,000 gamble, Humble chose Stanley B. Haas (left, center), shown briefing expedition leaders in *Manhattan*'s control center.

Humpty Dumpty ship: To rush conversion of the giant *Manhattan*, largest U. S. merchantman, Humble had her cut into pieces at Chester, Pennsylvania. Two sections were towed to other yards in Virginia and Alabama. Welding torches flared around the clock to install extra rudder guards, fit the midsection with a heavy steel girdle, and give a forward section extra beam so that its widened path through ice would allow the stern "wiggle room."

A Maine shipyard fashioned a new, rakish prow for the ship's unique "down-breaker" bow, designed to slide on ice and crush it with the ship's weight. Hundreds of electronic sensors went into the hull to record strains and stresses for future study.

Reassembled, the 150,000-ton ship set sail from Chester on August 24, 1969—the mightiest, most formidable icebreaker afloat.

S.S. *Manhattan*



FACING HER ONLY DEFEAT, *the mammoth tanker lies motionless, pinioned by pack ice. The conqueror: dread M'Clure Strait, a northerly short cut notorious for massive gale-driven floes.*

Smashing 120 miles into M'Clure before succumbing, the Manhattan *struggled for 12 hours to break free, hindered by insufficient backing power. As a last resort, she shut off her heating system to divert even this power to the engines. Then, aided by an escort and straining with all available horsepower, she slowly wrenched loose and retraced her course to try a more southerly strait.*

Hudson, his young son, and seven others adrift. They were never seen again.

The discovery of the way through finally came as a result of Sir John Franklin's ill-fated expedition of 1845. With 129 officers and men in two ships, Franklin vanished in the white wilderness of the Arctic islands (map, page 378). For a decade, dozens of attempts were made to find him, but in vain.

In 1850 a search party in *Investigator*, under Royal Navy Comdr. Robert McClure, entered the archipelago from the west. Frozen in at Mercy Bay, they were found in 1853 by an officer from the Royal Navy's *Resolute*, icebound 200 miles east at Dealy Island. McClure and his crew walked the 200 miles over the ice to *Resolute*. Then in 1854 all slogged on eastward, to be picked up by rescue ships at Beechey Island and to sail home, the first men ever to complete the Northwest Passage.

The honor of first making the passage in a single ship fell to the Norwegian explorer Roald Amundsen (later the first to reach the South Pole). With six other men in the 70-foot herring sloop *Gjöa*, he entered the passage from the east in 1903, and after three years sailed triumphantly through Bering Strait.

Mountie Makes the First Round Trip

The hazardous voyage was not achieved again until 1940–42, when Sgt. Henry A. Larsen of the Royal Canadian Mounted Police conned the schooner *St. Roch* through the ice pack from west to east. Two years later he brought the 104-foot vessel back, the first skipper to negotiate the passage both ways.

In 1954 the Canadian icebreaker *Labrador* smashed through a route negotiable by deep-draft vessels, and other large icebreakers have since followed. The *Labrador* also helped the U. S. Coast Guard ships *Storis*, *Spar*, and *Bramble* to become, in 1957, the first United States vessels to make the passage.

The most spectacular transits by U. S. vessels were those of *Nautilus*, *Skate*, and *Seadragon* in 1958, 1959, and 1960. Literally ducking the problem, these Navy nuclear submarines traveled under the ice via the Pole. Though *Nautilus* and *Skate* went by way of the main Arctic Ocean, *Seadragon* followed the traditional Northwest Passage through the Canadian archipelago. *

*See in NATIONAL GEOGRAPHIC: "Submarine Through the North Pole" (*Nautilus*), by Lt. William G. Lalor, Jr., and "The Arctic as a Sea Route of the Future," by Comdr. William R. Anderson, both January 1959, and "Up Through the Ice of the North Pole" (*Skate*), by Comdr. James F. Calvert, July 1959.

Nine years later, we found Lancaster Sound nearly ice free in September. Off Resolute, a Canadian far-north outpost on Cornwallis Island, we met the U.S. Coast Guard icebreaker *Northwind*. She had come from Seattle, north around Alaska and as far east as Thule, before joining our convoy here.

Off Bathurst Island, as we neared the north magnetic pole, our magnetic compasses spun in mad gyrations that made them useless. Even the gyroscopic compasses, specially fitted for far-northern operation, required frequent correction through celestial sights.

A solar storm complicated our problems. Thirty times wider across than the diameter of the earth, it rained subatomic particles on the upper atmosphere, pushing the magnetic pole far from its normal site. At night great curtains of northern lights, writhing and twisting under the torture of the sun's bombardment, reminded us that we had chosen the peak of an 11-year sunspot cycle for our journey across the earth's magnetic vortex. Our radios went wild.

When ice-reconnaissance planes reported that a dangerous floe concentration lay across our course through Viscount Melville Sound, our spirits took a further plunge. A Canadian officer visiting from the *Johnny Mac* failed to cheer us when he mentioned casually that a month earlier two oil-exploration barges had been crushed and sunk in that very ice.

The dangers of attempting to walk away from such an accident were underlined that day when we passed a polar bear feeding on a freshly killed seal. The gigantic bulk of the *Manhattan* and the cries of an excited crew did not bring a second's pause in the steady chomping down of seal meat. Only once did the bear deign to notice our passage, and then as if coolly appraising our caloric value.

Next day on the bridge I watched a gam of

RESCUING BY DON NEWLANDS, BLACK STAR © N.G.S.

Rescuing a stricken scout: Its rotor bent but its pilot safe, a helicopter lies on its side after breaking through thin ice in a routine landing. The *Macdonald* eases in to carry the craft to *Manhattan* for repair. Indispensable eyes of the task force, helicopters diligently flew ahead as pathfinders. Long-range aircraft scouted with ultramodern lasers to measure height of ridges and side-looking radar for mapping ice and land.

a hundred beluga whales playing near the bleak shores of Byam Martin Island. Beside me stood Capt. Tom Pullen, liaison officer for the Canadian Government. He kept his attention on the ship's course, peering ahead through binoculars. Suddenly he pointed.

"See the shafts of light running from the horizon to the underside of the clouds? That's called 'ice blink.' It means the edge of the heavy pack lies just below."

Aging Ice Turns Hard as Steel

Our progress through Viscount Melville Sound came to an abrupt halt shortly after we bashed into the solid ice. The ship lost way and stopped in a tangle of white ridges.

The broken ice, uptilted by storm winds, had been drained of salt in summer melts, then refrozen into cobalt-blue fresh-water ice, so hard it could cut through ordinary steel plates like a hatchet through a sardine can.

Even in the short time I had sailed Arctic waters, I had learned to tell weak first-year salt-water ice by its milk-white color, second-year less-salty ice by its green, and keelbuster multi-year ice by its diamond-hard blue.

I thought I would have a close-up look at the ice pack. Groping with a foot heavily booted against numbing cold, I found the frozen surface at the foot of the ladder and stepped off the ship into an unexplored world, the first man ever to stand, I suppose, on that particular portion of the universe.

The landscape glowed with an unearthly beauty. At latitude 74° N. the mid-September sun crossed the sky in so low an arc that the day seemed to consist only of flaming sunrise and fiery sunset. Eerily colored sunlight tinted the blowing snow orange and apricot, and the shadow side of jumbled ice blocks reflected the purple hue of the northern sky.

Seizing the occasion of our first stop, ice scientists (instantly dubbed "icetronauts" by the crew) followed me over the side and set up shop on the floe, drilling holes to measure ice thickness, taking core samples to test strength and salinity (page 384).

Off-duty sailors from the three ships in our little flotilla mingled on the ice, swapping gear and tobacco like seamen everywhere. On that one square mile or so in the middle of Viscount Melville Sound, our head count of 400 came to more than the population of the entire 168,000 square-mile Queen Elizabeth Islands to the north of us—an area larger than the British Isles (map, pages 377-8).

The temperature on the ice was high for the season, 17° F., but a strong wind blew down from the Pole. In that wind, exposed flesh would freeze as quickly as at 5° below zero in a calm. When I took off my down ski mittens to change film in a camera, I felt as though nails were being driven through my fingers. The film turned brittle and cracked.

An overcast drifted across the sun, and in the milky light mirages loomed around the horizon. Above Byam Martin Island soared a

Master of the *Manhattan*, Capt. Roger A. Steward mans the bridge; tam-o'-shanter reflects the Massachusetts-born mariner's Scottish ancestry. A veteran with Humble's tanker fleet, he bore responsibility for the safety of *Manhattan*'s 120 crewmen and passengers.

Armed with a spiral key for unlocking ice secrets, a scientist prepares to drill core samples. Ice parties gnawed through pack as thick as 22 feet to study temperature and hardness.

In thunderous war at sea, the tanker clashes with a floe in treacherous M'Clure Strait. As her sloping bow crushes the rim, pressures blast up a geyser of water and ice chunks as big as bushel baskets, hurling them 40 feet into the air. Incredibly, such deafening encounters send only faint tremors through the ponderous vessel. After abandoning M'Clure in favor of Prince of Wales Strait, the *Manhattan* triumphantly conquered the Northwest Passage on September 14, 1969, and plowed toward Alaska.

second island, upside down, and above that a third, right side up. The play of shimmering, shifting light reflecting from ice to cloud cover and back distorted shapes so that I could see anything I wanted—the prow of a shipwrecked yacht projecting from the floe, a downed plane, even Eskimos with sledges.

Frustrated Giant Calls for Help

After recalling the ice parties, the captain threw the ship against the ice again. But our wake had refrozen, and we had already discovered the *Manhattan*'s greatest flaw as an icebreaker—an inability to put her full 43,000 horsepower into reverse, because of the design of her turbine engines.

Captain Steward asked Canadian Captain Pullen to radio the *Johnny Mac* for help. He did, saying, "Would you mind coming over to nibble about our quarters?"

And the *Johnny Mac* came rollicking through the floe like a puppy in a pansy bed to break the ice around our stern. Capt. Paul Fournier, a peppery French Canadian from the Gaspé Peninsula grown gray in a career of fighting ice, hurled his guppy-shaped little vessel at the ice around us. It was a display of bold seamanship that pulled all the *Manhattan*'s officers to the wind-swept wings of the bridge to watch.

The *Macdonald*'s crimson prow slid up on the ice and then sank through it as the floes cracked under the ship's weight. When the doughty little vessel stuck, the captain backed her off and charged once more. Sometimes the icebreaker's bow passed less than a hundred feet from our stern plates, filling with horror those officer-observers who had never before seen a master ice mariner at work.

By changing solid ice into a broken swath the width of his ship, Captain Fournier opened a relief valve. The grip on our stern loosened; we backed free and then rammed our way into the floe and on toward M'Clure Strait, the

historic bottleneck that had turned back all previous ships coming from the east.

Our U. S. escort *Northwind*, hampered by crippled engines, now had to leave the expedition. She headed back to Resolute, and thence to Alaska along the edge of the Canadian mainland—a route ice free but too shallow for the *Manhattan*'s 52-foot draft.

As she limped on homeward to Seattle, *Northwind* made her own historic first that passed virtually unnoticed. Having come all the way from Seattle to Thule earlier in the year, *Northwind* became the first vessel to make a round trip through the Northwest Passage in a single season.

Manhattan Gripped by Icy Jaws

For the *Manhattan*, M'Clure Strait proved to be a nightmare sculptured in ice. Strong westerly winds drive the polar pack of the Beaufort Sea into the western portal of the strait, and the ice jams there into tortured ridges that rise 10 to 20 feet above the surface —and sometimes plunge to 100-foot depths. The strait may stay blocked by the immense ice plug for years on end.

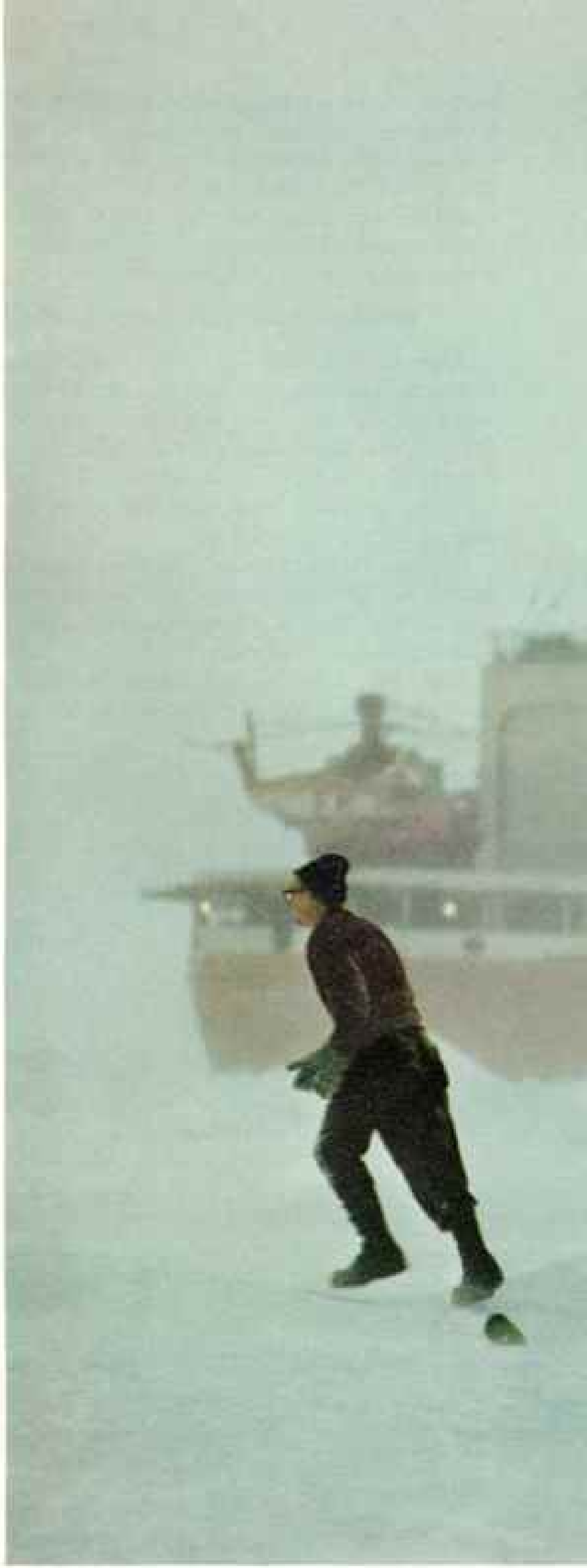
Our hope of breeching it held high during our early hours in the strait. When the ship plowed through some especially bad ice, Captain Fournier, one of the world's great ice skippers, said admiringly, "It's as if she were sailing through a granite quarry."

A little later, however, we made only 500 feet in one brutal hour, and our entire progress in a day came down to 29 miles. Then, halfway through the 220-mile strait, we were stopped by a truly formidable floe four miles across—aged polar ice broken in winter storms and refrozen into a bastion of ridges.

For 12 hours conning officers backed and rammed, trying to crack loose—but the ice held fast. The armored blisters guarding the inner hull stood up to brutal pressure without buckling, but friction of the pack against our broad side would not let go (pages 379-81).

On one watch the conning officer gave 62 bells—orders for change of engine speed or direction. One engineer set a record by going from full ahead to full astern in 27 seconds.

Spectacular servants of modern technology came to assist *Manhattan* from time to time. Now they scouted the ice ahead. A Canadian DC-4, flying a straight course, directed a laser beam at the pack; its fluctuations, recorded on magnetic tape, gave us a profile of the ice ridges we faced. Infrared photographs detected temperature variations in the ice,



Dauntless "icetronauts," as crew members dubbed the ice scientists, brave subzero temperatures to sample the M'Clure Strait pack. Thirty-knot winds whip up a blinding flurry of snow that almost obscures

KODACHROME BY TOMAS SENNOTT © N.G.S.

the *Macdonald*. Kneeling man saws core-sample sections in a wooden miter box; he will then test their strength in the lamp-shaped gauge at right. Survival sled, far right, holds sleeping bags, emergency rations, and rifle and pistol—the weapons as safeguards against attack by the region's numerous polar bears. The men also faced the peril of whiteouts, when horizon and surface details blur and disappear, causing loss of sense of direction and balance.

Watery Alaskan goal, North Slope barrens lie awash with melt trapped on the surface by permafrost. Off Prudhoe Bay, the *Manhattan* dropped anchor on September 19 and loaded a lone barrel of crude oil—symbol of an estimated ten billion barrels waiting underground.

Standing like a beacon, an oil derrick used for test drilling marks the discovery. Road leads to a gravel airstrip, left.

Deceptively inviting in this summer view, the hostile slope lies locked in ice 10 months of each 12. Plant life, sparse and fragile, grows with glacial slowness; wheel prints on the tundra at lower right could linger as long as a century before fresh vegetation grows to erase them.

Advance scout of oil armies that may follow, a workman tends a Prudhoe Bay test rig.

indicating its relative age and hardness. A U. S. Coast Guard C-130 swept 10-mile-wide strips with side-looking radar and dropped a film record aboard. All the reports confirmed that the floe that held us was too heavy to break through.

Near midnight on September 11, Humble Oil's Stanley B. Haas, the project director (page 377), routed us out of our bunks to report that M'Clure Strait had proved impassable—"beyond the capabilities of this test vessel."

He said, "We would like to have been the first to make the Northwest Passage the hard way, of course, but we are on a test voyage, and our first duties are to the experiment. So we will change course to Prince of Wales Strait and Amundsen Gulf, where you'll see caribou and musk ox, seals and polar bears, all the glories and beauties of the Arctic—except, I hope, more of this blamed ice!"

So, at 117°30′ west, we called up the *Johnny Mac* and, with her help, began the laborious job of turning. Our plane scouts had found a lead of open water, a path of escape from the strait back east and around Banks Island (foldout map, page 377).

Battered Ships Break Through to Open Water

Johnny Mac bashed and chewed ice, *Manhattan*'s huge propellers thrashed with all the power that could be given them, and we found and slipped through leads that our helicopters spotted for us. Thus we worked our way back down M'Clure Strait and through the ice plugging the northern end of Prince of Wales Strait.

On September 14, the radarscope on *Manhattan*'s bridge indicated that only 10 miles of ice separated us from open water. Near sunset, Captain Pullen showed me a black streak on the clouds ahead, the "water sky" that marks the open sea.

AEROCHROMES BY DAN HORNISH (ABOVE) AND BERN KEATING

Like a dog shaking a bone, the tanker rams an ice islet extending 120 feet deep. Deliberately testing her toughness, the ship on the voyage home amassed data that computers will digest to tell if tankers can endure extended Arctic punishment. Early inspection revealed that the ice took its toll: several cracked hull plates and a bus-size hole torn in an unarmored cargo tank. Stronger steel and more power are judged necessary for the future.

Unconcerned that a sea road could invade their neighborhood, polar bears cavort in the passage.

Just before midnight, the bow broke the far edge of the solid ice, and the ship swam free with only a thousand miles of open water between us and Prudhoe Bay, Alaska. The *Manhattan* had smashed through the Northwest Passage, despite dire predictions by some competent mariners and ice scientists.

After reaching her destination, *Manhattan* ceremoniously took aboard a single symbolic barrel of oil. Then, after a call at Barrow, the ship retraced her course to Viscount Melville Sound. There she settled down to four weeks of breaking ice along a measured course to gather scientific data.

"We won't have all the answers until mid-1970," Stan Haas told me. "But we know now that the route is feasible. It is up to economists to determine whether the Northwest Passage will be the less-expensive way to move the oil. The cost of building a year-round harbor at Prudhoe Bay and a 30-odd-mile pipeline out to deep water could run to $500,000,000. We're also studying the possibilities of using submarine tankers to go under the ice year round."

Promise and Problems of Northwest Passage

Striding to one of the National Geographic Society's Top of the World maps that adorned about every fourth bulkhead throughout the living quarters, Stan traced with fingertip the routes across the white archipelago.

"If the Northwest Passage does become operable," he said, "the whole world could benefit. Icebreaking ships could carry electronics gear from Japan to Europe and bring back machinery. Iron deposits at Baffin Island could feed steel mills in India. The Arctic might well bloom with industry."

The idea of industry blooming in the northern barrens, however, has caused concern to conservationists. Arctic experts have pointed out that the life cycles of the flora and fauna there are very delicately balanced. The margin of life is so slim that it may take as long as a century for mosses and lichens to cover a single wheel rut. A vast drilling operation and construction of the pipeline across Alaska to Valdez, the conservationists warn, could have a shattering effect on the Arctic ecology.

And what of the ultimate accident, a huge oil spill, the disastrous aftermath of which could linger in that cold climate for many years?

These questions became more insistent when the ice of Lancaster Sound knocked out a huge panel of old steel during the *Manhattan*'s return voyage, spilling 15,000 barrels of ballast water. Stan Haas was quick to point out that the accident occurred in the thin, unprotected hull—not in the reinforced section. Future ships would be fully armored.

"The oil companies are very much aware of the environmental problems," Stan told me. "You may be sure that we will proceed only when we know it is safe to do so, from an ecological as well as an economic standpoint."

The important thing for the moment was the first step. *Manhattan* had become the first commercial vessel to make its way through the Northwest Passage. As the huge ship sailed into New York Harbor on November 12, 1969, with her solitary but eloquent barrel of oil, the world knew that the awesome route across the top of North America might at last lie open to trade.

THE END

THE LIGHTS ARE UP AT FORD'S THEATRE

By LONNELLE AIKMAN
National Geographic Senior Staff

LIVE PERFORMANCES RETURN to the playhouse where Abraham Lincoln was shot. Darkened by tragedy 105 years ago, the theater was recently restored by the National Park Service. Here a cast of the Circle in the Square company takes a bow after presenting Eugene O'Neill's *A Moon for the Misbegotten*. But eyes often stray to the upper right-hand box where John Wilkes Booth, carrying gun and knife, fatally wounded the President and slashed the upraised arm of a Lincoln guest. In a mighty leap to the stage, the assassin broke his leg, but managed to rush off and escape on horseback.

EXTACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES L. STANFIELD © N.G.S.

FORD'S THEATRE. Those two words will forever haunt the American consciousness, evoking a sense of loss and bittersweet thoughts of the gentle, sorrowing man who led this Nation through four years of fratricidal war.

The building where Abraham Lincoln was shot stands at 511 Tenth Street Northwest, in the busy heart of Washington, D. C. Today, after more than a century of blackout, Ford's stage lights are up again. Once more audiences applaud actors as in the days when President Lincoln found respite there from the problems and heartbreak of the Civil War. Stage and house, inside and out, have been restored by the Federal Government to look as they did on April 14, 1865, when John Wilkes Booth fired the fatal bullet in Box 7.

The return of John Ford's old playhouse to its original role gives the Nation's Capital a unique and fitting monument to Abe Lincoln, who loved drama and the theater.

It also offers modern playgoers a new and needed stage for the performing arts. And for good measure, it contains a handsome museum displaying intimate and graphic mementos of the man "of laughter and tears," as poet-biographer Carl Sandburg called him.

ACTOR-ASSASSIN at age 26: John Wilkes Booth, the youngest performer in a family famous for Shakespearean roles, brought a melodramatic, often savage, intensity to the stage. He once said that killing Lincoln would give a man "a glorious opportunity . . . to immortalize himself."

"LET IT STAND FOR YEARS TO COME . . . silent, gloomy, forlorn." So spoke Lincoln's pastor about Ford's Theatre, center, in a passionate sermon following the murder of April 14, 1865. Sidewalk poster advertises *The Octoroon*, a drama on slavery scheduled to follow *Our American Cousin*, the English comedy Lincoln was watching when Booth struck. Here the black crape of mourning

Growing up in Washington, I often passed the blank face of Ford's when it was a Government storehouse. After the National Park Service made it into a museum for priceless Lincolniana, I roamed its aisles between relics and records that traced the life of the prairie boy who became our martyred President.

Actors Find Ford's Stage Exciting

Since the rebirth of Ford's Theatre with a series of brilliant black-tie events for Capital dignitaries in January 1968, I have seen almost every play presented. These have ranged from the Shakespearean works that Lincoln loved to Eugene O'Neill's recapturing of a vanished America.

Meeting cast members backstage, I asked a question:

"How does it feel," I wondered, "to act a part under that symbolically empty box and its forever empty chair?"

Their answers, though phrased in different ways, sounded curiously alike.

"Once we got over our awe of the place," bit players and stars agreed, "it was an inspiring, marvelous, exciting experience."

"It's the most beautiful and professionally satisfying theater in America," said Ted Mann,

LINCOLN PORTRAIT BY ALEXANDER GARDNER, 1865; ALL PICTURES FROM LIBRARY OF CONGRESS

drapes a street recently bright with decorations celebrating Union victory after four years of Civil War; soldiers stand guard at the theater. Feeling ran so high against both the building and the acting profession that owner John Ford could never reopen his playhouse. The Government leased, then bought it for offices and storage, converting it into a Lincoln Museum in 1932.

MARTYRED PRESIDENT: Peace had come and Lincoln smiled again for this photograph, made only four days before his death. A superb storyteller, the man "so bony and sad, so quizzical and comic," as poet Carl Sandburg wrote, had a feeling for drama onstage or off.

artistic director of the Circle in the Square company, which next month completes its second season there. "Though small, it gives an effect of space and light, and its old-fashioned stage apron brings actors and mood close to the audience."

"I Laugh Because I Must Not Weep"

To Abraham Lincoln, the make-believe of the stage gave more than entertainment. It was necessary relief from the pressures of military decisions, office seekers, and emotion-charged pleas by wives and mothers of fighting men.

"Some think I do wrong to go to the opera and the theater," he once said, "but it rests me." His "earbones ached to hear a good peal of honest laughter," he told a visiting Union officer. And to a woman writer for *Putnam's Magazine* he said, "I go to amusements very much against my inclinations. . . . I laugh because I must not weep. . . ."

During the first year of the war, however, the hectic little city by the Potomac offered few theatrical diversions to anyone. From the beginning, Washington's social life had revolved about official and personal entertaining, rather than the theater or opera. Then suddenly the Union capital was jammed with soldiers and war contractors seeking pleasure. Money flowed freely.

In the spring of 1862, two ambitious young businessmen, John T. Ford and Leonard Grover, opened rival theaters.

Ford's Atheneum, converted from an old Baptist church on the site of the present building, burned down the following December—as if to bear out a church member's prophecy that no good would come of such wicked use.

But the Atheneum had been a success, with the President himself present at one performance. From its ashes Ford raised a handsome new theater and opened it on August 27, 1863.

Lincoln patronized both Ford's Theatre, as it was called, and

EMPTY CHAIR AND UNION FLAG re-create the setting in which Booth (above) shot the President as he sat with his wife and guests Maj. Henry Rathbone and Clara Harris. Onstage here, students of the North Carolina School of the Arts present *She Stoops to Conquer* by Oliver Goldsmith, a classic comedy that Ford staged in Lincoln's time. Professional productions also appear through cooperation of the National Park Service and Ford's Theatre Society, a nonprofit group formed to make this house "a living memorial."

Grover's New National, on E Street four blocks west. He went to Ford's at least eight times, and oftener to the National, which is still a leading Washington theater.

In his choice of entertainment, Lincoln sampled such fare as minstrel shows, comedies, and revues; but his mind and heart went out to the Shakespearean dramas that he had read voraciously for thirty years. He so admired the veteran actor James H. Hackett that he attended Ford's two nights in a row to see Hackett play Falstaff in *Henry IV*, and returned the same week to applaud him in *The Merry Wives of Windsor*.

Lincoln's interest in the theater sometimes led to personal meetings with players he esteemed, either on visits to his box at the theater or at the White House.

Whether he ever met his future murderer, as some have claimed, remains a tantalizing mystery. It was quite possible. John Wilkes Booth, youngest of the gifted actors fathered by the erratic tragedian Junius Brutus Booth, came often to the wartime Capital and played many roles in both Ford's and Grover's houses (page 394). And on November 9, 1863, Mr. and Mrs. Lincoln saw John Wilkes Booth perform at Ford's in a melodrama called *The Marble Heart*.

By a strange coincidence, Lincoln became

IN THE LINCOLN MUSEUM

LINCOLN'S FACE AND HANDS—from casts made in 1860 by Leonard Volk—gleam in the spotlighted center of a specially designed circular hall below the theater.

Sitting for the mask in Volk's Chicago studio, Lincoln had to breathe through quills in his nostrils while his face was covered by plaster. Arriving on a Sunday morning, he told the sculptor he had chosen to pose rather than accept an invitation to church. "I don't like to hear cut-and-dried sermons," he explained. "When I hear a man preach, I like to see him act as if he were fighting bees."

Other cases display relics from Lincoln's youth, his middle years in law and politics, his wartime Presidency, and his funeral.

WOODCROMES BY WINFIELD PARKS (FAR LEFT AND BELOW) AND GORDON W. GAHAN © N.G.S.

A BLACK CHAPTER in history lives on in the pistol, knife, and compass used by Booth during his crime and flight. After shooting the President, the assassin dropped his small derringer, here resting on a contemporary newspaper account of the tragedy. Waving the knife wildly, to stab anyone who might try to stop him, he cleared the way to his horse in the alley behind Ford's Theatre. The compass came in handy when Booth and fellow conspirator David Herold crossed the Potomac from Maryland into Virginia, where, 12 days after the assassination, the killer met death and his companion capture.

These exhibits, with others linked to the tragedy, are arranged in a separate alcove under grim wall-to-wall enlargements of a photograph that depicts the hanging of four of Booth's convicted associates.

an ardent fan of John Wilkes's less flamboyant but more successful brother Edwin. He probably attended more performances by Edwin Booth than by any other actor.

A Booth Saves a Lincoln's Life

The Lincolns also had personal reason to favor Edwin. Early in the war, their son Robert, then a student at Harvard, was waiting to board a train at Jersey City. Pressed by the crowd, he slipped between the platform and the moving car; a bystander hauled him back. The rescuer was Edwin Booth.

To me, this chance incident underlines the gulf between the Booth brothers. A Northern sympathizer, Edwin twice voted for Lincoln. John Wilkes proclaimed his loathing for the man waging "war upon Southern rights. . . ."

In his hatred, John dreamed of playing Brutus to Lincoln's Caesar; his diary set the date—"April 13-14 Friday the Ides."

April 14, 1865, was Good Friday. That night Booth slipped into the Presidential box at a chosen moment in the play, *Our American Cousin*. He shot Lincoln in the back of the head, leaped to the stage, and escaped on horseback (page 397).

Entering Box 7 today, you feel a spine-tingling chill at the carefully reconstructed setting of that fearful night. You walk on a

carpet of the same red-and-white design, between walls covered by dark-red Victorian paper. Here stands the original red-damask sofa, with a copy of Mrs. Lincoln's chair and other guest furniture. In place is a replica of the carved walnut rocker where Lincoln slumped silently (page 396).

"They maneuvered his long body into this cramped hallway," said Park Service Historian John Lissimore, as we followed the same route. "They took him up this aisle, holding back the frenzied crowd, then down these side steps and across to the Petersen House [right]. He died there at 7:22 the next morning, without regaining consciousness."

The War Department closed John Ford's theater the night of the assassination; public outcry prevented its reopening. The Government first leased, then bought the property, remodeling it for storage and office use.

Another catastrophe blackened the building's history in 1893. Overloaded floors collapsed and fell 30 feet, killing 22 Government employees and injuring 65.

For the next four decades the old theater was used only for storage. Then its ground floor was turned into the Lincoln Museum that so charmed a generation of visitors like myself.

It was thus a logical and happy conclusion when in 1954 Congress began to vote funds—ultimately more than three million dollars—that would restore to the American people this charming 19th-century theater.

Brady Photographs Aided Reconstruction

"We had all kinds of building problems," said William M. Haussmann, the project's design and construction chief, as we stood on the restored stage looking down on sightseers moving up and down the aisles.

"The whole interior had to be gutted. We dug a new basement and rebuilt a complete theater inside walls that would have crumbled into the hole without special shoring.

"Because we could never find the original plans, scholars had to track down details from old records, pictures, and sketches of this and other theaters of the time. Our best information came from photographs made by the great Civil War photographer Mathew Brady right after the assassination.

"A few modern changes were necessary," Mr. Haussmann added. "People are bigger now, so the cane-bottom chairs for the audience had to be bigger. The present theater seats only about 700. Ford squeezed in more than twice that many. We also had to provide electricity instead of gas in footlights and wall globes. But Ford and Lincoln would both recognize this theater as you see it."

When I walked into the large circular hall created below for the new Lincoln Museum, I felt that the man from Illinois would also recognize much on display.

Long, curved cases hold copies of works young Lincoln read—*Pilgrim's Progress* and Parson Weems's *Life of George Washington*. You see the cradle in which his children slept, and models of his inventions to improve wagon steering and to refloat grounded boats. Lawbooks and campaign cartoons recall his legal and political careers.

INTO A BACK BEDROOM of the Petersen House, across from Ford's, men carried the unconscious Lincoln. Death came nine hours later as his son Robert stood by. Mrs. Lincoln, inconsolable, lay in the front parlor. This recent painting shows a newsboy hawking accounts of the murder; the poster at right announces Ford's play at the time.

REOPENED January 21, 1968, after a three-million-dollar restoration, Ford's Theatre brings Washington a needed new stage. Though the builder's plans have never been found, researchers gleaned essential details from old pictures and documents. Today's box office, next door at right, was the Star Saloon, where Booth downed a last drink before invading the President's box.

PHOTOGRAPHS BY GORDON W. GAHAN © N.G.S.; PAINTING (OPPOSITE) BY ROBERT SHARP, COURTESY NATIONAL PARK SERVICE

"To arms! To arms!" reads a wartime poster. Nearby lies the woolen shawl the President used on frequent trips to the War Office. And beyond, reflecting Lincoln's full height of six-feet-four, you find the long frock coat he wore to the theater on April 14.

The grim relics of the murder itself rest in a side alcove (page 399). They include the little derringer that killed the man who held the Union together, and the guns and diary Booth carried when he was dragged dying from a burning Virginia barn 12 days later.

Sightseers in Ford's Theatre will find something new this summer when the National Park Service begins its Sound and Light program, to go on continuously during exhibit hours. In the darkened theater, disembodied voices and moving spotlights will dramatize the events of that tragic long-ago night.

Nor is this all. In addition to winter performances by the resident company, the American College Theatre Festival, in which contest-winning student players participated last spring, will again enliven this historic stage (page 396).

Such productions will help make the new Ford's a truly national theater, dedicated not just to the commemoration of a great man's passing but to the living American stage so loved by President Lincoln. THE END

Panama, Link Between Oceans and Continents

By JULES B. BILLARD Senior Editorial Staff

Illustrations by National Geographic Photographer BRUCE DALE

EKTACHROME © K.O.D.

Global crossroads: From gold-laden mule trains to 20th-century ships, strategic Panama has bustled with trade. Here dusk purples Gaillard Cut, where the 50-mile-long Panama Canal crosses the Continental Divide. For three decades, French and then United States engineers battled slides of mud and rock to gouge this eight-mile cut through the backbone of the hemisphere.

IT POURED. Rain sheeted across the sidewalk and splattered into the building entryway in downtown Panama City where I had taken refuge.

"Does it rain like this often?" I asked the package-laden Panamanian standing beside me.

"Almost every day in the rainy season," he said. "But it lasts only ten minutes or so. Or an hour or two. Or sometimes all day. Still, we Panamanians like the rain. It cools things off. Besides, it means water for the canal, and without the canal, there wouldn't be much to Panama."

Thus was I introduced to two dominating facts about

this little Middle American nation: its weather, and its people's awareness of the asset a happenstance of geography gives them. Of its climate, I was to meet unexpected facets later. Of its fortunate location, I had seen a reminder on my arrival a few hours earlier. "Panama —Bridge to the World, Heart of the Universe," a marker at the airport proclaimed.

Perhaps the pint-size country—only 480 miles long and from 30 to 120 miles wide—can be pardoned a bit of hyperbole. The thin isthmus linking the American continents has in truth been a vital crossroads since the days of migrating tribesmen. The coming of the Spaniards first thrust it into importance in world commerce and politics.

Stowaway's Discovery Starts a Dream

With explorer Rodrigo de Bastidas when he discovered Panama in 1501 was an obscure seaman named Vasco Núñez de Balboa. Nine years later Balboa returned as a stowaway with a colonizing expedition—sneaking out of Hispaniola after failures in farming. Yet when bickering, disease, and starvation threatened disaster, this obscure nobody rose to command. And in 1513 he crossed the isthmus on the trek that immortalized him as the discoverer of the Pacific Ocean.

Knowledge that only a thread of land separated the two great seas brought adventurers and traders. They beat a path through the pestilential jungle. They fought over the Spanish treasure that crossed there in a drama of blood, and lust, and gold. And they dreamed of a water route that would connect the Pacific and the Caribbean.

That dream became a fiasco in the 1880's, with an unsuccessful French attempt to dig through the backbone of the isthmus, where mountain chains of North and South America subside to a low saddle. But it became a glorious reality when United States engineers and doctors went to work in what came to be called the Canal Zone (map, pages 412-13).

That zone, a strip 10 miles wide across the isthmus, had been signed over to U. S. control by an infant Panama that had become a nation only 15 days earlier. With U. S. backing, it had declared itself independent from Colombia, of which it had been a part since the end of Spanish rule in 1821.

The treaty giving the United States the right to build a canal was drafted and signed by a French engineer, acting as Panama's ambassador. It granted concessions even more liberal than those the U. S. itself had sought in earlier, unsuccessful, negotiations with Colombia. The terms, as a Panamanian businessman phrased it in a discussion with me one day, "have caused resentment for that Frenchman and the 1903 treaty ever since.

"There have been other aggravations, too," he added. "Such things as the insularity, even arrogance, of U. S. residents of the zone in relations with Panamanians. And segregation, with labels of 'gold' and 'silver' for drinking fountains, toilets, and so on. This stemmed from canal construction days. Skilled workers, mostly U. S. citizens, were paid in gold coin and unskilled laborers—usually Panamanians and Negroes—were paid in silver."

"But such discrimination was stopped long ago," I protested.

"Yes, but we Panamanians still remember it," he replied.

Old frictions exploded in 1964. A flag-raising incident between U. S. and Panamanian high-school students touched off three days of rioting and gunfire. Four U. S. servicemen and 21 Panamanians were killed.

New Treaties Ease Old Tensions

Shocked, the governments of the two countries moved to erase antagonisms. And at the heart of the rapprochement were three treaties proposed to replace the 1903 pact. One gives effective recognition to Panama's sovereignty, returns large portions of the zone to her control, and gives her increased payments from canal operations. The second affirms the need for a continued U. S. military presence to protect the canal and Panama. The third spells out terms for the building and joint administration of a new sea-level canal.

All three treaties remain to be signed and ratified by both countries before they become effective, but tensions have eased.

I traveled broad streets and back alleys throughout Panama last summer without a single instance of discourtesy toward me as an American. And over a long lunch one day with a high government official, I came to

(Continued on page 412)

Daily deluge of the rainy season drives two youngsters to shelter beneath a roadside stand. Flaming pimentos, plump manioc, and bunches of plantains await buyers along the Boyd-Roosevelt Highway, which parallels the canal between Colón and Panama City. The vital rainfall that feeds the canal averages 130 inches a year on the Caribbean slope and 69 inches on the Pacific.

Pint-size tugs nudge an ore carrier through Miraflores Lake toward the Pacific under the eyes of a helicopter pilot. Beyond Pedro Miguel Locks lies the Gaillard Cut. Of more than 200 million cubic yards initially excavated for the entire canal, almost half came from this cut.

Electric mule helps move a ship through a lock. Large vessels need six of these locomotives, three on each side. Two at the bow pull, two at the sides pull or brake as needed, and the last pair brakes.

Keeper of the gates, a repairman cleans one of the mammoth portals at Gatun Locks. Each leaf of these original gates spans 65 feet. Heights range from 47 to 82 feet in the various locks. Watertight compartments make the gates buoyant to relieve stress on lock walls and hinges.

Amazingly, much of the equipment installed 56 years ago still performs perfectly. But improvements are constant: Gaillard Cut is being widened from 300 to 500 feet, new lighting ensures safer night transits, and more powerful locomotives (above) cut time in the locks.

Conveyor belt of commerce, the Panama Canal winds northwestward in a dramatic view from 31,000 feet (preceding pages). The adjacent cities of Balboa, in the U. S.-administered Canal Zone, and the republic's Panama City, overlooked by Ancon Hill, stand at right of the Pacific gateway. Ships enter under the Pan American Highway's Thatcher Ferry Bridge, locally called "Bridge of the Americas." They steam through island-studded Gatun Lake and exit into the Caribbean at upper left. An unfinished channel begun in World War II runs to the left of the main course from Balboa harbor to Miraflores Lake. Infrared film, used to cut through the almost constant haze, reddens the foliage.

THIS PAGE FOLDS OUT

"The greatest liberty Man has ever taken with Nature," British historian James Bryce called the Panama Canal. This diagram illustrates how engineers utilized natural forces to feed the waterway. Warm air pushing in from the Caribbean (map, pages 412-13) rises over the coastal hills, condenses, and dumps rain onto the watershed of man-made Gatun Lake. Locks at either end fill by gravity from the lakes. Each transit of a ship sends 52,000,000 gallons into the sea—enough fresh water to supply a city of 350,000 for a day. To overcome the loss during the dry season, the lake is filled to capacity before the rains end in December.

Panama

NARROW WAISTLINE of the Western Hemisphere, Panama's isthmus was so logical a site for a canal between Pacific and Caribbean that men first thought of digging one there in the 1520's. Water-borne trade underpins the nation's economy and provides one of its greatest assets. Abundant rains feed crops of bananas, rice, sugar, corn, and coffee; fish and shrimp teem off the thousand miles of coastline; the Chagres River's mighty flow sustains canal traffic. From Panama's curving mountain backbone some 500 streams rush to the two great seas.

AREA: 29,208 sq. mi. (excluding Canal Zone with 553). **POPULATION:** 1,417,000 (excluding Canal Zone with 36,000). **GOVERNMENT:** Republic. **LANGUAGE:** Spanish. **RELIGION:** Roman Catholic. **ECONOMY:** Chief exports—bananas, refined petroleum products, shrimp, sugar. Undeveloped timber and mineral resources. **CURRENCY:** 1 balboa (of 100 centésimos) equals $1 U. S. **MAJOR CITIES:** Panama City (population 389,000) capital; Colón, port; David, trade center.

understand why. He spoke freely on condition that I not use his name.

"We Panamanians are really an easygoing people," he said. "We may blow our tops, but once we let off steam, it's over; we seldom harbor a grudge.

"We may not like some of the things you Americans have done, but that doesn't mean we don't like you or respect you. And we'd a lot rather do business with you than with, well, Communist powers, for example."

He paused a moment, then went on: "You have to remember that you had a part in bringing a baby Panama into the world. You helped us grow. Now that you've raised us to manhood, you can't blame us if we want to be treated like a man."

Canal Builders Were Men of Vision

Everywhere I went in Panama I found an appreciation for the engineering feat of building the canal, and the spirit of the men who accomplished it. Capitalizing on French mistakes, plans, and buildings left behind, U. S. engineers pushed the canal to completion. They dammed the mighty Chagres River, penning its incredible yearly flow of 200 billion cubic feet of water into man-made Gatun Lake, 85 feet above sea level. They sliced a gorge through Panama's spine—the rock and heartbreaking mud of Culebra Cut, later renamed Gaillard (pages 402-3). And they shaped concrete and steel into stairstepping locks on the Caribbean and Pacific ends to float ships through with water from Gatun Lake (diagram, pages 409-10).

You begin to realize the immensity of the undertaking when you stand atop Contractors Hill at Gaillard Cut and peer down on ocean liners dwarfed beneath. Or when you look up at the towering man-hewn cliffs from the deck of a transiting ship.

I did that aboard *Timaru Star*, a British freighter carrying a cargo of Australian beef and wool to New York and Montreal. The skipper, Capt. C. P. Leighton, was my host, and Capt. S. W. Peterson the canal pilot who took the ship through.

"You have to admire the vision of the men who built the canal," Captain Peterson said. We were heading past Balboa, sister community to Panama City. "They built the lock chambers 1,000 feet long and 110 wide—far bigger than anything on the seas when the

canal was opened in 1914. Not until the 1930's did yards build ships too big to go through."

I said I thought the *Timaru*'s 65-foot beam left little enough room to spare. Captain Peterson smiled.

"We get supertankers so big four pilots are required, one on each side of the bow and two on the bridge aft. Some U. S. aircraft carriers have only a seven-inch clearance. They have to be given a one-degree list so their projecting islands will be out of the way of the control building beside the locks. And the building has hinged eaves that can be lowered to prevent scraping.

"Putting a ship in a lock is like pushing a cork into a bottle. You have to drive her in or pressure of her own displacement will shove her back. You need the help of electric mules" (page 410).

Lock gates closed behind us, and dull emerald-green water welled in to lift us the first step of our passage.

"It takes 52 million gallons of water for each ship that goes through the canal," the captain said. "And when you consider that the canal averages forty ship passages a day, you can understand the importance of the Chagres River and Panama's rains."

The average vessel, I learned, takes 15 hours to get through the canal—half in waiting time. It pays $6,600 in tolls, but saves as much as $50,000 in time and travel costs compared to a trip around South America.

"Rates are the same today as when the canal opened,"

Though it joins North and South America, Panama runs east and west; the Pacific end of its canal lies 27 miles east of the Caribbean terminus. Experts estimate that the strategic waterway may reach its 25,550-ships-a-year capacity by 1990, and a commission now investigates four sites for a new sea-level canal (below): (1) the Nicaragua-Costa Rica border, (2) an area in or near the Canal Zone, (3) Panama's Darién region, and (4) near the Colombia-Panama border.

Captain Peterson added. "They're figured on the ship's tonnage. Any boat can go through. In 1928 adventurer Richard Halliburton got permission to swim the canal. They figured his toll at 36 cents."

It all seemed so simple. Yet I couldn't help but recall the shattered hopes and herculean efforts that had made it possible.

A white-haired Frenchman, Ferdinand de Lesseps, builder of the Suez Canal, had fired imaginations with his plan to dig through the Continental Divide. Tens of thousands of his countrymen poured out their savings to finance the scheme. Thousands followed him abroad to fill construction jobs. But failure stalked from the start; the ground-breaking ceremony in 1880 had to take place in a box of earth aboard a river boat because the vessel couldn't reach the planned site. Nine years and more than a billion francs later, the French crusade collapsed.

Mismanagement, mud, and disease vanquished de Lesseps. At the end, the French had excavated only two-fifths of what they had planned to complete in six years.

But disease was the main adversary: malaria with its wracking chills, and yellow fever—the "black vomit"—that killed in as little as 24 hours. Men wrote their wills before leaving for "the hell-hole that is Panama"; a few even brought their own coffins. Estimates place deaths as high as 20,000; no one knows the exact number.

The small French cemetery just outside

Birthday party for a new regime: A military junta seized power from President Arnulfo Arias in October 1968. On the first anniversary of the military government's takeover, watchers throng Avenida Central, main shopping boulevard of Panama City, during the four-hour parade. Bystanders leap for a bag of rice thrown from one of the floats. Walkie-talkie in hand, a member of the National Guard (below), a 5,000-man police and defense force, monitors the route.

Panama City is one of the few from those days whose traces today's canal and rife jungle have not erased. Little iron crosses corrode in the tropic air. Stand there, as I did, and you will marvel at the audacity of men who dared their lives for a mud-mired dream.

Neat Moats Spread Disease

The ignorance of the times brought the terrible toll. "Miasmas" and "mephitic vapors" were blamed for the deadly fevers. No one realized that neat tile moats around shrubs, even water-filled pans under the legs of hospital beds—placed there to stop foraging ants—became breeding grounds for mosquitoes that spread disease.

Even after the United States picked up

where France left off, men in high places scoffed at the idea that a mosquito—a particular kind, and only the female at that—carried malaria. And that another brought yellow fever. Efforts of Col. William C. Gorgas to erase disease from the zone were stymied at first by obdurate officials.

Captain Peterson's voice brought me back to the *Timaru*. "That's the Chagres we're passing," he said.

The Chagres—what a name to evoke the drama of the past! Once it was a rampaging stream that plunged from Panama's highlands to the Caribbean: a treacherous water road traversing more than half the isthmus—used by the Spanish for goods less precious than the trail-carried treasure, preyed upon by pirates, plied by forty-niners bound for California gold. Harnessed now, it is the mighty force that powers the Panama Canal.

I looked at the place Captain Peterson indicated. I saw only a placid lagoon where the river empties into sprawling Gatun Lake. It looked more like a meadow than a watercourse. Rafts of weeds choked its surface. And I remembered that Madden Lake upstream now tames the tributaries that once sent the Chagres rising as much as forty feet in a single storm. And that Gatun Dam on its lower reaches backs up the river into a quiet lake of 163 square miles.

Unseen Army Makes the Canal Go

That lake made islands out of hills. The largest, 3,600-acre Barro Colorado, has been serving science for half a century as a biological research station run by the Smithsonian Institution. Staff and visiting scientists use its laboratories and primitive jungle for studies of the island's thousands of species of plants and animals preserved here in isolation.

Through lake-channel and lock *Timaru* steamed. On shore an unseen army—the Panama Canal Company employs 4,000 U. S. citizens and 12,000 Panamanians—worked at jobs supporting our passage. On the bridge the pilot paced from vantage point to vantage point, his keen eyes roving—sizing up distances, checking markers, noting movements. And when he slipped *Timaru* delicately between a Danish freighter and an explosives-laden Victory ship in Cristobal, the canal's Caribbean terminal, I had new admiration for the waterway and the men who make it go.

Cristobal sits in the Canal Zone, that strip sometimes described as "a little U.S.A." with its neat housing, stores, and military installations (pages 422-3). Colón, Cristobal's neighbor, sprawls in Panama proper and lives—like much of the nation—on canal trade.

Free Zone Creates Jobs

Colón once was an island in a swampy bay where Christopher Columbus anchored when he cruised Panama's coast in 1502. Dumped fill has linked it to the mainland and expanded its acreage to rank it after Panama City, the capital, as the country's second most populous city. A hundred of those acres hold special importance; they mark the Colón Free Zone.

"It's an area where goods from abroad can be processed, repackaged, warehoused, or exhibited, and then sent on to other countries without having to pay Panamanian taxes or customs duties," Enrique Townshend, the Free Zone's general manager, told me. "A manufacturer in, say, Japan, the United States, or Great Britain can stockpile his products, shipped here at low bulk rates, and make distribution quickly to markets in Latin America. Or he can assemble items with parts brought from different sources.

"In 1953 eight companies used the Free Zone; today there are 600. This has created jobs for 6,000 Panamanians—and has had some surprising side effects. One textile mill, attracted here by the Free Zone's advantages, used to import cotton because little was grown in Panama. Now our farmers expect to grow all the mill needs by 1972."

Another promising boost to Panama's economy lies in the hills not far from Colón. There an exploration team has found a deposit of copper ore. Test borings suggest a metal content richer than in open-pit mines of the Southwestern United States. But exploitation

Framed by flickering candles, a young Roman Catholic comes to pray before the storied Golden Altar in Panama City's church of San José. The buccaneer Henry Morgan sacked Panamá Vieja—Old Panama (pages 434-5)—in 1671. Priests whitewashed the gold-sheathed masterpiece and thus saved it from pillage, local tradition has it. Today's Panama City rose following Morgan's raid, and the altar was moved to the new church. Overwhelmingly Roman Catholic—93 percent—Panama guarantees religious freedom in a constitution adopted in 1946.

When life dances

CARNIVAL IN PANAMA—the four days preceding Lent—gives wings to the heart. And yet, joke Panamanians, carnival is one of the few things they take seriously.

It begins on Saturday, Coronation Day for the carnival queen. On Sunday, Pollera Day, the nation's pride in its past goes on parade. Riding a float, a dark-eyed beauty (left) shows off her *pollera*, a traditional dress of linen, embroidered and appliqued in fruit and flower designs, edged in lace, and adorned with pompons. Hair ornaments, called *tembleques*, flash with beads, gilt wire, and fish scales. Her gold medallion is an heirloom. The costume dates from slave days, when colonial matrons competed in dressing their nursemaids ever more elaborately.

PHOTOGRAPHED BY BRUCE DALE © N.G.S.

Tide of joy sweeps Avenida Central in Panama City (left). On the third day of carnival, everybody gets into the act. Clubs, fraternal orders, business firms, and families sweep along the streets in a fantasy of costumes, dancing to the thunder of bongo drums and the blare of trumpets. One youngster wears a painted hand on his back and shows up in white-face (above).

Climax of the festival comes on Tuesday as the carnival queen leads an extravaganza of floats. Dancing follows until dawn, when a candlelight procession, marching to a funeral dirge, wends its way to the nearest beach and ceremonially buries a fish, signifying the beginning of Lent. It is Ash Wednesday, a time for prayer and denial—and dreams of the carnival to come next year.

must await further testing, and solution of the not-so-simple problem of building roads into the wild area.

"Oil and other minerals also may be found in Panama's soil," a government economist told me. "Extractive industries would help diversify our economy. Right now, though, we're mining our geographical location." And I remembered the slogan on Canal Zone license plates, "Funnel of World Commerce."

That commerce can have some odd sidelights, I discovered as I rode the 50-mile paved highway from Colón to Panama City in a clattery Panamanian bus. The driver hurtled along on the wrong side of the road, grudgingly moving over into the right lane only when forced by an oncoming car. I asked why.

"Southbound trucks leave Colón loaded with cargo brought by ship," he said. "Their weight breaks up the pavement in the right lane. But they come back empty and make no chuckholes. So, when I'm traveling south, I take the wrong lane; it's smoother."

The highway, built during World War II, added a parallel route to the canal and the railroad that had crossed before. The railroad came first. Its last spike was driven in darkness and pouring rain in 1855.

Across the Continent in 80 Minutes

Promoters envisioned a fat return from traffic to and from California's gold fields. At $25 a passenger, $100 a mule, and 50 cents a cubic foot for first-class freight, they got it.

So many workmen died during construction that it was said the railroad "cost a life for every tie." Some literal soul, however, counted 140,000 ties in the 48 miles of track; though the precise number who died isn't known, it was a mere fraction of that.

Construction of the canal inundated the original railroad, but a relocated line still operates. On it you can travel across the continent in 80 minutes. The fare? One and a quarter balboas. Panama's monetary unit, named for the explorer, equals in value the U. S. dollar. Coins are issued, but no paper money; hence U. S. currency is the chief medium of exchange throughout the nation.

The canal's builders and the railroad's entrepreneurs imported laborers from wherever they could entice them. Irish, English, French, coolies from India and China, Negroes from the United States and the West Indies—tens of thousands flocked in. Of those who survived disease, many stayed in Panama to live. So did trekkers of the California gold-rush days. The newcomers intermingled with the local stock of Spanish, Indian, and mestizo descent. Thus today's Panamanian is a rich amalgam of nationalities. Phone-book names—Arosemena, Boyd, Chen, Ducret, Ludwig, Maduro, Singh—attest to the ethnic variety among Panama's 1,417,000 people.

Variety Brings "Cultural Shock"

The diversity provides some delightful touches. In Colón the British-accented English you hear betrays the Jamaican and Barbadian origins of the inhabitants' forebears. In Bocas del Toro you meet a softer English.

Bocas is a province capital of weathered buildings, rusting roofs, wide streets, and a delightful beach. Its 2,700 population makes it one of the larger towns on Panama's forest-quilted Caribbean side.

"I got a cultural shock when I came here in 1922," Josefa Jaén de Ryan, local historian and civic leader, told me. "Nobody spoke Spanish, only English, and the whole way of life was strange." Now Spanish is compulsory in all the nation's schools, and regional differences are dying.

Conformity has come, too, to the Guaymí Indians of the province's interior, Señora Ryan pointed out. "They used to wear bright clothes and magnificent beaded collars. Now they work on the banana *fincas* and sport transistor radios, watches, and Arrow shirts."

Bananas are Panama's number-one export; so I went from Bocas to the nearby port of Almirante and north on the railroad from there to visit the domain of the Chiriquí Land Company, the number-one exporter. For mile after mile along the track reaching to the Costa Rican border bananas grew in ordered profusion. Ponderous stems of fruit hung encased in plastic bags (page 425).

Tossing her skirt flirtatiously, a dancer leads her partner in the *tamborito*. As drums beat at a fiesta in Ocú, the couple enters a circle of friends who sing and clap time to the music. The verses may speak of love, politics, social events, or personalities. The male dancer wears his country's traditional straw hat—made in varying black-and-white designs. The familiar all-white "Panama hat" actually comes from Ecuador.

The U.S. in Panama

FOR FIVE MILES on either side of the canal the United States holds sway. Within the Canal Zone live more than 42,000 U.S. citizens—military personnel and employees of the canal and government agencies.

Roy Mahan (left) plays saxophone in the zone's Curundu Junior High School band. The 2,030 students at Curundu eat lunch in the cafetorium (above)—a combination cafeteria and auditorium. A children's art project decorates the balcony. Panamanian youngsters attend on a space-available basis.

U.S. installations in the zone include Howard Air Force Base (right), part of the U.S. Southern Command. Medical facilities are available at Gorgas Hospital, where the fight against tropical diseases continues in the tradition of Col. William C. Gorgas, who eradicated yellow fever during the building of the canal.

"We grow the bananas in bags to protect them from insects and from being scarred by wind-whipped leaves, and to ensure a better-quality product," B. D. Walker, manager of this sprawling division of the United Fruit Company, explained. "Last year we produced enough to supply every person in the U. S. with three pounds."

That night in Changuinola I did my bit for consumption by having a banana daiquiri and a slice of banana cream pie.

Problem: How to Keep Tribal Ways

The progress bringing changes to the banana-working Guaymis is being felt, too, at the opposite extreme of Panama's Caribbean coast. Here string the numerous San Blas Islands—"one for every day in the year," I was told. This is the land of the Cuna Indians.

Small, shy, and friendly, the Cunas work mainland plots and paddle back and forth daily to thatched homes on the breezy, almost insect-free islands. And they struggle to maintain tribal ways against the pressures of an encroaching modernity (pages 432-3).

"It's a losing battle," I was told by barefooted John Mann. An ex-Iowan, he came to Panama 15 years ago, "liked the place, and decided to stay." Now he follows an easy existence as a sometimes-guide among the Cunas.

"Do-gooders encourage a switch to hot tin roofs instead of cool thatch, and concrete floors instead of packed clean sand," he said. "Youngsters go off to Panama City to school, or to jobs, and when they come back they can't accept tribal ways that have worked for centuries. Why, some of the islands even have drum and bugle corps! In ten years the whole San Blas will be ruined."

I went with John Mann to palm-studded islets whose multisyllabled Cuna names identified them as "Big Orange," "Little Orange," and "Wild Pig." I flew alone to bigger Ailigandi, whose 1,200 population is nearly a tenth of the San Blas total. And I noted that relatively few girl babies had nostrils pierced for gold rings like those their mothers wore. Not many teen-aged feminine noses were

Bananas: big business

"CHIQUITA" say the labels that a pretty Panamanian sticks on bananas at the United Fruit Company's plantation in Puerto Armuelles. Panama's number-one export was worth $52,500,000 in 1968. Refrigerated ships keep the fruit green while it travels to markets around the world.

In a jungle of banana plants (right) at Changuinola, a worker lugs a stem to an overhead trolley wire that will carry it from field to shed for washing, grading, and boxing. Plastic bags in which the stems grow protect them from insect damage and from bruising or scarring by wind-whipped leaves. Each stalk produces a single stem during its one-year life.

marked with black lines to enhance their length—and ward off devils. Young misses were as likely to be wearing dresses as the traditional *mola* blouses.

The word mola means "cloth," but outsider misuse applies it to the blouse itself, and to the brilliantly colored panels from which it is made. Reaching from waist to armpits, the panels have as many as seven layers of cloth, with designs cut through and edges stitched under to show colors beneath. Exquisite hand sewing can go into this cloth "sculpture," whose design inspiration relies on everything from tribal lore to comic-strip characters and magazine illustrations (page 433).

Tooth Extraction Costs Two Coconuts

On Ailigandi I got another view of what progress means to Cuna ways. I stayed in a five-room concrete-block hotel—"built as a cooperative venture by 350 of us here," Napoleón Gómez told me.

The hotel boasts an island luxury: one flush toilet, which was fed only fresh water to protect its plumbing. I winced when I learned that Ailigandi's fresh water had to be brought in cans by canoe from the mainland—a daily chore for Cuna women. And I lauded a project that would soon bring a plentiful supply from a mainland river.

Next to the hotel stands the only hospital in all San Blas. A dedicated young medical missionary, Dr. Daniel Gruver, is its administrator—and whole medical staff. His daily routine is a wearying round of ward visits, operations, clinic hours, X-ray work, baby deliveries, and even tooth extractions.

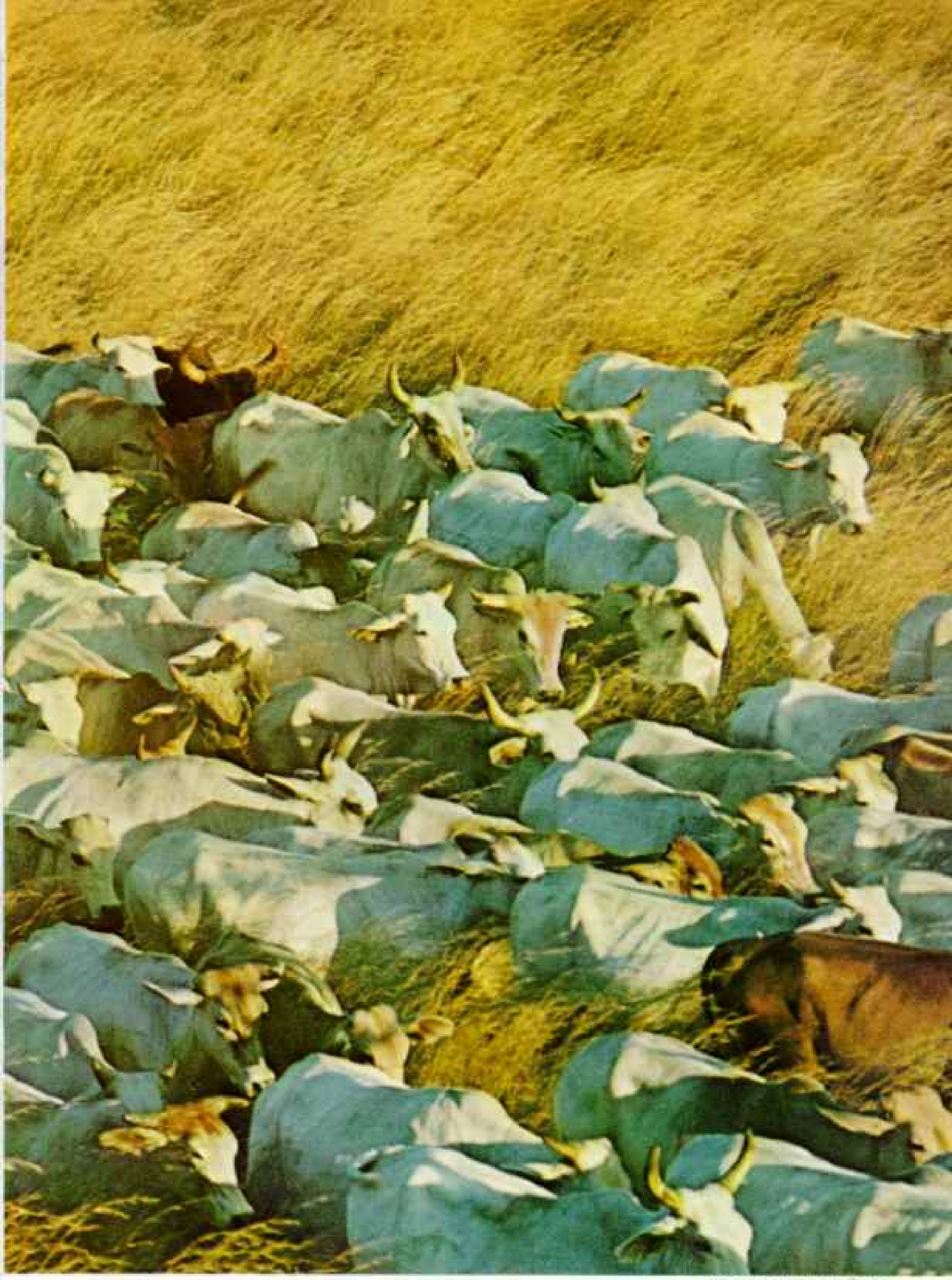
"The hospital is supported by the Baptist Home Mission Board and private contributions," he said, "but the Cunas pay for medical care. I charge 10 cents—the value of two coconuts—for pulling a tooth. Just recently I had to raise my fee for a delivery to two dollars, and for an appendectomy to three."

Most of the Cunas' medical needs, however, are met by the tribal *nele*, or medicine man. On Ailigandi, GEOGRAPHIC photographer Bruce Dale witnessed a curative ceremony. Wooden medicine dolls and a pot of coals were placed on the ground beneath a hammock in which the patient lay, covered by a blanket. The nele began a monotone chant and threw cocoa beans and powdered pepper plants on the coals. Pungent smoke arose.

In the chant the nele pleaded with spirits of the medicine dolls to descend through the layers of the underworld and find the devil who had stolen the sick person's soul. Chanting may last for days before the soul is released and the patient cured.

"To whom do you go when you get sick?" Bruce asked the medicine man.

Wading a sea of sere grass, cattle rumble ahead of a cowboy on Los Canelos Ranch in Herrera Province. The spread supports a herd of 5,500—zebus crossed with native stock. Cattle breeders imported the zebu for its ability to withstand heat and dry



DESIGNED BY BRUCE GALT © W.S.S.

spells and for its resistance to insects. Some have crossed it with the Holstein to produce a combination beef-and-dairy cow. The nation now raises its own beef, part of the continuing effort to reduce food imports in a land devoted largely to agriculture.

"For some things I go to Dr. Gruver," came the reply.

The Cuna domain edges the shores where Balboa led a band of starving Spaniards who took over an Indian village on a river called Darién—a name now applied to the whole of eastern Panama. The village, which they rechristened Santa Maria la Antigua del Darién, was the first successful Christian settlement on the New World mainland.

Santa Maria long ago disappeared. No one is sure where stood a second town Balboa founded, in which he met his end. Nearly six years after he waded into the surf and claimed for Spain all lands the Pacific washed, a jealous governor had him beheaded on trumped-up charges of treason.

The jungle swallowed Balboa's grave. Today, in the Darién and in other parts of Panama, that jungle grows as vigorously as when the Spanish first came with their lust for gold. Orchids hang from leafy branches, jaguars pad the humus-soft floor, howler monkeys boom their challenge, insects teem, and snakes and tapirs and brilliantly plumaged birds go their timeless ways.

Mona Lisa of the animal world, the three-toed sloth wears an enigmatic smile all of its days. The slow-moving creature keeps to the trees, nibbling at leaves. Placid pace helps protect it from the eyes of predators; lack of odor saves it from those with keen noses.

Like precious metal, a golden frog gleams on a stream-washed perch. Once abundant here in the El Valle region, *Atelopus varius zeteki* dwindled when trappers captured many for sale abroad to pet fanciers. Today they are protected by law. One frog's skin contains enough poison to kill 500 mice, a recent laboratory experiment showed.

On a U. S. Air Force Tropic Survival School exercise, I felt a touch of this wilderness when I spent a night in it with three women students—and 21 other men (pages 430-31).

"The idea of this course is to familiarize you with the jungle so that you will have confidence in your ability to survive if you're ever forced down," Maj. R. Jerry Hawkins, the school's commander, had said.

After preparatory classwork and demonstrations, we set out. And in six-man squads we plunged separately into the forest. I mumbled some excuses about "for the pictures, you know," and attached myself to the one with the ladies. Survival school instructor Federico Mancilla led the squad.

"See this guarumo tree?" the wiry Panamanian said. "If you can't find two lengths of balsa log to use as a life preserver, this 'ant tree' is almost as buoyant." He lopped off a branch, and ants boiled out. Dropped in a stream, he added, it or a piece of termite nest yields bait to attract fish that can be caught with a net made from parachute cloth.

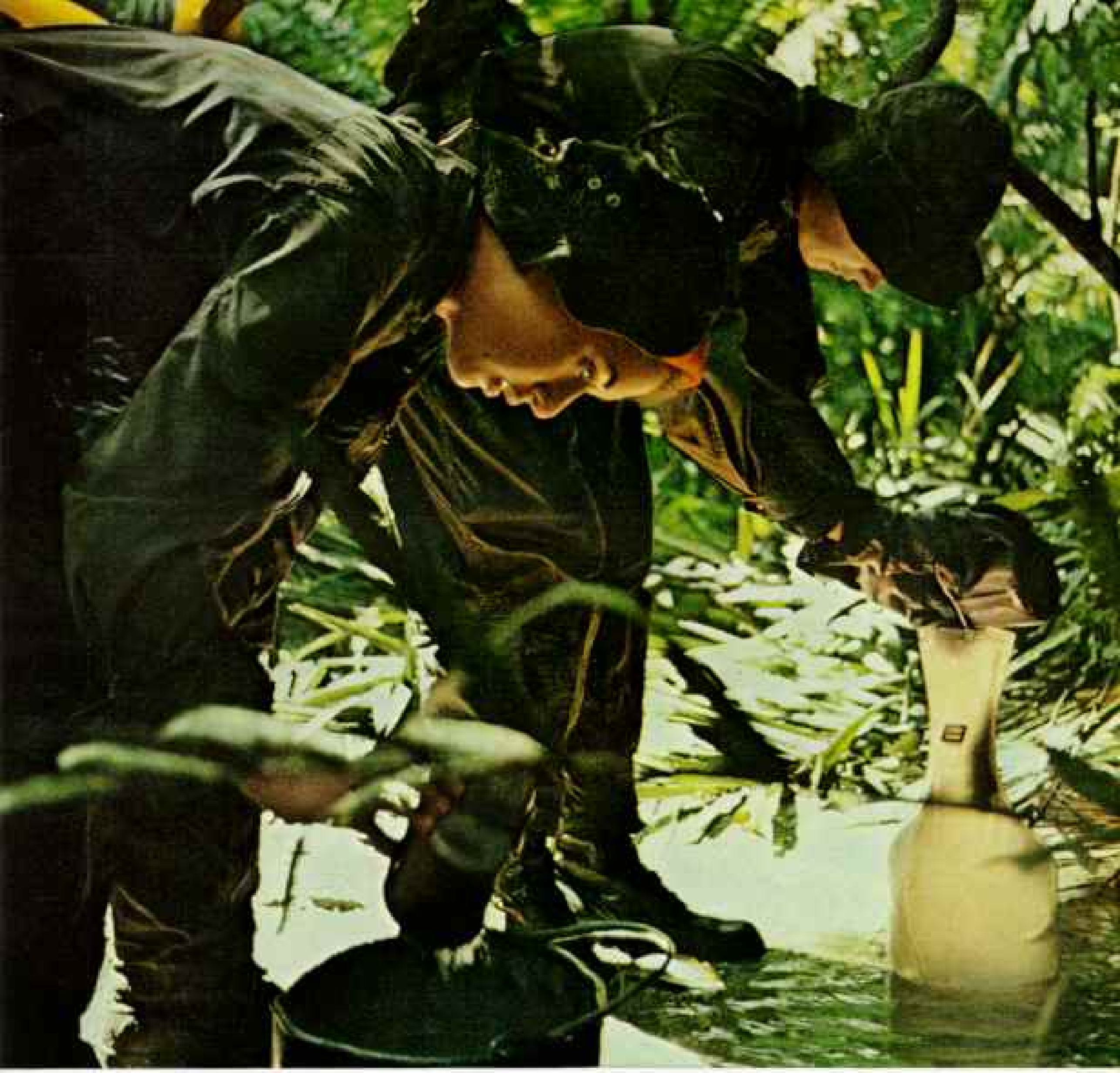
"That fruit is a monkey plum. Anything you see animals eating usually is safe for you. Try one." I bit off a hard outer husk and sucked at the orangish flesh clinging to the pit. It was stringy but sweet, and I made a mental note that I'd need a hatful for a meal.

"Thirsty?" Federico asked. I nodded. He swung his machete twice and handed me a wrist-size length of jungle vine. I raised it to my mouth and cool, sweet water poured out; my yard-long goblet held nearly a pint.

Son of a woodsman and raised in the forest, Federico intimately knows its ways. He showed us leaves that would make tea, cure a fever, fold into a cup without cracking, or serve as sandpaper. He traced wiry runners on the ground that led to edible wild yams. He taught us how to rig hammocks out of parachute sections, and split palm fronds for thatch roofs over our individual shelters.

I noted with some chagrin that my feminine class colleagues were as adept in woodsmanship as I. But my male ego was bolstered when one turned girlishly squeamish about the iguana that was slated for supper.

In case you're curious, iguana stew—rich



with wild yams, plantains, and cassava, and served with raw heart-of-palm as a salad—tastes absolutely marvelous.

Sleep would not come to me that night. My clothes were soaked by the dank jungle. The whine of mosquitoes bespoke their uncountable numbers. And I understood then the tropical torment Panama spelled for the adventurers and builders of long ago.

"Golden Castile" Becomes Panama

S-curved Panama confounds visitors with preconceived ideas of geography. Along its coasts you can watch the sun rise in the Pacific, or set in the Caribbean (map, pages 412-13). Its tropical location gives it even temperatures the year around—kept bearable by cooling trade winds during "summer," the mid-December to mid-April dry season, and by the cloud cover that rolls over jungled hills during the rainy "winter."

Those hills are as empty today as when Balboa died, and when the Spaniards moved from the fever-ridden Darién coast to healthier Pacific shores. The governor who had Balboa executed ordered the move. He was Pedro Arias Dávila, who came to be known as Pedrarias the Cruel for his ruthless extermination of the Indians. In 1519 he founded the City of Panama on a shallow, muddy bay.

Its name, most authorities hold, stems from an Indian phrase for "abundance of fish." Some believe it the word for tall trees that grew near the village Pedrarias took as his capital's site. Others say it came from *panaba* —"far away"—the native reply when asked

about the source of the gold in the ornaments they wore.

That gold brought the isthmus the early-day title of "Castilla del Oro—Golden Castile." It brought, too, a brilliant period in Panama's long history of ups and downs. By royal decree all the treasure of the Incas, Bolivia's silver, the pearls of the Pacific—and goods from Europe sent in exchange—funneled through the isthmus crossing.

This "Royal Road" was a cobbled trail, just wide enough for loaded mules to pass. It linked Panama City with the Caribbean towns of Nombre de Dios and Portobelo.

Masts bristled in Portobelo's harbor during its annual fair in colonial times. Galleons came then to pick up the treasure—"bars of silver stacked like cordwood," one observer wrote. Merchants gathered to trade cacao and quinine and vicuña wool for furniture and rice and cloth from Europe. It was a bustling, roisterous time, but followed by what residents called the *tiempo muerto*, the "dead time" that hung until the next fair.

Today Portobelo sleeps that sleep year round. Old cannon rust where they sagged when wooden carriages rotted away. Ruined walls molder with memories—memories of colonial times; of Sir Francis Drake, who was buried at sea just outside the bay; of pirate Henry Morgan, who used captured nuns and priests as shields to assault fortress walls.

Devout Residents Honor a Black Christ

Only about 700 people live in Portobelo now. Many descend from Negro slaves brought to Panama long ago. One long-time resident, retired Judge Justino Sanguillen, showed me the town and its ruins, and told me about the Festival of the Black Christ.

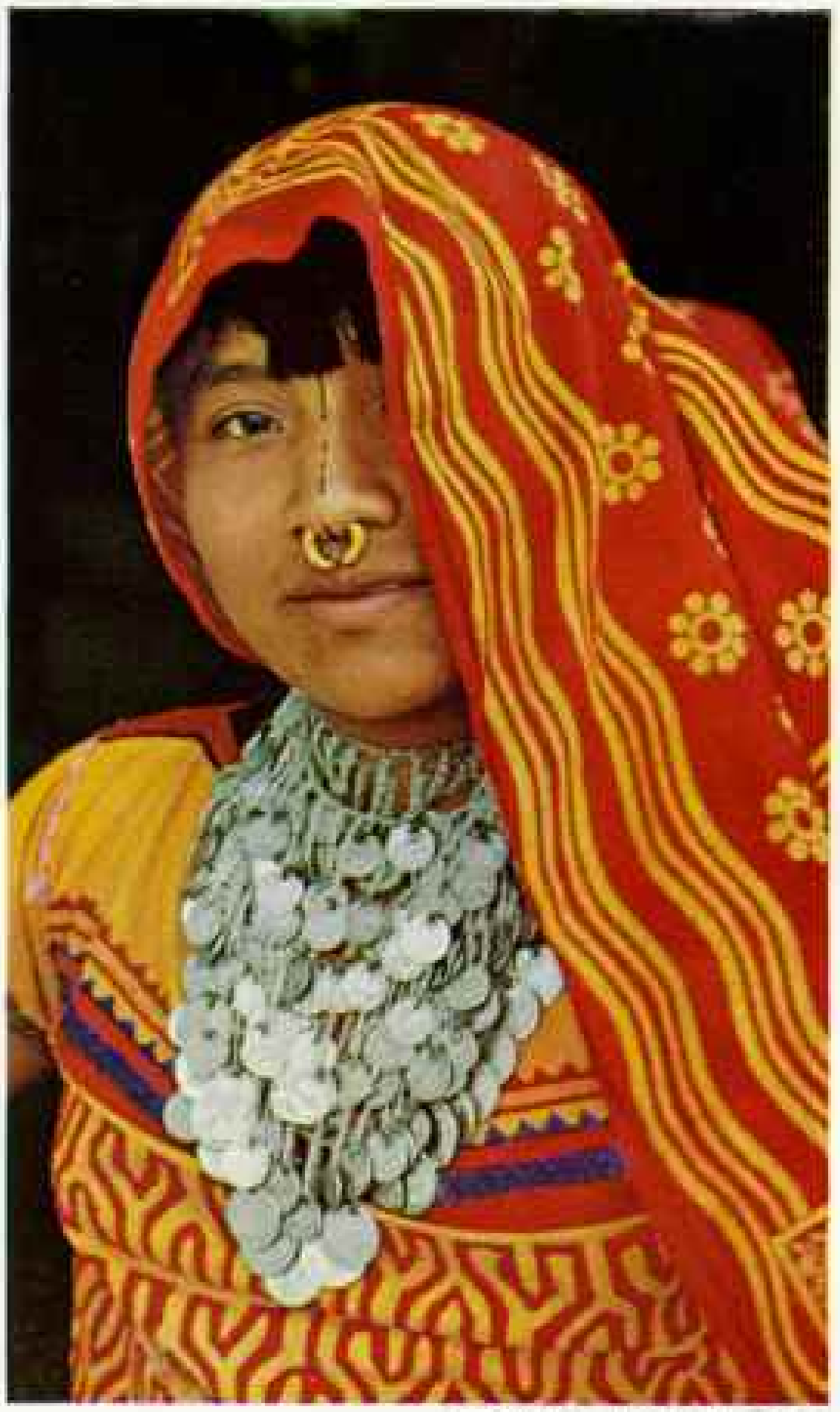
"It centers around a 300-year-old statue carved from cocobolo wood. On October 21 each year, devout residents parade a heavy platform mounted with the holy image, a dark-visaged Christ shouldering the Cross."

From the cathedral the night-time procession winds down streets with a lurching, hypnotic pace—three steps

Survival

"ONE OF YOUR WORST ENEMIES is fear; you won't panic if you know what to expect," declares the commander of the U. S. Air Force Tropic Survival School.

In the hands of an instructor (right), a jungle vine turns water tap, yielding almost a pint. Getting water from a stream, Lt. Linda Blum (above right), a USAF evacuation nurse, will purify the liquid with chemical tablets. Also taking the course is Kathy Axel, a student of tropical medicine at the Gorgas Memorial Laboratory in Panama City.



People apart: Since the Spanish conquest, the Cuna Indians have clung to isolation, allowing visitors to come freely only since World War II.

Their houses (left) crowd some of the 365 San Blas Islands off the northeast coast. This woman accentuates the length of her nose—a standard of beauty—with a black line and a gold ring. She wears a necklace of silver coins and the traditional *mola* blouse, made of multilayered cloth cut to reveal colors beneath. Modern design below portrays a beelike plane dropping parachutists.

forward, then two back. Candles light the route, dripping wax on cobblestones that mark the end of the old Royal Road.

Jungle-wise hikers can follow the length of that history-charged trail today, though rank growth has obliterated its stones in all but a few spots. Less hardy souls can see a companion stretch beside a paved highway a few miles from the bay where Pedrarias founded Panamá Vieja—Old Panama. Ruins of that city still stand, vines throttling its crumbled walls (following pages).

Henry Morgan led his buccaneers across the isthmus and sacked Old Panama in 1671. To pleadings of the inhabitants he growled, "I came not hither to hear lamentations and cries, but to seek money." Money he got. He left the burned city with 175 mule-loads of loot.

Old Panama never recovered. In 1673 the Spanish moved the capital to a better anchorage five miles away, the site of present-day Panama City. And to protect it, they threw up a wall so massive—and expensive—that the King's Council acidly inquired whether it had been built of silver or gold.

You can walk atop that wall today in the portion called Las Bóvedas, where on a Sunday afternoon Panamanians gather to chat, and to watch the soaring gulls and the shrimp fleet coming in. You can visit, too, the nearby Metropolitan Cathedral, begun in 1688; its twin towers gleam with embedded abalone shells and hold bells that once rang in Panamá Vieja. Or you can stand before the most storied treasure of all, the Golden Altar of the church of San José (page 416).

Broad Avenue Bears Two Names

Bumper-to-bumper traffic clogs narrow streets of the city's old section. Balconied tenements there contrast with the lawn-trimmed neatness of the Canal Zone. A broad avenue separates the two—and sports two names along its length: Fourth of July and John F. Kennedy.

I dodged across it one day, horns assailing me in tones from polite warning to vociferous threat. My intent: a walk to the city's waterfront. Buses rattled by, decorated with plastic streamers, painted scenes, and such quips as "Bachelor Driver at Your Service," "Pay Me With a Kiss," and "God Bless My Clients."

Along Avenida Central, ticket sellers displayed chances for the twice-weekly drawings of the national lottery. Office girls and salesladies scurried back to work after the

EKTACHROME (ABOVE) BY BRUCE DALE AND KODACHROMES

Crumbling remnant of Spanish glory rises beside an impromptu baseball field in Old Panama. Pedro Arias Dávila, later known as Pedrarias the Cruel for his wholesale massacre of the Indians, founded the city in 1519. Galleons came bearing gold of the Incas, silver from Bolivia, and pearls from the Pacific. Merchants grew rich on trade and built grand houses of mahogany and cedar. Then in 1671, during Morgan's raid, the city caught fire and burned to the ground, leaving only the ruins of stone churches and public buildings.

ALBERT MOLDVAY (RIGHT) AND JOHN M. KEDDISON, W.D. © N.G.S.

Promise of tomorrow, new apartment buildings rise in Panama City above the rusted metal roofs of shabby tenements. Proposed treaties between the republic and the United States would bring Panama more income from the canal, and help continue the nation's progress.

Offerings for the dead, artifacts called *huacas* are often found in pre-Columbian Indian graves. The National Museum in Panama City preserves this one, made of gold-copper alloy. The figure probably represents a deity. Greed for gold prompted massacres of Panamanian Indians, until discovery of the Inca treasury in Peru turned Spanish eyes elsewhere.

siesta-hour closing, their chic skirts and blouses a uniform distinctive for each establishment. The avenue, a phalanx of bars and night clubs during World War II, now is the city's busiest shopping street. Blaring go-go bars have moved to such thoroughfares as Via España—locale, too, of plush hotel gambling casinos whose slot machines Panamanians call *traganiqueles*—"nickel swallowers."

I walked by shops whose offerings ranged from gems and gimcracks to housewares and *huacas;* the latter are artifacts of pottery, carved stone, or gold (page 435) dug from pre-Columbian graves—and often reproduced in eye-catching imitation. I passed placarded windows advertising "Duty Free Store"—a slight misrepresentation, although Panama's low duties on tourist-popular goods provide bargains in a host of items.

Finally I came to the waterfront. My aim: to talk fish and fishing with energetic young Federico Humbert, Jr., President of the Pearl Islands Sea Food Company.

The firm takes its name from an archipelago off the Darién coast, one visited by Balboa and called by him Islas de las Perlas because they were the source of pearls given him by Indians. Long ago the oyster fisheries dwindled in importance, and now the islands attract mainly as a vacation resort and as headquarters for exclusive sport-fishing clubs.

Records Set by Panama Catches

"Panama's seas abound in fish," Señor Humbert said. "More than two dozen world sport-fishing records have been set here. Fifty species are commercially important. Our company specializes in shrimp, a nine-million-dollar-a-year export."

Trawlers ply the coast from the border of Costa Rica to Colombia, he said. They net the crustaceans at varying depths and bring them to freezing plants in Panama City. Some twelve million pounds a year are exported.

About a third of the nation's population lives within ten miles of the Canal Zone—389,000 in Panama City alone. Yet the "interior," as the capital's residents commonly call anything beyond the metropolitan area, offers delightful surprises and locales.

Come with me along the Pan American Highway, which winds a paved ribbon to Costa Rica's border. It leads past sparkling waterfalls where Panama's rivers run power plants or provide pools for swimming. It skirts curving beaches—San Carlos, Rio Mar of surfer appeal, and Santa Clara, to name but a few.

Side roads take you to such mountain-cradled resorts as El Valle, where motel proprietor Vicente Greco told me about jaguar hunting in the forests, trees that grow with square trunks, and golden frogs (page 429). They take you, too, to out-of-the-way towns like Las Tablas, where you can watch nimble fingers fashion *pita* straw into real Panama hats; strips dyed black create designs that make them distinctive from "Panamas" made in Ecuador (page 421).

Live Fence Posts Defeat Termites

At Aguadulce, now on the Pan American Highway, colonizing Spaniards found a spring of sweet water that gave the place its name. I found an exciting project that may bring irrigation to nearby plains.

Offices open early in all Panama, and at 7 a.m. I sat down across a desk from Leslie M. Wray, an engineer with a British firm and director of the project. Why, I asked, would a wet land like Panama need irrigation?

"Almost no rain falls in the dry season," he said. "If farmers had water then, they could raise a second rice crop each year. Also, dry spells in the first half of the rainy season sometimes hit newly planted fields, and supplemental irrigation would prevent losses and increase yields. If studies show that dams in the hills are feasible, rice growers and other farmers would benefit."

Even fence posts take root in Panama's fertile soil, I noted as I drove from Aguadulce past fields where hump-shouldered zebu grazed. Leafy sprouts topped new-strung barbed wire; older fences had become a luxuriant line of trees. In Santiago I learned that these living fences aren't accidental.

"Ordinary posts rot quickly here, or get ruined by termites," rancher Juan R. Brin explained. "So we take sapling-size cuttings of a wild plum tree and root them. Then we have a permanent pole."

To my query about the preponderance of zebu among the cattle I had seen, Señor Brin

Smile of maternal pride warms a Choco mother's face. The Indians live in Darién Province, raising plantains which they take in dugout canoes to a river boat for shipment to Panama City. In the steaming heat the women wear only skirts, the men loincloths, and the children beads. Darién's dense jungle has long thwarted efforts to finish the last link of the Pan American Highway.

Rustic social center, the Salon Buenos Aires draws Boquete residents to a bowling match. Crowding the end of the improvised alley and hanging off the sideguards, spectators follow each delivery with critical eyes. Boquete nestles in the foothills near 11,400-foot Chiriqui Volcano,

EXTACHROME © N.G.S.

highest point in Panama. Coffee and sugar-sweet oranges thrive in the region's rich soil and year-round temperate climate.

replied, "Their light skins help them resist heat. You see some Holstein and zebu crosses, which make a combination of milk-and-meat animal [pages 426-7]. But for pure breeds like Hereford and Charolais, you have to go up around Boquete—but then Boquete isn't really Panama."

I drove to that mountain resort by way of David, trade center and Panama's third largest city. And I had to agree that Boquete is something special.

Its 5,800-foot altitude gives the town a climate of almost perpetual spring. Coffee bushes and citrus trees march up the sides of surrounding hills. And from the peaks in summer blows the *bajareque*, a drizzle so fine people call it "liquid sunshine."

The moisture, and the area's rich volcanic soil, may hold the flavor secret of the famed Boquete orange—"so sweet you think a half cup of sugar is in each glass of juice," hotel proprietress Vera Elliot told me. She terms her little Hotel Panamonte "my window to the world" because it brings "people from all over to me."

The many groups—Spanish, French, German, Italian, Scandinavian, U. S.—that settled here give Boquete a cosmopolitan air. But on my way back to Panama City, in the little plains-country town of Ocú, I encountered the Spanish Panama of pre-canal days.

Oceúans Dance With Eyes and Feet

Ocú was holding its annual festival. I mingled with the throng in the plaza in front of the cathedral. Vendors hawked syrup-doused cones of shaved ice, cotton candy, and *carne en palitos*—spicy bites of meat grilled on a wood sliver. Stands along side streets catered to sit-down diners with such Panamanian dishes as tamales and fried plantain.

On a stage, costumed groups danced the *tamborito* and other folk figures to the beat of small drums and guitars. The steps were mincing, somewhat stiff, yet elegant. "We dance as much with our eyes as we do with our feet," a bystander explained (page 421).

Men with machetes at their waists paraded in the peasant *montuno*. Made of unbleached linen, its calf-length pants and embroidered shirt are a garb that originated in Ocú. Women swished about in the elegant, ruffled *pollera*, once a servant dress but now the national holiday costume (page 418).

"Pollera means 'hen cage,'" my bystander friend said. "The dress got that name not because of the chick it graces, but because the

skirt's bell shape looked like cages people took hens to market in. An earlier costume had the name *tumbahombre*—'man stunner.'"

I decided that the beauty I saw enhanced by the pollera was no less devastating.

That night I drove back to Panama City. The contrast between its bustling urbanity and the tranquillity I had found in the interior struck me forcibly. I remembered how vital to the pulsing capital was the water artery that coursed the nation's heart. And I wondered what the canal's future might be.

Tall, incisive Maj. Gen. W. P. Leber, whose Army assignment makes him both Governor of the Canal Zone and President of the Panama Canal Company, summarized:

"Already more than fifty warships and a thousand commercial vessels are too wide, or draw too much water to go through the canal," he said. "The rise in movement of high-value cargo by air also is skimming off some business. Still, forecasts project continued traffic growth; there will always be a need for a canal. As a matter of fact, we expect the canal to reach its maximum capacity of 70 ships a day by around 1990."

Nuclear Energy Could Dig New Canal

With an eye to the future, an elaborate study has been made of sites for a new canal. Col. Alex G. Sutton, Jr., field director of the study commission, told me about it.

"A lock canal is subject to sabotage, and to bombing in wartime," he said. "The idea of a less vulnerable, faster-to-travel, easier-to-operate, sea-level canal isn't new—de Lesseps started out to dig one. But means exist today for doing it that weren't available at the beginning of the century. And there is the possibility of excavation with nuclear energy."

The commission analyzed four locations: in or near the Canal Zone, a Nicaragua-Costa Rica route, one across the Darién into the Gulf of San Miguel, and through northern Colombia's Atrato swamps (map, page 413).

"Surprisingly, pretty much the same routes were proposed more than 400 years ago," Colonel Sutton said.

News of Balboa's discovery was still fresh when the idea of linking the two great seas was born. Hernán Cortés considered a water passage across the isthmus more valuable even than his own conquest of Mexico. His cousin, Alvaro de Saavedra, proposed an artificial strait, and by 1529 had drawn plans for routes across the Darién, at Panama's narrow waist, through Nicaragua, and across Mexico's Isthmus of Tehuantepec.

The proposal bore no fruit. One grandee wrote the King of Spain that "all the gold in the world would not suffice for its execution." But a contemporary historian argued: "Give me a man who has the will to do it, and it can be done; if courage is not lacking, there will be no lack of money. . . ." With the Panama Canal's official opening in August 1914, his words rang true.

Sea Snakes Tagged With Radios

Today's commission studying a sea-level canal made exhaustive surveys. It considered myriad problems, including such things as the practicality of digging with nuclear blasts, danger from fallout, complications from the difference between the Caribbean's 10-inch tides and the 12½-foot ones of the Pacific, and risks to nature's balance from intermingling the marine life of the two seas.

One facet of the last is a study of the poisonous yellow-bellied sea snake, a Pacific species, by the Smithsonian's Tropical Research Institute here. It includes tagging snakes with radios to learn if their travel habits might make them a menace in Atlantic waters.

Estimates have been made that to widen and deepen the present canal, where population density forestalls atomic excavation, might cost more than 2½ billion dollars. "A much wider and much deeper canal might be dug at one of the more remote locations, utilizing nuclear energy, for considerably less," Colonel Sutton said. "The final choice of location will involve political decisions as well as economic ones."

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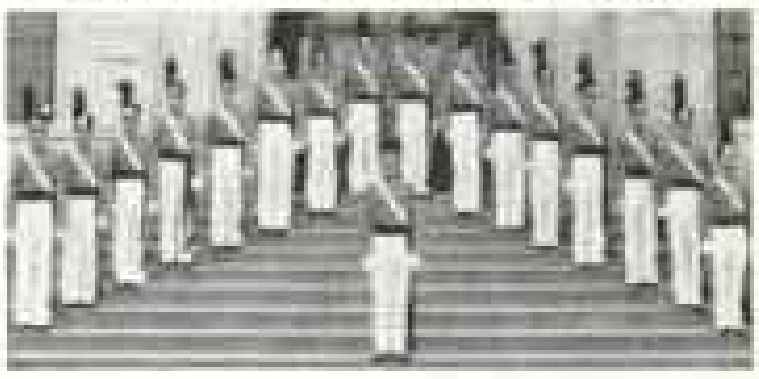

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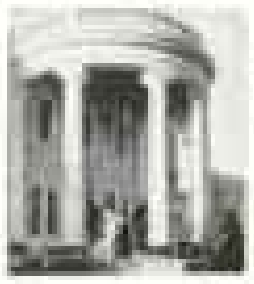

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