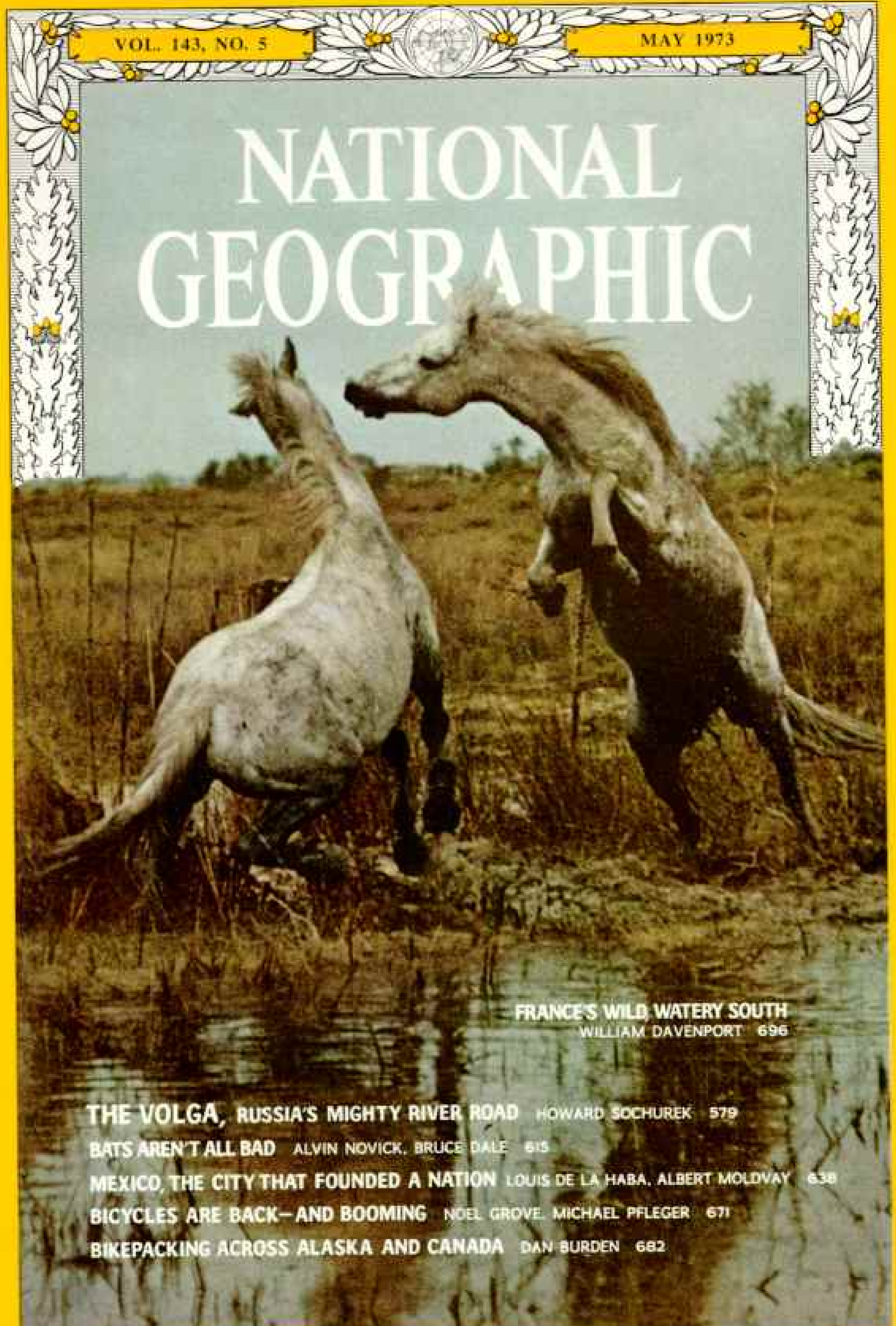
DOUBLE MAP SUPPLEMENT: MEXICO AND CENTRAL AMERICA



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

NATIONAL GEOGRAPHIC

May 1973

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 143, NO. 5 COPYRIGHT © 1973 BY NATIONAL GEOGRAPHIC SOCIETY, WASHINGTON, D.C. INTERNATIONAL COPYRIGHT SECURED

Russia's Mighty River Road

THE VOLGA

ARTICLE AND PHOTOGRAPHS BY HOWARD SOCHUREK

TO RUSSIANS the name means "holy," and the longest river in Europe has indeed been venerated by poet, priest, peasant, and musician. But they also call her Matushka, or Mother, Volga, for along her banks the Russian nation came to be. There the Soviet Union survived the holocaust of Nazi warfare. There it harbors the past, in a thousand dusty villages moving to the creak of a peasant's cart. And there it strives toward the future, in Space Age factories humming with power from seven of the world's largest hydroelectric projects.

"Yes, the Volga flows in the heart of every Russian," Benedict Vitalyevich Kisten said to me. The ship's youthful captain and I stood on the bridge of the sleek new river steamer he commands—the *Yuri Dolgorukiy,* named for the prince who founded Moscow. On each side a wide bow wave curled away as I began, on the busiest and most historic stretch of the famed 2,300-mile river, a three-month journey along it by ship, car, and plane.

"I was born beside the Volga," Captain Kisten said. "I have studied it all my life. It is a thing of size and strength, like Russia itself. Where the Kama joins it, the stream is 30 miles wide. The channel is sometimes 300 feet deep. But the important thing about the Volga is its power—its political power."

Inside the cabin he unfolded a large map and ran a finger from the far-northern White Sea down through the heart of modern Russia to seas named Caspian, Azov, and Black.

"This huge piece of a planet, all of it joined by a single river and its canals. A trade route between north and south since prehistoric times. Finns from the north, Turks and Slavs from the south and west, Mongols and Tatars

---

The author: Burly and quiet-spoken Howard Sochurek is one of the most experienced U. S. reporters covering the Soviet Union. He first went to Moscow in 1958. After two years as Time-Life's only correspondent there, he won a Nieman Fellowship to study Soviet affairs at Harvard University. This Volga trip was his thirteenth to Russia.

from the east—all seeking to hold the Volga, the great river road to conquest, to trade, to better lands."

The ship radio broke in, a metallic voice from shore: "This is Kazan Radio. Congratulations on Construction Workers Day to all aboard the *Yuri Dolgorukiy*."

Captain Kisten flipped a switch and replied: "And my congratulations to you. We are approaching your beautiful city."

"Your pier is number 114. Kazan off."

The captain resumed his thought.

"A famous date in Russian history, 1552. Ivan the Terrible defeated the Tatars and opened the way to Russian control of the Volga. From that event can be traced the beginnings of what is now the Soviet state. The battle was fought . . ." he pointed ahead toward the shore, "here at Kazan."

Dam Transforms Land of the Tatars

A gray haze had gathered over the river, heat and smoke from distant woodlands burning in Russia's hottest and driest summer in many years. Through the pall an indistinct form slowly took shape, like the figure of history itself—a huge wall topped by six towers, the Tatar defenses from Ivan's time.

The sight was like an old friend. Some years before, when I was a correspondent living in Moscow, I had traveled the meandering, still-free Volga, flowing between green lines of trees. I had grown fond of the medieval towns, the aged churches, the bucolic way of life along an old river still fresh and blue. The walls ahead were a part of that nostalgia, but as the haze cleared, I saw that they were among the few things left after a decade of strenuous development.

Around Kazan, nearly halfway down the river, the Tatar Autonomous Soviet Socialist Republic exists inside the Russian Soviet Federated Socialist Republic, one of 15 such

"The Volga is a good horse," a Russian proverb declares. "It will carry anything you put on it." And carry it does—more than 120 million tons of cargo a year. It also bears thousands of passengers on boats such as this high-speed hydrofoil passing the onion-dome towers of Yaroslavl, a 17th-century czarist capital. Path of conquest, culture, and commerce for centuries, the water highway through Russia's heartland is being transformed by 20th-century currents, yet flavorful old-time ways endure.

A changing Russia overlooks the Volga at every turn. Elaborately carved butterfly window adorns a village home. In cities beside the stream, contrasts abound. Rose-colored glasses, upswept hairdo, and brief swimsuit grace a comely medical student in Volgograd, whose earlier name—Stalingrad—was

major republics in the U.S.S.R. Some 1,100 square miles of its territory were flooded by the Kuybyshev Reservoir after a massive dam was completed in 1957, and Kazan, which had been two and a half miles inland, found itself on the brink of the river.

I saw that old log cabins along the waterfront had been swept away by bulldozers, and a modern pier, figured with huge cranes, had taken their place. Hydrofoils skimmed the waters, big and busy bugs ferrying passengers upstream to Gorkiy. Cream-colored high-rise buildings marked the skyline. And I knew that the entire river had been transformed into a series of vast lakes, the old shores swamped, the lines of trees drowned, and the current harnessed by the most ambitious dam and development project on earth. Moscow is now lighted by Volga power.

Thus I wasn't as surprised as I might have been to find and meet in Kazan a smiling black American surrounded by United States space vehicles, lasers, computers, and other paraphernalia of modern technology. His name was William B. Davis, and he was the manager of a U. S. Information Agency exhibit touring the Soviet Union as part of the cultural exchange program.

"We 'play' six cities with this exhibit," Bill told me. "Russians, like Americans, are fascinated by technology. We have lines a mile long, waiting two to three hours to get in. In the month we are here, about 400,000 people, nearly half of Kazan's population, will pass through the exhibit.

"But let me introduce you to the real stars of the show, Golnar and Ashraf."

Among the 23 Americans who accompanied

changed to "City of the Volga" in 1961. A river of tractors flows from a factory built there in 1929 under the U.S.S.R.'s first five-year development plan. Today the plant turns out 81,000 machines a year. And, with traffic a growing problem, posters caution city commuters about safety practices at trolley and bus stops.

the exhibit from the United States were two Tatar-speaking girls, Golnar Salah, a 24-year-old student at Queens College, New York, and Ashraf Alleavitch, who was born in Japan, married a Polish-American Moslem, and now lives in Hempstead, New York.

Russians Flock to Meet U. S. Tatars

"Kazan has been a Tatar city for centuries, as you know," Golnar told me. "But now the population is changing; there are many more Russians. When word got around that there were two Tatar girls from America at the exhibit—well, I spend all day answering questions about my personal life and how I live in New York. It's been very touching, really. One old lady came here from a remote village, a six-hour trip by train. She came in and clutched my hand and just held on.

"It was as if I were her own daughter and she wanted to feel I was doing well in America. Today one woman half-scolded me, 'I hope you are going to marry a good Tatar boy!' I told her I would try to find one."

One evening two other guides were invited out to dinner. Their host and his wife were elderly pensioners who lived in a two-room log house. They served dried fish and cucumbers. But what may have been lacking in elegance was more than compensated for by the warmth and affection with which the elderly couple greeted their visitors. One of the Americans had a Polaroid camera along, and when the first pictures were produced, they were greeted with amazement.

"A miracle, a miracle," said the old man. His wife, her voice marked with pride, said, "To have such a visit!"

Men who work with their hands talk with their hands. This carpenter in Gorodnya proudly describes his craftsmanship in building sturdy houses. The

vegetable-storage shed behind him protects his homegrown produce through winters so cold that the Volga usually freezes for months along much of its course.

The U.S.S.R., like many other countries that embrace a variety of peoples and cultures, seeks a balance between national unity and preservation of minorities. The Tatar peoples have their own national theater, opera, and ballet, and read Tatar-language newspapers. The Russian-language schools in the Tatar Autonomous Republic are bilingual. Tatars learn their own language in 1,500 ten-year schools.

With advancing modernization in cities like Kazan, the two cultures steadily grow closer. But Mr. Pismin Fedor, administrator of a Christian church in Kazan, expressed some doubts about the future. "There were dozens of active churches here," he told me, "but the trend is more and more away from religion. If that happens, it will be a shame.

"We are one of the largest ethnic minorities in the Soviet Union—Volga Tatars along the middle course of the river, Kasimov Tatars, Mishar Tatars, and smaller groups, five million altogether. Before the Revolution, most were Moslem but many were Christian, depending upon whom their ancestors first encountered. We are all descended from the warriors of the Golden Horde, who came here in the 13th century. We were ruled by a khan until the 16th century; the khan's family ended up as part of the Russian nobility, and that nobility ceased to be."

Father Sounds an Age-old Theme

As the *Yuri Dolgorukiy* headed downriver on the eight-day passage from Kazan to Volgograd, I watched the banks slip by and thought of two Kazan students who had been raised on the river and had gone on to shake the world—novelist Leo Tolstoy and revolutionary V. I. Lenin. I passed the thought along to a Russian gentleman who had joined me at the rail. He shook his head in the way of parents since time immemorial.

"I wish my own boy would turn out to be a Tolstoy or a Lenin, but I'm worried about him. He left school. He sings in a jazz band in Leningrad. His hair is that long. He has a beard. But he is 22, and what can you do? Someday he will regret not having followed a stable, acceptable profession."

Thus social and cultural currents common to the rest of the world affect Russia as well. Exchanges are welcomed. My cruise ship, built in East Germany, held about 150 French and 90 Russian tourists. We spent hours watching the Olympic Games telecast by Eurovision from Munich, where the Russian teams were doing well. When the games were over, so was the outside programming.

We stopped one afternoon at a sandy beach near the Kuybyshev power station, and a group of French passengers went swimming. One did not return. The ship delayed its departure for an hour, two hours. At dark, Russian divers went into the river. It was about noon on the following day when I heard the soft weeping of a woman and saw the divers taking the drowned man from the cold Volga.

"We Care for One Another"

"My people have been diving the whole night to find him," said Galya Smirnova. An attractive redhead, Galya managed the ship's boutique, but it was a summer job only, taken to polish up her French and English before she returned to her studies in Gorkiy.

"Foreigners are not allowed in Gorkiy," she said, "because of the military and industrial installations there. So I seldom see them. I like them, as a rule. But sometimes not."

She motioned to a group of tourists frolicking in the same Volga waters that had claimed their companion.

"They do not seem concerned," she said. "I will tell you something. We Russians care for one another. There have been many good changes in Russia, but there are still shortages. Millions of new apartments have been built, and even though the quality may not be as high as we would wish, that is an achievement. Many frustrations and disappointments, but we go on and try to succeed because we care for one another. My beloved people, I could never leave them."

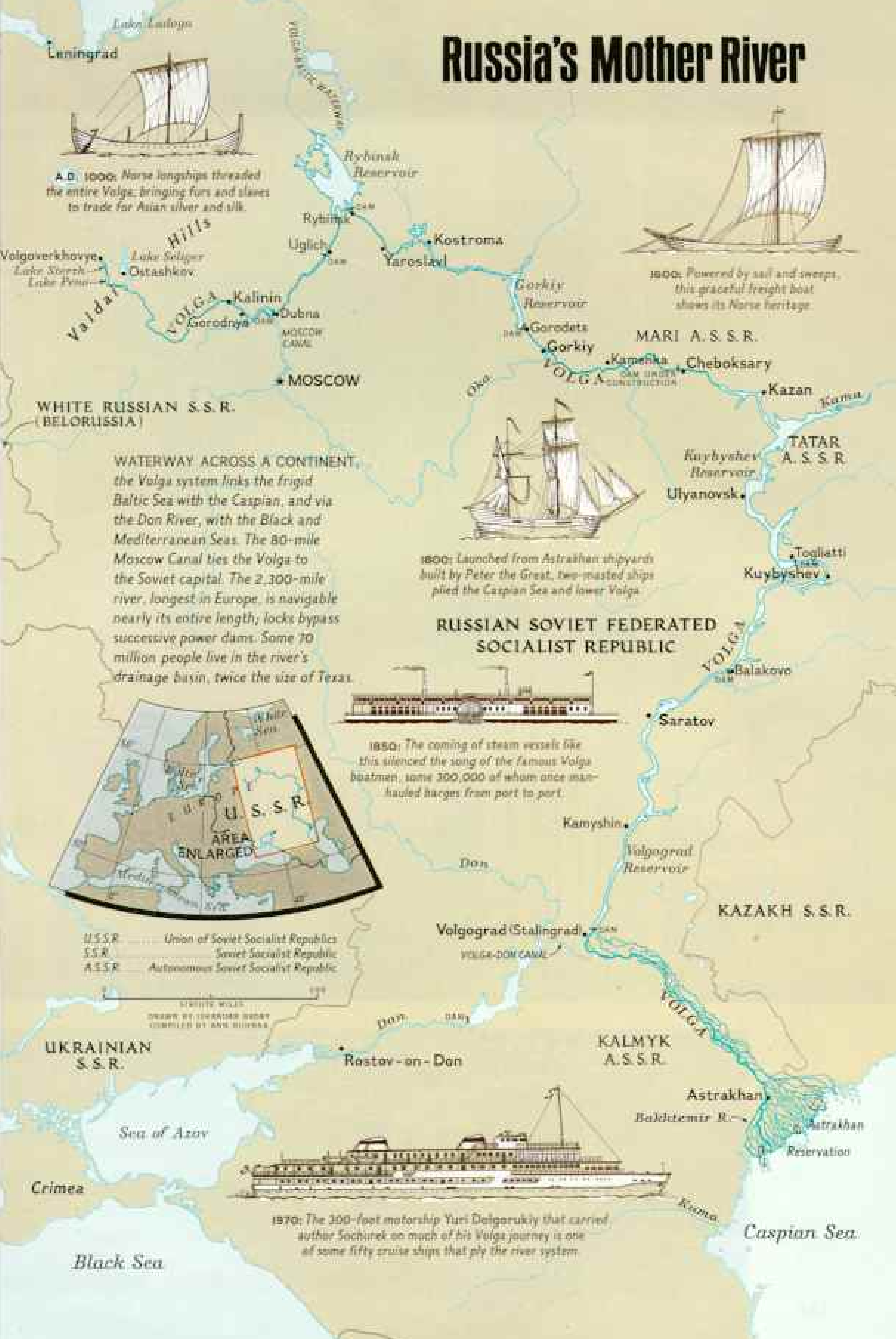
Silenced by the strength of her sudden emotion, we remained at the rail. It is a moot point, I thought, whether the French make too little of death or the Russians too much. I tried to change the subject.

"I have noticed fires burning in the fields."

"There has been no rain all summer," Galya replied. "The crops are failing. This will be a bad year. In czarist times, many thousands would have died, but we will make it through."

Humble Classroom Now a Shrine

The writer Maxim Gorky once described the Volga waters as being conscious of their invincible power. Certain it is that the land of the Volga gave birth to one of this century's most sweeping political currents. On the farmlands and in the hamlets of this wide region,



Russia's Mother River
Lake Ladoga
Leningrad
VOLGA-BALTIC WATERWAY
A.D. 1000: Norse longships threaded the entire Volga, bringing furs and slaves to trade for Asian silver and silk.
Rybinsk Reservoir
Rybinsk
DAM
Uglich
Kostroma
Yaroslavl
Valdai Hills
Volgoverkhovye
Lake Seliger
Lake Sterzh
Lake Peno
Ostashkov
VOLGA
Kalinin
Dubna
Gorodnya
MOSCOW CANAL
MOSCOW
1600: Powered by sail and sweeps, this graceful freight boat shows its Norse heritage.
Gorkiy Reservoir
Gorodets
Gorkiy
MARI A.S.S.R.
Kamenka
DAM UNDER CONSTRUCTION
Cheboksary
Kazan
Kama
Oka
WHITE RUSSIAN S.S.R. (BELORUSSIA)
TATAR A.S.S.R.
Kuybyshev Reservoir
Ulyanovsk
WATERWAY ACROSS A CONTINENT, the Volga system links the frigid Baltic Sea with the Caspian, and via the Don River, with the Black and Mediterranean Seas. The 80-mile Moscow Canal ties the Volga to the Soviet capital. The 2,300-mile river, longest in Europe, is navigable nearly its entire length; locks bypass successive power dams. Some 70 million people live in the river's drainage basin, twice the size of Texas.
1800: Launched from Astrakhan shipyards built by Peter the Great, two-masted ships plied the Caspian Sea and lower Volga.
Togliatti
Kuybyshev
RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC
Balakovo
Saratov
White Sea
EUROPE
U.S.S.R.
AREA ENLARGED
1850: The coming of steam vessels like this silenced the song of the famous Volga boatmen, some 300,000 of whom once man-hauled barges from port to port.
Kamyshin
Volgograd Reservoir
Don
KAZAKH S.S.R.
Volgograd (Stalingrad)
VOLGA-DON CANAL
U.S.S.R. Union of Soviet Socialist Republics
S.S.R. Soviet Socialist Republic
A.S.S.R. Autonomous Soviet Socialist Republic
STATUTE MILES
Don
DAM
UKRAINIAN S.S.R.
Rostov-on-Don
KALMYK A.S.S.R.
Astrakhan
Bakhtemir R.
Astrakhan Reservation
Sea of Azov
Crimea
Kuma
Caspian Sea
1970: The 300-foot motorship Yuri Dolgorukiy that carried author Sochurek on much of his Volga journey is one of some fifty cruise ships that ply the river system.
Black Sea

the yoke of an aloof, aristocratic czarist government must have seemed especially heavy. And it was this region that gave birth to the man who made one of history's most decisive changes.

His memorials speak eloquently for themselves—a plain seventh-grade classroom where he studied as a boy, the middle-class home where he was born, and the more elegant house where he later lived. The town then, in the late 19th century, was called Simbirsk. The Volga flowed past it, through what writer Nikolai Karamzin called "some of the loveliest landscapes in Europe." Life, too, seemed serene for young Vladimir Ilyich Ulyanov—at least on the surface. His father was director of the schools; their home had a piano, a chessboard ready for play, maps of Europe to fire the young imagination, a handsome wall clock keeping the hours of a comfortable middle-class existence.

But talk of social justice and politics led from the parlor to the streets. Vladimir's elder brother Alexander participated in a plot to assassinate Czar Alexander III, and was captured and hanged. By 1901 Vladimir Ulyanov had made a name as a revolutionary writer of power; he had been expelled from law school in Kazan for participating in a student demonstration; he had been exiled to Siberia, after being jailed for revolutionary activity and smuggling writings from prison. In that year he assumed a new identity, signing one of his documents with the name that has the sound of thunder across Russia—Lenin.

Millions Come to Visit Shrines of Lenin's Boyhood

Today old Simbirsk has become Ulyanovsk, and Lenin's humble scene of childhood and youth has been monumentalized with a huge surrounding marble structure (page 597). It is Russia's most important shrine except for the tombs in Moscow's Red Square. Each year a million tourists visit the site, standing in long lines for a glimpse into the well-preserved houses.

I was wandering in the square around the memorial one afternoon, waiting for an exhibit to open. My eye was taken with the clean, modern lines of a technical institute that frames the square on one side—but even more with an old-fashioned cart from which vendors were dispensing kvass, Russia's traditional summer drink. A light fermented beverage, it comes at three kopecks (3.6 cents) a glass. There is usually a line at a kvass stand, since the vendor has to wash and rinse his few glasses for each new group of customers.

I set up a tripod and framed the cart with its barrel and its rustic angles against the marble-and-glass wall of the imposing building behind it. Through the viewfinder I watched as a tall, handsome captain of militia detached himself from the line and strode briskly toward me. Every correspondent in Russia sooner or later has an experience

(Continued on page 594)

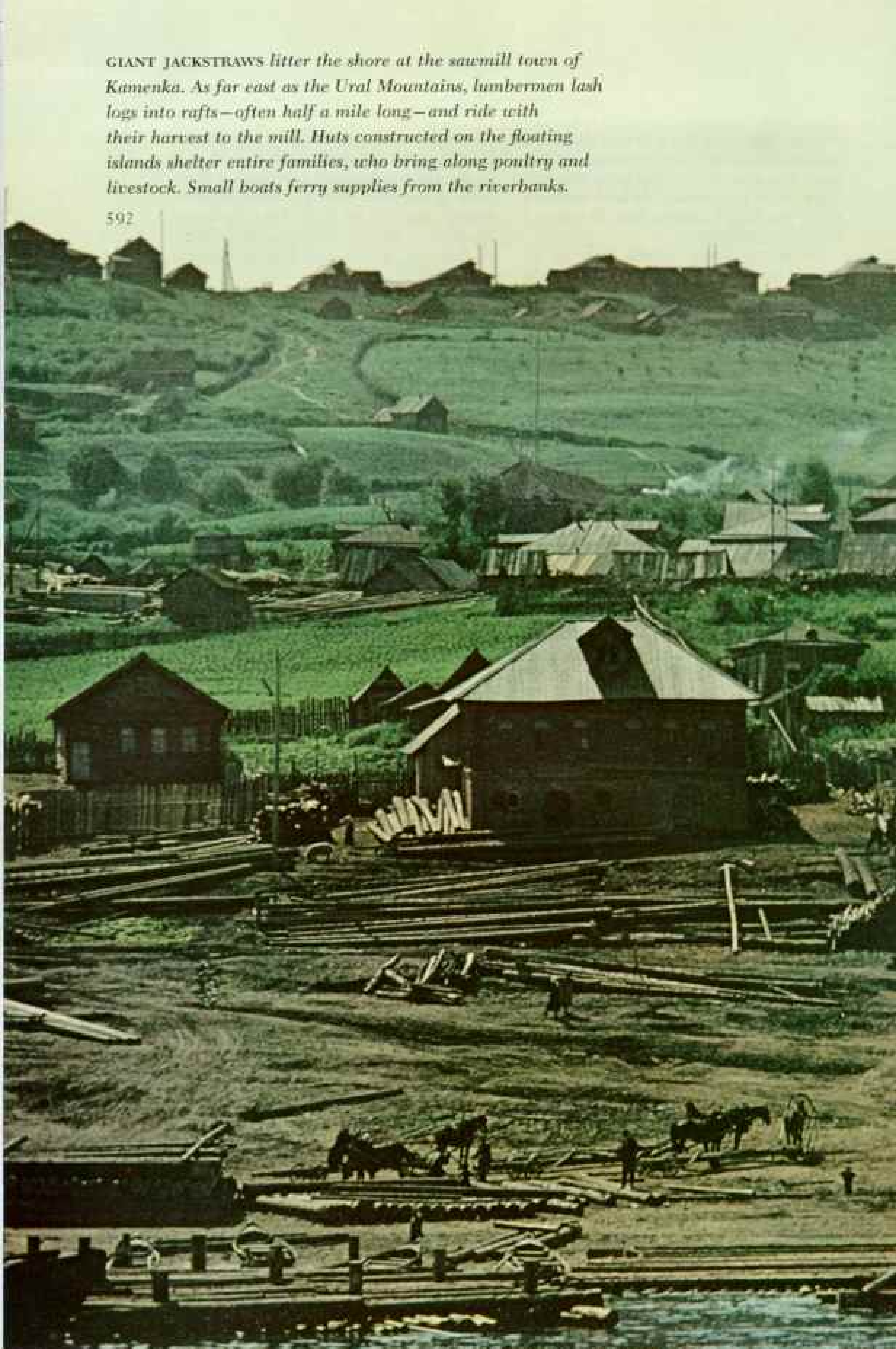
Their catch hung up to dry, vacationing Russians settle down to a game of cards at a tourist center (**upper**) on Lake Seliger. Growing amounts of leisure time, plus holiday rewards for increased production, send Soviet workers streaming to such resorts. Vacationists at Seliger pay only $2.50 a day.

Mass-produced rowboats, runabouts, and cruisers bob at a marina in Yaroslavl (**left**). These craft sell from $480 to $3,000; Russian workers, who earn an average monthly salary of $165, can nonetheless save enough for one, thanks to extraordinarily low living costs. But most boats belong to state-subsidized sports clubs and cooperatives.

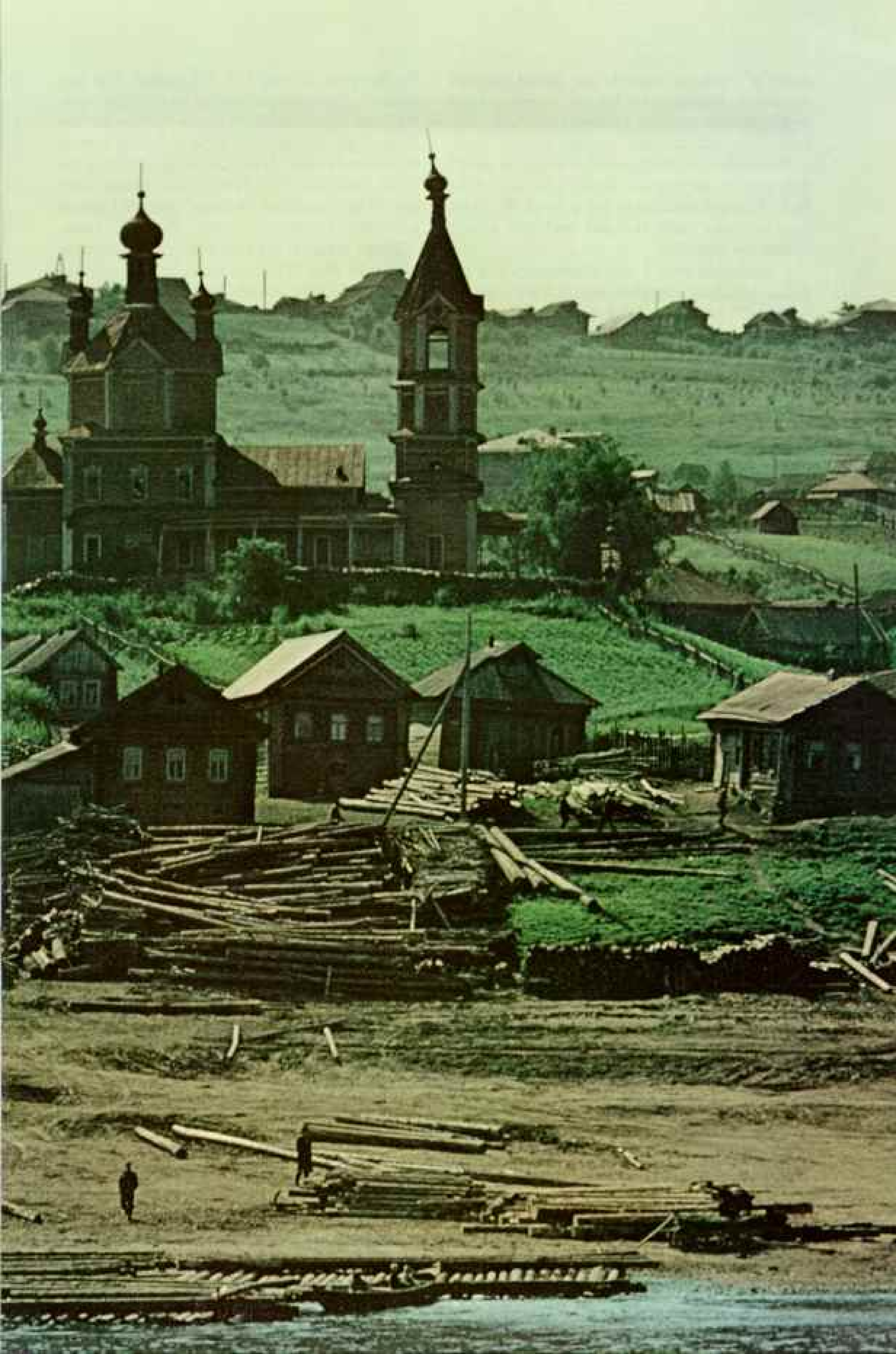
Pulse of progress beats slowly in a thousand small villages along the river's banks. The postmistress of Gorodnya (**upper left**) both sorts and delivers mail to customers she calls by their first names. In the local savings bank (**lower left**), a clerk still does her calculations by clacking abacus, preferring it to a modern adding machine

nearby. Although horse-drawn carts are seen less frequently, they continue to prove their dependability on muddy backcountry lanes. Here a schoolboy (**below**) hitches a tow from a cart coming from Gorodnya's collective potato farm.

Under the Soviet system, most of the arable land has been put together into collectives, where the farmers jointly husband the land and share in the harvest and profits. Other large farms are state-run "factories in the fields" that pay hired hands a regular wage. To offset the hardship faced by collective farmers in the years of low production, the government now guarantees an income.



GIANT JACKSTRAWS *litter the shore at the sawmill town of Kamenka. As far east as the Ural Mountains, lumbermen lash logs into rafts—often half a mile long—and ride with their harvest to the mill. Huts constructed on the floating islands shelter entire families, who bring along poultry and livestock. Small boats ferry supplies from the riverbanks.*



with a vigilant citizen, on guard against intruding foreigners who see nothing good in the Soviet system. I knew that such vigilance was coming my way at a rapid pace.

He addressed me in curt, somewhat angry Russian. "I see you are taking a picture of the line of people waiting to get a drink. Why are you showing only the old and bad things about my country?"

I explained that I was photographing the entire building complex, not just the cart.

"Nyet," he said. "I have recently read an article in the paper about foreign correspondents who write nothing but negative things about Russia." At that point, my government escort joined us and explained my journey to the militiaman. Only partially satisfied, he started back to the stand, paused, then continued on—an exceedingly vigilant man.

Pivot of War at Stalingrad

Just as the Russia of the czars took root along the Volga, and the Soviet Union of Lenin sprang from the same soil, so the greatest test of survival for that new society came at the Volga city known for 336 years as Tsaritsyn, for 36 years as Stalingrad, and for the past 12 years as Volgograd. The city sprawls along the high west bank of the river for almost 40 miles. Just to the south the Volga-Don Canal links two of Russia's most important rivers. A shipbuilding yard, tractor plant, and sawmills blend their smoke with that of the huge Red October Steel Mill (pages 602-603). Thirty years ago, all lay in ruins.

From August 1942 to February 1943, one of World War II's most ferocious, costly, and decisive battles raged along the riverbank and throughout the heart of the city. When Field Marshal Friedrich Paulus surrendered the broken remnant of his forces on January 31, 1943, Adolf Hitler had lost a fourth of his entire army. Nazi hope of conquering Russia was crushed forever.

Today there are few tangible reminders of that epic conflict. A plaque marks Paulus's basement headquarters, part of the Univermag department store. There is a war museum on Communist Street with a scroll in the lobby commemorating the gallant defenders, whose "glorious victory stemmed the tide of invasion and marked the turning point in the war of the Allied Nations against the forces of aggression." It is dated May 17, 1944,

Swinging her baton and switching her ponytail, a traffic girl keeps order along a busy main street of Volgograd.

Gateway of empire, hub of commerce: Kazan, its square now busy with 20th-century traffic, fell to Ivan the Terrible in 1552, ending the reign of the Tatar Golden Horde. Within five years the entire Volga came under Russian

and it is signed "Franklin D. Roosevelt."

I visited the museum with a survivor of the battle, 72-year-old retired Col. Alexander Yemilyanovich Serkov (page 604). We examined a photograph of a group of soldiers wrapped in heavy coats, standing in the snow. Then he pointed to a single portrait and said, "That commander of 42 years of age, the man there with the crippled left arm, is myself.

"I commanded Bogunsky Company No. 61. Our position was on the bank where the steel plant was. The city was totally destroyed, all rubble. Behind us was the Volga, but there was no crossing it. We would stand or die.

"The German S.S. Company 95 was 300 feet to our front. It was all hand-to-hand combat. Their losses were fantastic. A company would fight a week, and what was left of it would be pulled out and another put in. Often they lost 100 men in one night's action.

"It went on that way in the rubble and snow for month after month, until there was nothing left standing and hardly anyone left alive. A city of 445,000 people before the war had only 43,000 civilian inhabitants at the battle's end. And the Germans—their entire Sixth Army was annihilated. More than 800,000 men of both sides were killed in less than six months. We couldn't find many of the bodies until the spring thaw."

We walked out into the haze and the old man studied the distant terrain, as though he had not been a part of it. "All told," he said, "Hitler's invasion cost 20 million Russian lives. In Belorussia, every second family was wiped out.

"Before the battle of Stalingrad I was at Leningrad," he said. "In the fighting there, with Company 62 of the Eighth Army, I took shrapnel in my head and left arm and was in a bad way. My left arm was all but useless, but they treated me in a hospital and sent me home to my wife and my two sons in Leningrad. But I came home to find them dead."

"Killed in the fighting?" I asked.

"No, they died of starvation."

A German Survivor Returns

As has happened more than once in a peripatetic life, fate provided me with an irony. The *Dolgorukiy* had stopped at an island in the river, as it often did, for a day of hiking and picnicking. The island was uninhabited, and I welcomed the solitude and the

control, and a century later the czar's empire extended 4,000 miles to the Pacific.

Today 37 percent of the city's 900,000 population claim Tatar ancestry, and the Soviet Union respects their culture, including language, ballet, opera, theater, and literature.

Busiest freight port on the river, Kazan handles oil from the rich Volga-Ural fields, aircraft, engines, compressors and other heavy machinery, medical supplies, and film.

opportunity to wander along the beach shaded by fir trees. There I came upon a party of people sitting on the sand around a large wood fire. The scent of simmering *ukha*, the famous fish soup of the Volga, wafted from a large pot.

They were East Germans on vacation. I fell into conversation with a small, balding man in his late sixties. I asked if this was his first trip to Russia.

"No," he said, "I have been here before." He seemed somewhat evasive, and when his wife said in a thickly accented English, "during the war," he shook his head and made figures in the sand with a small stick.

"Yes," he said finally, "during the war. I was at Stalingrad. A corporal in the Sixth Army. One of 91,000 Germans captured there. I was taken with 12,000 others to a detention camp at Vorkuta. The camp produced coal—10 million tons a year. The war was still on, and life was hard. Oat porridge and bread twice a day at 4 a.m. and 9 p.m."

He looked at the brimming bowl of ukha his wife set in front of him.

"I became a Communist, and eventually returned to Leipzig. I was in my early thirties when I left Germany, and I was an old man of 43 when I returned."

The Volga flowed on by the beach. I wondered if Colonel Serkov was, at that moment, also watching its ever-moving current.

Journey to the Headwaters

It was time for me to say good-bye to the crew of the *Dolgorukiy*, leave the river, and return to Moscow to negotiate permission to travel farther. Until now, the headwaters region had been closed to travel because of a disastrous drought and the danger of fires in that heavily timbered area.

After I had waited and worried a while in Moscow, the permissions came through. A new official guide and interpreter, Valentin Provednikov, picked me up at two o'clock one afternoon, and by eight o'clock that night

COURTESY LENIN MUSEUM, ULYANOVSK

Father of the Russian Revolution, Vladimir Ilyich Lenin addresses massed factory workers in a painting that now hangs in Ulyanovsk, his birthplace. The city adopted the revolutionary's real surname, Ulyanov, in 1924. Lenin was one of many aliases used to mask his identity and protect his family from czarist agents.

we were in Ostashkov, not far from where the river is born.

The river rises in the Valdai Hills (map, page 587), a lake-studded area similar to the lake districts of Minnesota and Wisconsin. Finding the headwaters of the Volga in that wide sweep of forest and lake, each connected by stream or rivulet, seems to be an arbitrary exercise. The state places the source to the west of Ostashkov at a place called Volgoverkhovye. From there a small creek trickles down into Lake Sterzh. To the east lies another lake, Seliger, 45 miles long, whose outflow forms another tributary of the Volga.

Valentin and I took a hydrofoil across Lake Seliger to visit one of the half-dozen tourist bases that repose in the fresh and quiet forest along the shore.

Tourist Base Seliger, where we stopped, was modest but clean, two hotel-like buildings and a hundred summer houses spread over ten acres of woods. One would expect in a similar place in Wisconsin to find families vacationing together. Tourist Base Seliger, however, was filled with *Stakhanovites*, outstanding workers who had traveled there individually. In the Soviet Union, both husband and wife are usually employed; it is often difficult to make schedules coincide. So vacations are sometimes taken separately.

I chatted with several vacationists who were drying small salted fish (pages 588-9) they would later eat with beer.

"A factory is allotted places at a tourist base like Seliger," one explained. "If a worker does a good job, he or she is selected by the union to receive a *putyovka*, a coupon entitling the worker to a stay at a tourist base. Then you come, for three or four weeks."

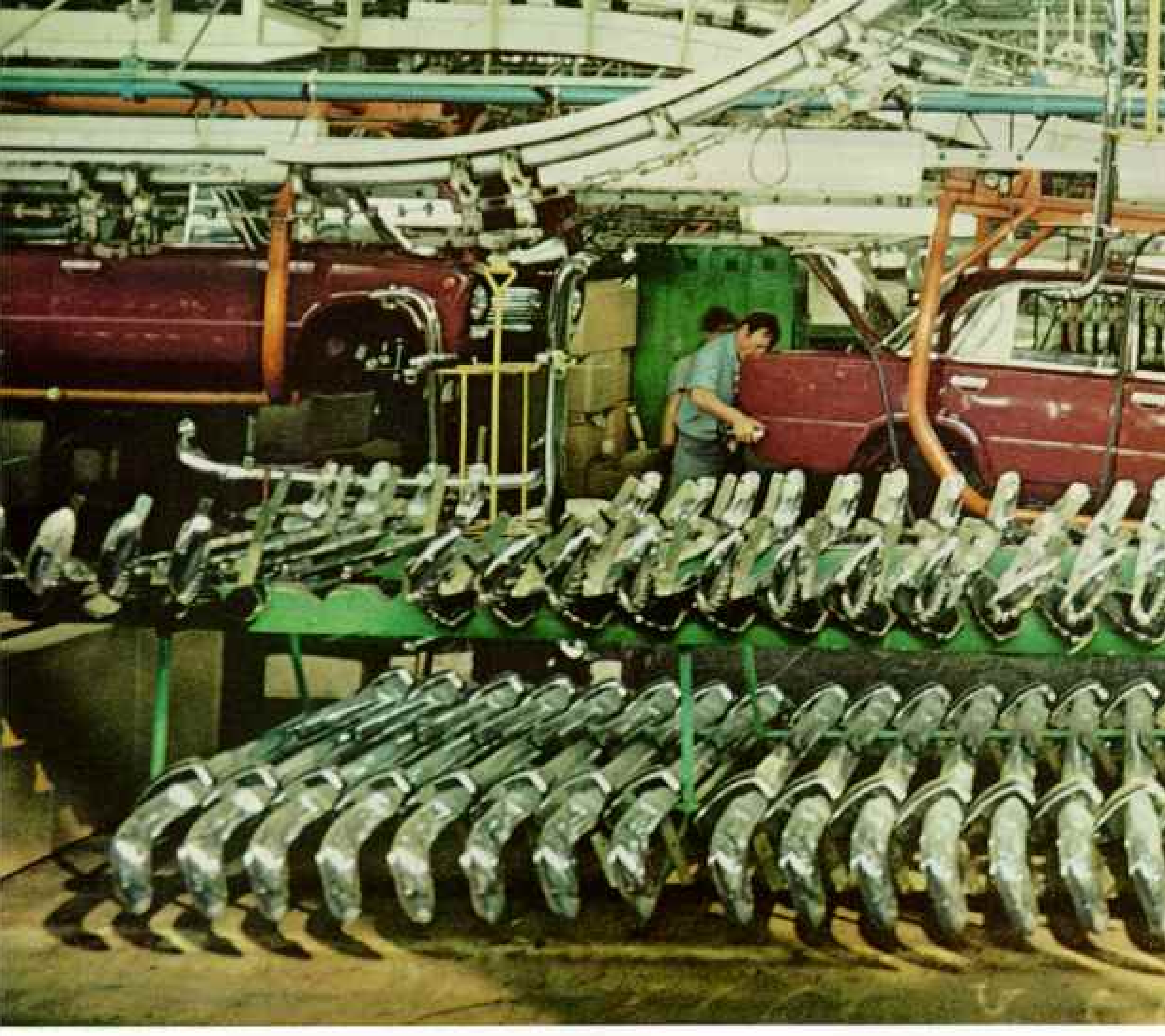
The manager of the base, Nikolai Ivanovich Soykin, told me that reservations are booked as much as a year in advance. What does it cost? A mere $2.50 per day, including food, lodging, boats, guides.

"Those who like can hunt wild pig and

"Build no memorials to him . . . he placed no store in such things," pleaded Lenin's widow. Yet no country can ignore a man who so dramatically changes its course in history. Ulyanovsk preserves his boyhood home, flanked by symbolic statuary and a memorial complex with a school and museum.

Radiant newlyweds, 18-year-old Svetlana and 22-year-old Vitaly now share life as they do a profession; both are jugglers in the circus at Ulyanovsk. They pledged their wedding vows in a brief civil ceremony. Thereafter, in a new nuptial custom, the couple set off to pay their respects at a memorial to the Russian Revolution—in this case, Ulyanovsk's riverside statue of Lenin. Rented taxis broadcast the presence of newlywed passengers with bridal dolls (**above**) affixed by friends.

Though only civil ceremonies are legally binding, couples who choose may also be married in a church. Finding a place to live may be a problem, despite the fact that the U.S.S.R. constructed more than two million new apartments in 1971. But if one turns up, the rent—a mere 4 to 5 percent of income—is one of the lowest in the world.



moose," Mr. Soykin said. "But not the bears. All our bears are tagged and protected."

I would have liked to drift on Seliger for a week with the happy Stakhanovites and contented bears, but my visa time was running short and I still had much of the Volga to explore. Before I left the lake district, though, I gathered one more memory. Valentin and I had taken a boat out on Lake Peno, with a man named Yuri from a nearby village. We came upon a photogenic old church and a nearby field where two babushkas, grandmotherly women, were harvesting potatoes. I asked to stop.

Church Saved From Rising Waters

"Who's interested in a ramshackle old church?" Yuri asked. Nonetheless, he yielded to the mixed-up foreigner and pulled ashore.

Karl Marx, in one of history's most famous phrases, once described religion as "the opium of the people." The Soviet Union prides itself on being free from the superstitions of the past. At the same time, it displays a regard for many old churches as works of historic and architectural importance. Millions of rubles have been spent on restoration of such national monuments. Near the Kuybyshev dam, for example, engineers went to great lengths to build a dike to protect a church from the rising waters.

Some churches of czarist Russia, however, that have neither congregations nor architectural distinction, have slowly declined toward oblivion. I found the church before me in such disrepair. Trees grew from the roof. The interior had been vandalized. Obscene graffiti despoiled pillars once painted gold, and in what had been the aisle the villagers had piled a large mound of peat moss for winter fires. I moved around it

(Continued on page 606)

From bumpers to borsch, everything moves by assembly line in the new city of Togliatti. A three-year-old plant produces a compact car called the Zhiguli, for which auto-eager Russians pay the equivalent of about $6,600. Not surprisingly, all three models resemble those manufactured by Italy's Fiat company, the prime contractor for the Soviet plant.

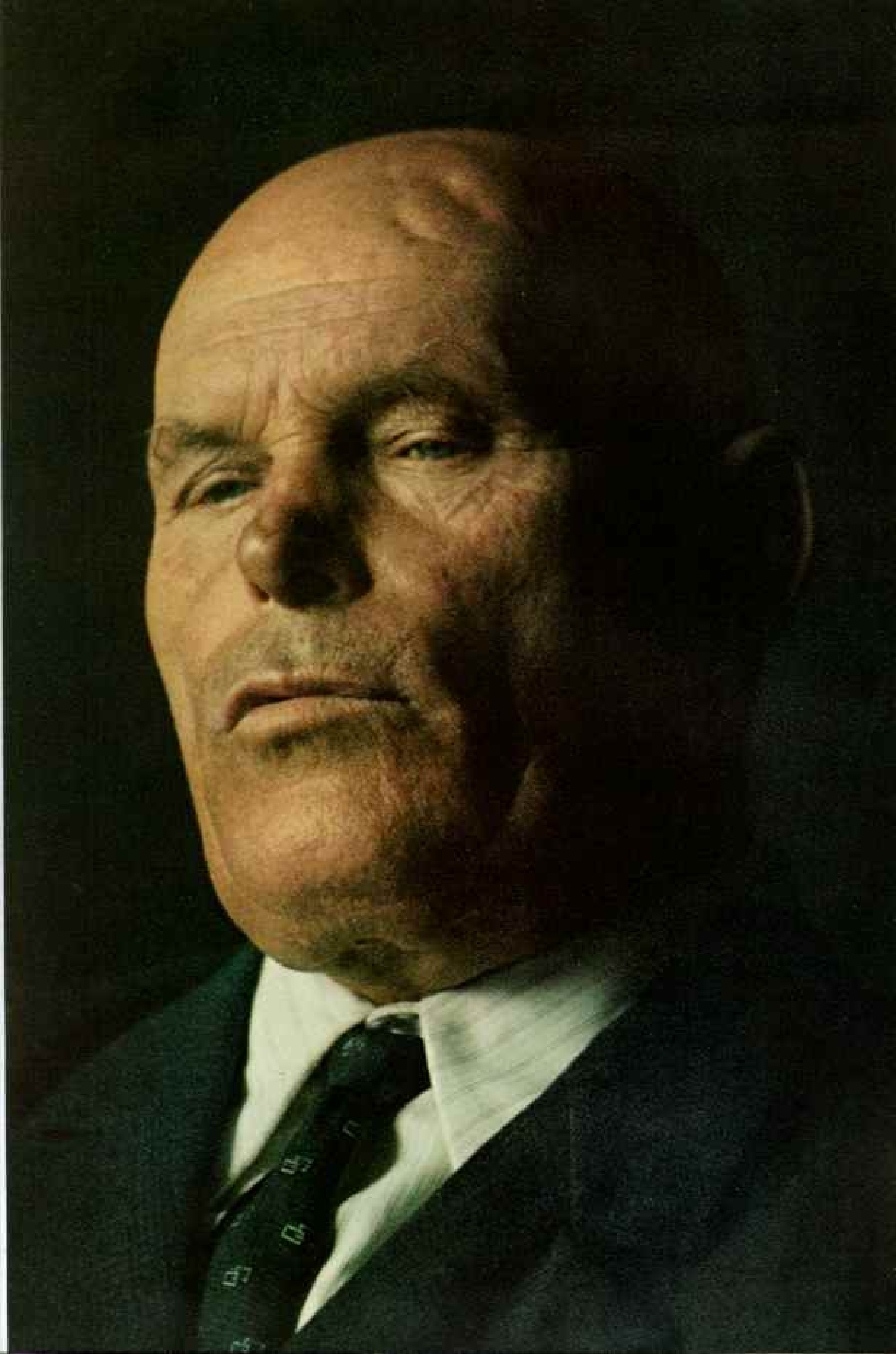
Conveyor belt in the plant's cafeteria (**right**) transports the main meal of the day to workers. They pay 40 kopecks, about 48 cents, for borsch, meat, potatoes, and coffee. Husbands and wives often work side by side on the lines, leaving their children in state-run day-care centers.

Amid production's din, Charles Statler, a Pennsylvania engineer, and Elvira Pokrovskaya, an English-language translator, communicate with shouts and gestures at the Togliatti auto factory. Statler and four other Americans supervised the installation of U. S.-made cylinder grinders in the factory.

Rare sight in today's world: Soviet determination to keep down pollution on the Volga makes swimming possible even beneath the smoking towers of this Volgograd factory. Some 15 cities and more than 400

industries along the river have been ordered to renew efforts to further cleanse these waters, beloved by Gorky and Pushkin.

The Red October Steel Mill rises on the site of some of the fiercest fighting during World War II's Battle of Stalingrad. One of Russia's largest factories, it helped the U.S.S.R. produce nearly 140 million tons of steel in 1972, surpassing the United States' output of 133 million tons.



Memorials in flesh and stone reflect the grim Russian determination that gained victory in the five-month Battle of Stalingrad. Retired Col. A. Y. Serkov, 72 (**left**), stood with his men, their backs to the river, only 300 feet from the Germans in one of the last-ditch efforts that turned the tide.

From Mamayev Hill (**right**), a major battle area, visitors look across a metropolis rebuilt except for skeletal remains of a flour mill (**above**), a shattered memorial of the siege that left 800,000 Russian and German troops dead. Each year thousands climb Mamayev. Many burst into tears in the presence of the heroic soldier in stone (**upper right**).

to the main altar. There, amid the debris and pigeon droppings, were two freshly picked bouquets of blue marsh flowers.

So it goes along the Volga—the age-old Russia of horse carts and icon worship giving way to giant dams, jet planes, and spanking-new cities like Togliatti. I was especially pleased when permission came to fly there, since no American journalist had ever seen the place.

Auto City Springs From Nowhere

It came as a shock. Ten years ago, when I first passed along that part of the middle river, there was only a swamp. Now a city of 340,000 spreads wide-paved streets. It will grow to 500,000 by 1975.

The city is named for the late Palmiro Togliatti, leader of the Italian Communist Party, and with good reason: Fiat of Italy was the prime contractor for its 800-million-dollar auto factory.

On the drive to the plant, I passed through busy streets lined with the white-tile facades of apartment houses. A cinema, the Saturn, was built in the shape of a flying saucer. After a nine-mile drive down a new boulevard, I arrived at the Volga Automobil Zavod.

A huge signboard in front of the administration building quotes the Soviet poet Mayakovsky: "I know a city will be, I know a garden will be in blossom, when we have such people in our Soviet country." It is not surprising that Soviet planners should be moved to sing, or even crow, about their achievement here. Ground was broken in October 1967; the first car rolled off the assembly line in August 1970. The plant now produces nearly 1,400 Zhiguli sedans and station wagons a day, employs 53,000 people, covers six square miles, and is still growing. By the end of 1973 it will build 660,000 cars a year. About half the production is exported—to other Communist countries and to Helsinki, Stockholm, Copenhagen, and other sources of hard currency. The rest go to Soviet motorists, in line with Premier Kosygin's promises to improve consumer goods and services.

Boris Alexeyevich Kozlovsky, assistant manager of the foreign department, took me around the factory. "We asked every Soviet embassy in the world to find the most modern machinery," he told us. "Then we bought it. Our equipment comes from more than a hundred companies in seven countries."

As we walked the mile-long assembly line (pages 600-602), he proved his point: "Those automatic welders are from Pennsylvania, and these big stamping machines from England. The conveyors are from Italy, the lathes from West Germany. And we brought in foreign technicians as well as machines—2,000 of them, including 15 Americans."

I remarked to Boris on the number of pretty young girls on the assembly line, and he told me, "More than half the workers are women, and the average age of all workers is 22."

In the cafeteria, he introduced me to one of these average pretty young workers, Nina Martinova, a welder. She told me she came from the town of Zaraysk, 80 miles from Moscow. The Komsomol (Communist youth organization) in her district had advertised openings at Togliatti, stating that a modern low-rent apartment was part of the employment contract. With her husband, who is also a welder in the plant, and their 3-year-old daughter, she moved two years ago, claimed the apartment, and went to work. Her monthly salary of 140 rubles is about average for Soviet workers.

With the apartment, Nina also gets a garden. Just outside the plant boundaries, each worker has a 300-square-foot piece of land. I noticed that most workers had planted flowers and vegetables.

Italian Outpost on the Volga

The Fiat experts responsible for plant supervision reside at the Zhiguli Hotel, and they have made it a Little Italy on the Volga. The hotel has an Italian chef to make pasta, an espresso coffee bar in the lobby, and a wine cellar full of Chianti. Italian TV tapes have been flown in from Rome for viewing on the lobby TV set. And an Italian priest is on hand to hear confession.

The Italian influence has naturally extended to car design. The Zhiguli four-door sedan (pages 600-601) strongly resembles the Fiat 124. I drove it on the five-mile loop where the *ispitatel*, the Russian test drivers, were barreling around curves and over deliberately hazardous hills at up to 80 mph.

All in all, the car seemed roadworthy, and certainly a value at the highly competitive export price of $1,200, about half that of the Fiat 124, the Toyota, or the Volkswagen. The domestic price to Soviet citizens, however, is far greater: 5,500 rubles, about $6,600, a neat profit for a Socialist system.

While autos burgeon on the Volga, the

famed state-owned caviar industry struggles against progress, pollution, and rising costs. South of Togliatti, I stopped at the Volgograd Sturgeon Hatchery.

"The total sturgeon catch dropped from 24,000 tons in 1938 to 13,500 tons in 1960," manager Alexei Lubyansky told me. "Naturally, the output of black caviar was affected. It was because of the power dams on the Volga, which block off the fish from their natural spawning grounds in the tributaries."

Sturgeon Struggle for Survival

The Soviet Government has opened 18 hatcheries, which produce some 50 million fingerlings a year (page 610). When the sturgeon are about 35 days old, they are released back into the river and its tributaries. Many perish, but since 1960 the catch of adult fish has been slowly growing. Still, not enough caviar is produced to meet demands.

Mr. Lubyansky showed me the ponds where tiny fish, weighing only a few ounces, darted away from our shadows.

"You wouldn't think it, but one of these fish may still be alive in the year 2072. I once saw a beluga that weighed 1,200 pounds and was at least 50 years old. We think today about the caviar, the eggs, but the flesh is also prized. In times gone by, the czar and the nobility had their Volga beluga shipped to Moscow; it took a month, by *troika* or *drozhky*. The fish were packed in wet hay and kept asleep with vodka, so the story goes. They arrived drunk but alive."

The Communists are taking even more trouble to keep the sturgeon, and the lucrative caviar industry, alive. The usual fine for poaching a sturgeon is 100 rubles (about $120), but recently a Volga dredge captain poached several and got a five-year jail sentence.

The Soviet Government has taken a no-nonsense approach to the entire problem of protecting the river and its fish from the dangers of pollution. It has decreed the expenditure of enormous sums of money in the next two years; 15 city governments along the river will spend 300 million rubles for sewers and water-treatment plants, while 421 industries, large and small, will allot 700 million rubles for antipollution facilities.

I went downriver to the delta city of Astrakhan, near the Volga's outlet to the Caspian Sea, to enjoy the fruits of this concern. A *prorezi*, a water-filled barge that

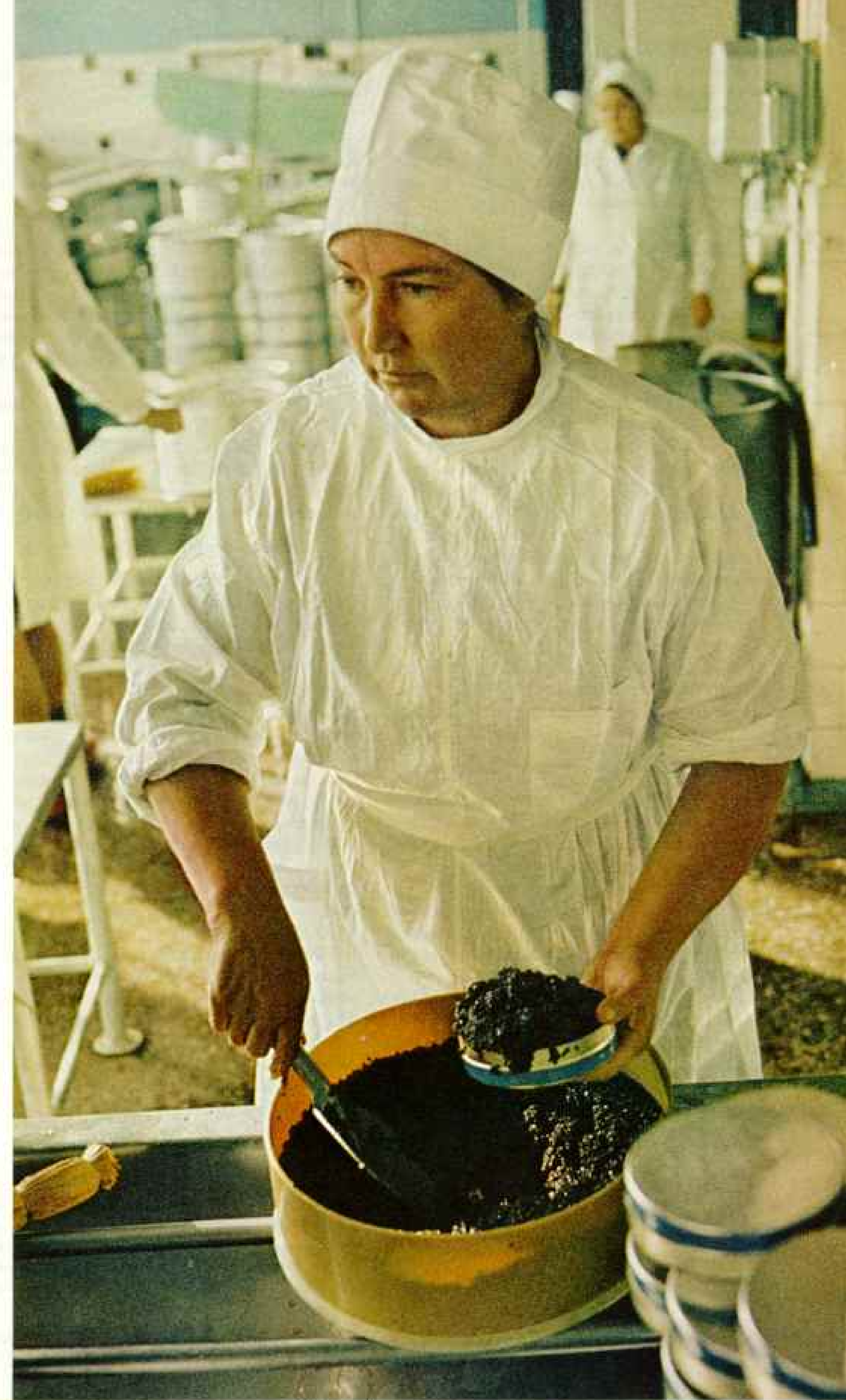
(Continued on page 612)

Woman's touch prevails in the Soviet Union's healing arts; some 80 percent of the country's doctors are women. In a land where free medical care is offered to every citizen, the demand for physicians is enormous. At the Volgograd State Medical Institute, these two girls are among the 3,500 physicians-in-training enrolled for six years of study.

Personal scales for private sales: Counters full of fresh flowers, fruits, and vegetables attract shoppers to a market near the Volgograd waterfront. Villagers allowed to cultivate small plots of their own sell the best of their produce here for premium prices. A

pound of tomatoes costs 25 kopecks; a ruble buys four apples, a pound of pork, or a bouquet of flowers. On the opposite side of the huge covered hall, the state-run market sells food at generally lower prices, but lacks the in-season selections of the backyard gardeners.

Caviar makes a comeback: When new dams blocked the Volga's caviar-laden sturgeon from their natural spawning areas, the Soviets built hatcheries to give nature—and the caviar industry—an assist. Amid an explosion of foam and fins, a hatchery worker in Volgograd (**above**) captures a male sturgeon whose milt will be used in breeding. Long-snouted fry (**below**) are nurtured for more than a month before being released. At maturity, a single female sturgeon can yield 50 pounds or more of fresh roe. The best grade brings close to $100 a pound in the U. S. In a plant at Astrakhan (**right**), a packer fills tins with the washed and salted delicacy, bound for gourmets around the world.



transports live fish, was tied up at the dock of a fish-canning and freezing company. As I watched, a crane hoisted a 350-pound sturgeon from the hold and swung it to the dock. A workman killed the huge fish with a mallet, and another sliced out 55 pounds of gray-black caviar—worth about $5,000 in the United States.

The canning factory's young director, Vittaly Mikhailovich Lushnikov, invited Valentin and me in for lunch. And what a lunch! Not only heaping platters of black caviar, but also the red caviar that comes from salmon. Hot fish soup and cold fish soup. Fish antipasto. Fresh sturgeon and smoked sturgeon. All the strange but delicious bounty of the Volga, handsome, fat fish with names like sazan, sudak, osetr, sterlet....

As I was yo-ho-heave-ho'ing away from the table, Mr. Lushnikov remarked: "This is a small sample of our products. We produce 90 million boxes of fish each year. We have 80 varieties of black caviar, each different: Caspian Ikra, Sol, Malosol, Balyk, all marketed by the agency Prodintorg."

I asked how long the caviar would keep if I took some home.

"You can buy it at home. But, please, treat it with care. Pasteurized caviar will keep for at least a year; unpasteurized, for six months, but it must be stored just above freezing."

Birds Rule a Watery Maze

Below Astrakhan, the flat delta region fans out into a land of startling contrast. Much of it is semidesert, below sea level. Through this dry region, the freshwater Volga spreads a maze of grassy waterways teeming with fish and fowl. Shortly after the Russian Revolution, Lenin set aside several large delta areas as the Astrakhan Reservation, one of the richest in birdlife in the U.S.S.R.

From the reservation base at Damchik, Valentin and I set out on a two-day trip with guide Stepan Stepanovich Kuzichenko. We traveled in a narrow, flat-bottomed boat pushed by an outboard motor. It was by now autumn, and a high east wind was blowing. Bundled in sheepskin coats, we made our way through a fabric woven of tiny streams, some no wider than four feet.

"We are on the flyway from Arctic Siberia to South Africa," Stepan said. "So we have lots of birds, about ten million, and more than 260 different kinds."

In this region the Volga's branches assume different names: Bakhtemir, Staraya or Old Volga, Bystraya. On the banks of the Bystraya we pitched camp and were joined by a twinkling Father Christmas figure: Alexander Andreanovich Nesterov, naturalist, taxidermist, and maker of the best ukha soup on the Volga (opposite).

As we sat around the campfire, Alexander recalled his 40 years on the reservation.

"Before the reserve was here," he said, "there were hardly any birds, believe it or not. They had been killed to obtain feathers for women's fashions. How times have changed!"

A Nation Striding Into the Present

As the fire burned down, I thought of the truth of his remark and recalled my long journey on the river, and my years as a correspondent in the Soviet Union. A country full of contradictions and energy, part of it comfortably caught in the past, part of it scrambling toward the future. The old, familiar attitudes: dying but stubborn religious orthodoxy, resignation and indifference to fate, generosity and hospitality in a stolid, strong peasantry attached to the land.

But there was the new side, too: The confident, shrewd leadership, the brilliant scientists saying anything is possible, and gambling and working and succeeding; the bright, energetic management class pushing industrialization ahead.

These new men and women of the Volga—harangued on one side, encouraged on the other—are making a new land that belongs as much to the Industrial Revolution as to the Russian Revolution. Being with them, one senses—as with the river itself—only powerful movement, far from both source and end. □

"How times have changed!" reminisces Alexander Andreanovich Nesterov, naturalist and taxidermist at the Astrakhan Reservation, a wildlife sanctuary in the Volga delta. Sixty years ago, he recalls, feather hunters had nearly emptied the sky of birds. Today, in an ecology-conscious era of strict conservation and antipollution laws, millions of migrating birds find a safe way-stop here as they commute between Asia and Africa. Thus, in one more way, change makes its mark along the Volga.

Bats Aren't All Bad

By ALVIN NOVICK, M.D.
Photographs by BRUCE DALE
NATIONAL GEOGRAPHIC PHOTOGRAPHER

THE SCIENTIST IN ME commanded "Go!" but the rest of me cried "Never!" I was standing there, naked, outside a long-abandoned gold mine in Panama's jungle. Inside, I knew, lived colonies of a common fruit bat and, I hoped, a rare spear-nosed bat.

A young biologist facing his first tropical cave, I wanted to capture several of the spearnoses to study their intriguing sonar system. Fallen dirt had partially dammed the cave's entrance, backing water into a lake three feet deep along the tunnel. Every morning for half a century hundreds of bats had flown back to this roost bearing morsels of fruit which they often dropped into the stagnant water, along with their guano. All this had brewed into a pungent mix the color and consistency of thin chocolate pudding.

Stripped except for a flashlight strapped to my head, I steeled myself to wade in. Finally I braved the morass, carrying net and cage. As I rounded the first bend, my light shone on the hanging bats. Startled, many took flight. In confusion and terror they became disoriented and crashed into the walls, the pudding, and me.

To a novice, indeed to anyone, a rain of dozens of bats smashing wildly into face and chest is alarming, and, as many might have done, I ducked. I found myself chin-deep in the soup and verging on nausea.

But science makes us rise to *(Continued on page 624)*

What flies with its hands, "sees" with its ears, and sleeps hanging by its toes? The much-maligned bat. These night-flying mammals often carry their young aloft. A days-old pup clings to a short-nosed fruit bat as she homes in on a meal of bananas. She maneuvers by sight, but most of her kind employ intricate sonar systems. Emitting a stream of beeps and interpreting the echoes as they rebound from obstacles, bats flit unerringly through forest and jungle. "By understanding how they do it," the author says, "we may learn how man's brain processes sensory information."

CYNOPTERUS SPHINX, 4 1/2 INCHES LONG; T. S. LAL, [illegible]

In pursuit of bats, Dr. Alvin Novick of Yale University explores caves and culverts, belfries and birds' nests—as well as attics. "I've fallen through ceilings around the world," says the 47-year-old physiologist, who studies how bats orient themselves by sound.

The scientist removes a moustache bat from a mist net (**below**), strung at the mouth of a cave in Jamaica where he makes frequent trips to capture animals for laboratory study. Inside another Jamaican cave (**below right**), he wields a net.

Bats broadcast most of their sonar pulses at frequencies too high for humans to hear. "It's a good thing we can't hear them," says Dr. Novick. "For example, I measured the pulses of a Malayan naked free-tailed bat—an animal about as big as a bluejay —at 145 decibels. That's comparable to the sound level of some jets at takeoff."

In an echo-absorbing chamber at Yale (**left**), Dr. Novick's associates implant electrodes into bats' brains, then "listen in" as the animals navigate with sonar.

Dr. Novick is also working on a "dictionary" of bat sonar. "No two sonars are the same among the world's 900 or so species," he says. "Some differences are slight—just as between automobiles with different horns. But other differences are enormous, like those between a car and an airplane."

Faces that only a bat could love

HYPSIGNATHUS MONSTROSUS, 11 INCHES; JACK W. BRADBURY

FORM FOLLOWS FUNCTION with flying mammals. The hippopotamus-like muzzle of the male hammerhead (**1**) gives resonance to bonks from a gigantic larynx that extends from throat to navel. Thus this African bat announces his location and availability to females. The slender bones supporting the wing membranes are actually elongated fingers, used like the ribs of an umbrella to open and close his wings. Big eyes and small ears—the reverse of most bats—identify the hammerhead as one of a group that navigate by sight.

In repose, the leaf-chinned bat (**2**) relaxes its lips into elaborate folds; in flight this sonar-guided bat spreads them like a megaphone to beam its pulses forward.

Most bats weigh an ounce or less, though a few equal the weight of a large squirrel. No heavier than a good-size moth, an Eastern pipistrelle (**3**) roosts on a rock. Molars of the big free-tailed bat (**4**) chomp insects to the consistency of soup to speed digestion in flight. All bats have voracious appetites. The big brown bat may devour as many as 1,000 insects in an hour.

The cave bat (**5**) likes it hot. A scientist found one colony roosting in an attic in Arizona in a temperature of 99° F.

A vampire bat (**6**) bares fanglike canine teeth, but

OPPOSITE PAGE FOLDS OUT

2 MORMOOPS MEGALOPHYLLA, 3 1/2 INCHES

3 PIPISTRELLUS SUBFLAVUS, 1 3/4 INCHES

the razor-sharp incisors between them open the shallow wounds necessary to secure its sustenance: about a tablespoonful of blood a day. This one-ounce creature, flying low to locate cattle, circles its prey for several minutes before landing to feed.

No vampires reside in Transylvania—Dracula's fictional haunt in central Rumania; all live in the New World tropics. And they are more timid than intimidating. "In captivity they're so shy," says the author, "that if I even swallow while near them, they stop feeding."

4 TADARIDA MACROTIS, 3 3/4 INCHES

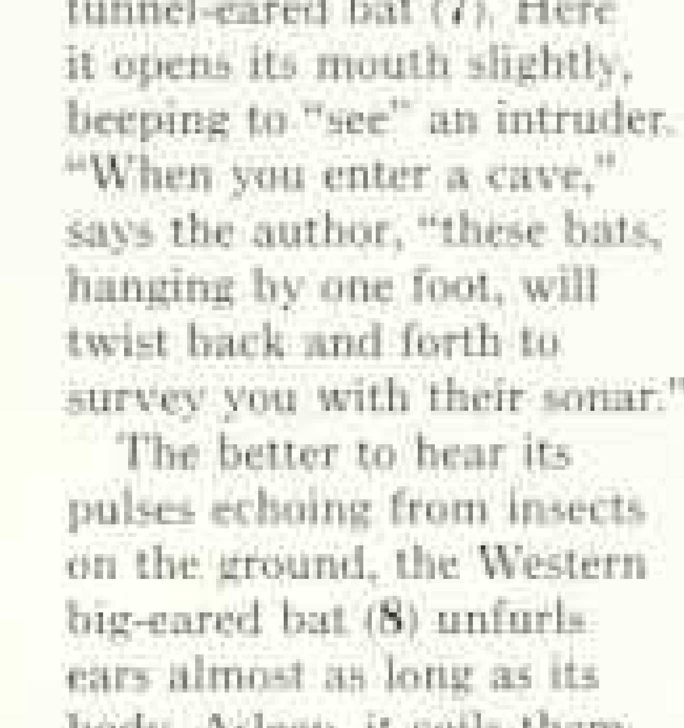
8 PLECOTUS TOWNSENDII, 2 1/2 INCHES

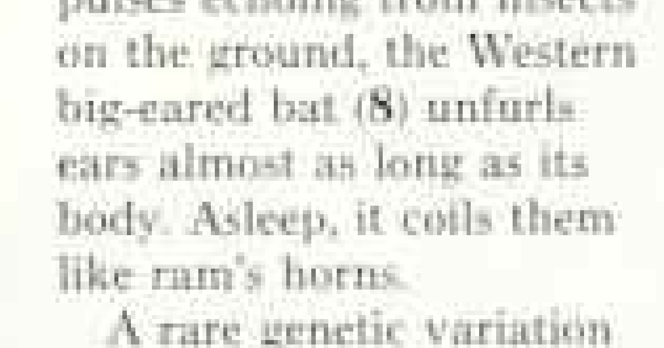
9 TADARIDA BRASILIENSIS MEXICANA, 2 1/4 INCHES

An elegant moustache adorns the upper lip of a funnel-eared bat (7). Here it opens its mouth slightly, beeping to "see" an intruder. "When you enter a cave," says the author, "these bats, hanging by one foot, will twist back and forth to survey you with their sonar."

The better to hear its pulses echoing from insects on the ground, the Western big-eared bat (8) unfurls ears almost as long as its body. Asleep, it coils them like ram's horns.

A rare genetic variation of the Mexican freetail (9) hangs amid normally colored roostmates in a Texas cave.



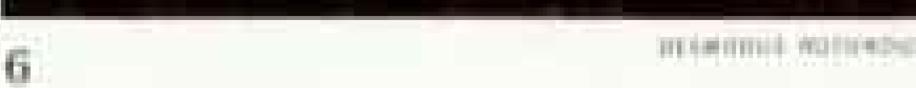


4 AND 7 BY BRUCE DALE; ALL OTHERS ON PAGES 619-20 BY ROBERT W. MITCHELL

5 MYOTIS VELIFER, 3 INCHES

6 DESMODUS ROTUNDUS, 3 INCHES

7 NATALUS MICROPUS, 1 1/2 INCHES



Angler on the wing, the fishing bat gaffs prey with talons. This nocturnal skimmer (**left**) of Central and South American rivers, bays, and lagoons will beam his sonar toward the water to detect the swirl of a fin or tail breaking the surface. One swoop produces a red swordtail for dinner (**below**). Reaching for altitude, the bat transfers the fish from his claw (**right**) to his mouth. Sharp teeth crunch the victim into pieces that are stored in cheek pouches and eaten later.

NOCTILIO LEPORINUS, 4 1/2 INCHES; PHOTOGRAPHED AT THE BRONX ZOO'S WORLD OF DARKNESS

(Continued from page 615)

many occasions. I downed my emotions, rose dripping from the gumbo, captured my quarry, and moved out swiftly. Under a nearby waterfall I rinsed myself for nearly an hour.

All this stemmed from an interest in bat sonar. The only mammals to have evolved true flight, most bats find their way to and from their roosts, locate and track their prey, detect water and orient toward its surface, avoid obstacles, and perhaps even monitor their altitude by literally evaluating sound.

They accomplish this by emitting intensely loud high-frequency, ultrabrief bursts of sound—and then interpreting the echoes. In this way they assess the distance, direction, movement, and possibly the nature of nearby objects that reflect sound. We scientists refer to this sonar system as echolocation, or acoustic orientation.

Detection range is not yet fully studied. It appears to vary from one or two feet to several yards, depending on the species of bat, size of target, and speed of bat and target.

Fly-by-nighters Haunt the Tropics

At Yale University my colleagues and I are studying the behavior and natural history of bats in association with our interest in their sonar systems. Research on these highly specialized mammals may help explain how man's brain processes information. The basic design of a brain—be it man's or bat's—is much the same. By tracking the processing of sound through a bat's brain, which is much simpler than man's, we hope to understand how sound is coded, analyzed, integrated, and acted upon.

To observe and collect a wide variety of bats and to study their sonars, I have traveled to Panama, the Philippines, Sri Lanka (the former Ceylon), Zaire (the old Belgian Congo), Mexico, and Jamaica.

Among orders of mammals, bats rank second only to rodents in number and diversity of species. I'd guess the world's bat population is some tens of billions. About 900 species are recognized, in 18 families. By far the greatest number live in the tropics. They abound in temperate climates but, being nocturnal and usually small and secretive, rarely attract attention or arouse curiosity.

They vary considerably in size. For example, the tiny Philippine bamboo bat, with a 6-inch wingspan, weighs 1/20th of an ounce, while the flying fox, with a wingspan of four or five feet, may weigh two pounds.

Generally bats bear a single infant, which subsists on its mother's milk. Some bats carry their young while foraging (page 614). Others leave their offspring hanging at the roost; upon returning, each mother finds her young by position, smell, and sound.

Plugged Ears Make Flight Impossible

Most bats are insectivorous. Mexican free-tailed bats consume an estimated 20,000 tons of insects a year in Texas alone. Some bats feed on pollen and nectar, and act as the main—or only—pollinators of a number of tropical and subtropical plants.

The true vampires of tropical America lap the blood of large birds and mammals. In some areas the vampires become significant pests of livestock, at times carrying rabies. Other bats feed on fish; still others dine on fruit—and disperse the seeds.

Bats' ways of life—especially their foraging habits—interact strongly with their sonar design. Echolocation was first studied in New England bats by Donald R. Griffin and Robert Galambos at Harvard University in the years before and during World War II.* When I joined the group in 1953, Dr. Griffin had just returned from a field trip to Panama. From his experience there, he believed that a survey of different bat families might reveal diverse sonar designs.

Dr. Griffin had found that many species flew well even when blindfolded, but made no detectable ultrasonic orientation pulses—and yet they couldn't fly when we plugged their ears. We realized we had to continue our studies of the sonar systems of tropical bats, and so it was I came to enter the abandoned gold mine in Panama.

*Dr. Griffin's early studies were described in "Mystery Mammals of the Twilight," in the July 1946 issue.

Upside down is rightside up for flying foxes. Hanging from their roost, they sleep secure from landbound predators. Always a few are awake and alert, and fly away at the approach of a hawk or a tree-climbing snake, thus alarming the others. One species of flying fox, biggest of bats, attains a wingspread of four to five feet. Lacking sonar, these fruit-eaters see their way to nightly meals with eyes ten times as sensitive as those of humans.

PTEROPUS HYPOMELANUS FROM THAILAND; 8 INCHES

As a result of our observations, we now refer to many of the New World tropical bats as "whisperers." The orientation pulses of these fruit-eaters are relatively less intense than those of many other bats, hence our failure at first to detect them. Actually, whispering also characterizes many of the species that feed on large insects, spiders, scorpions, and small vertebrates. These bats tend, too, to make very brief pulses.

Our studies indicate that various sonar-design features enable bats to fly through heavy jungle or close to walls, tree trunks, and the ground. When flying through the jungle canopy, for example, a bat's orientation pulses will produce a great many echoes within a few feet.

Were the bat to hear all these echoes, surely only confusion would result. I believe that they attend, at one time, to the echoes from the closest object and perhaps to a general background range—but not to everything.

Insights of this kind can be achieved only by going into the field and seeing what bats really do. We have discovered them roosting in a surprising variety of places—caves and grottoes, tree hollows, boulder heaps, culverts, attics, belfries, abandoned animal burrows, thatch, birds' nests, under bridges, and even in the open.

Attic roosts in particular can be disconcerting for me and my kind, and not only because attics are unbearably hot, dry, dusty, and unaesthetic. Attic floors of old tropical

SACCOPTERYX BILINEATA, 2 INCHES

Whipping his wings in a hover display, a white-lined bat chirps a serenade to a local beauty he has attracted to his harem. She rasps acquiescence, but may interrupt her song to squabble with another female and perhaps chase her away. White-lined males daily form new harems of as many as nine females. These and other behavioral traits of the tiny Trinidad bats turned up in a study by Dr. Jack W. Bradbury of Rockefeller University.

buildings are often built of flimsy materials. They are weakened by termites, dry rot, and by the leaps and bounds of enthusiastic batmen. I've fallen through ceilings from Panama to Mexico and thence around the world.

At the Casa Vieja in Paso de Ovejas, Mexico, the clerks who work in a government office on the ground floor are always friendly to me. Nevertheless, they point out that my visits to the attic overhead mean guano-strewn typewriters and filing cabinets, if not an actual vertical descent by me.

The last time I stopped by, I assured them that I was not going into the attic at all. The bats I sought roosted on the tops of the outside stucco walls, beneath the eaves. My quest succeeded, and almost no guano was redistributed. But when I returned to the ground-floor office to say good-bye, I was not surprised to see the typewriters and desks all neatly covered against the usual by-product of my visits.

The diversity of roosts is paralleled by striking variations in foraging behavior. The effect of hunting habits on sonar design has held my attention for years.

In pursuit of flying insects, bats catch so many so rapidly that their flight paths appear highly erratic. A mere half second may elapse between identifying and capturing an insect. In the laboratory we have monitored bats catching up to 15 fruit flies a minute—by diving, looping, turning, sideslipping. Between such pursuits, however, the flight path is straight or gently curved.

Airborne Angler Fishes With Its Feet

Bats catch insects in flight by mouth and by wing.* When a large insect hits the wing's skin, the bat gathers it to its mouth as if with a hand. The wings, of course, actually are highly modified arms and hands.

Some bats snatch up grasshoppers, roaches, and other insects from the ground, walls, tree trunks, or vegetation—sometimes landing, sometimes not. In fact, certain bats are incapable of walking or of taking off from the ground should they land.

A few bats routinely forage for insects over water, some snatching their prey from the surface with their hind feet.

The fishing bats, particularly, have perfected this method. *Noctilio leporinus*, the best known of the fishers, occurs from Mexico southward well into South America and on some of the Caribbean islands. It flies low and, on detecting a fish breaking the surface, dips its hind feet, soles forward, into the water (pages 621-3).

One or more of the sharp toe claws gaff the fish and lift it from the water. In flight, the bat raises the fish to its mouth. Then it ducks its head and places the fish in the membrane that stretches between its two legs. Now the bat regrips its prey with its teeth, but takes the head first; at this time, I believe, the bat usually seizes the opportunity to kill the fish by biting it.

False Vampires Eat Their Relatives

In two families a few species, often called false vampires, have evolved to feed on quiet or sleeping lizards, tree frogs, birds, rodents, and even smaller bats.

False vampires appear to engulf their prey for a moment and to crush the back of the skull or the neck with powerful jaws and teeth. None of these bats is large in an absolute sense (the largest have wingspans of two feet or a little more), but all are larger than their close relatives that eat fruit or insects.

Probably no bat is powerful enough to win a battle with any but the most harmless victims—but it's just such helpless victims that are chosen. One wonders how small bats defend themselves and their young from the false vampires with which they share roosts. And how does a young false vampire avoid being eaten by its mother's colleagues?

I am particularly well acquainted with the omnivorous bat, *Phyllostomus*. Some years ago in Panama I stood in a cave looking up at a colony of several thousand on the ceiling. My light had awakened them. In unison they flexed their knees and urinated.

Bats almost always urinate and defecate on awakening so they will not have to take flight with a useless load. By flexing their knees appropriately, they avoid soiling themselves or their neighbors, but they lack consideration for observers below.

And so it rains on collectors. That was my first shower but not my last. We accept the rivulets that trickle down our heads as the price of success in finding our quarry.

I returned from one collecting trip to find Dr. Griffin entertaining two eminent bat naturalists from the Netherlands. To show off some of the specimens I had captured, I released them into our flight room, launching

*See "How Bats Hunt With Sound," by J. J. G. McCue, NATIONAL GEOGRAPHIC, April 1961.

Bloodthirsty creature of the night, a vampire bat drinks from a sleeping calf (**above**). Most agile of bats, the vampire can walk like an ape, scurry like a mouse, or jump like a frog, and stalks its prey on foot (**right**). But the bat rarely attacks man. "They make excellent laboratory animals," says the author, whose pet vampire Gwendolyn would sit in his hand or hang contentedly from his breast pocket.

two *Phyllostomus* last. Clumsy from being caged, they couldn't hold their altitude, and soon one of them found an emergency landing field. Perhaps for the first authenticated time, one might have been able to say that a bat had gotten into someone's hair. Alas. Our guest's cranium was shiny, shaved bald.

I handled *Phyllostomus* with leather gloves for a few months, knowing them to be powerful and not having mastered my feelings about bats. Then one day I experienced the ultimate in shame. I saw Dr. Griffin's female graduate student handling them freely with her bare hands. Ever since, I've worn gloves regularly only for newly captured vampires and for the unbelievably vicious Caribbean flower bat, *Phyllonycteris*. As a result my fingers are peppered with bites, but I like to preserve the image of trust, confidence, and valor. The blood loss is negligible.

Tribesmen Feast on Flying Foxes

Most of the Pteropodidae, the Old World flying foxes and their kin, feed on fruit. From their relatively unspecialized skeletal structure and lack of sonar, we judge them the most primitive of living bats. They orient by sight and smell, with one exception: The dog-faced bats, *Rousettus*, have evolved their own sonar independently of other bats.

In the Philippines' Zambales Mountains, I enlisted Negrito tribesmen to help capture specimens of flying foxes. They led me to a large colony roosting in trees 150 and 200 feet tall, but when the bats saw us they took flight in great soaring swirls. At the Negritos' suggestion, we covered our heads with banana leaves. Immediately the bats seemed soothed and returned to their tree roosts.

After capturing two flying foxes for my lab, my chief guide killed seven others using my shotgun. This I considered a feat; these Luzon tribesmen, unused to firearms, normally stalk their game, principally birds, with bow and arrow, shooting at close range.

The seven dead bats—flying foxes, in particular, are widely considered choice, even gourmet, morsels—were prepared for a feast. First their fur was thoroughly singed in an open fire to get rid of a musky oil that permeates it. Then the bats were roasted whole, on a spit.

As the honored guest and owner of the shotgun, I was given first choice when the bats were fully roasted. My hosts, who relish the flying fox's intestine—usually empty because of rapid digestion—fully expected me to endorse their preference. That I could not do. I did take a breast quarter. It proved delicious —lean, dry, and flavorful—but I couldn't bring myself to eat much. I considered these bats as well as others to be more my friends than my intended victims.

Flying foxes use their hind feet to hold and manipulate food. Such manipulation is not seen among the more specialized "sonar" bats. Two small relatives of the flying foxes—the short-nosed and the long-haired fruit bats, *Cynopterus* and *Lissonycteris*—use their feet with particular agility. They often hang from a branch by one leg alone, a posture that makes them resemble a piece of fruit or a dead leaf. The free leg and foot comb and cleanse the coat throughout the day.

When we give these bats a large morsel of food, such as half a peeled banana or a chunk of melon, they accept it with their mouth but then bring down their free foot and hold the fruit with the spread toes and claws while severing a chewable fragment. They continue to grasp the reserve piece with the foot until ready for the next bite.

The New World spear-nosed bats have evolved their fruit-feeding habits independently of the flying foxes. Some fruit-eaters must vary their diets, because the fruits ripen seasonally. They find attractive many wild species that man considers neither desirable nor even edible. Often the chosen fruit is rock-hard, bitter, sour, or puckering. They also eat soft, man-edible fruit, but commercial crops are seldom seriously affected.

Bats Seduced by Tempting Fruits

A Dutch botanist, Leendert van der Pijl, and others, studying the ecological relationship between fruit-bearing plants and fruit-eating bats, concluded that the fruits of many plants have, through evolution, become attractive to bats, which are involuntarily seduced into the service of seed dispersal.

Such fruits must not only attract bats but, of course, must also be accessible to them. Usually, the fruit grows apart from the bulk of twigs, leaves, and thorns on the plant. Thus, free from obstacles, it can be easily reached in flight.

Bat-attractive fruits are mostly green or brown (bats are color-blind as far as we know). These fruits often have a rancid, sour, or musky odor, and are likely to bear either a single large seed or many small slippery seeds.

In-flight feast of nectar and pollen rewards a long-nosed nectar bat, which dines from the night-blooming flower of a saguaro cactus (**left**). This nimble flier approaches the blossom from above, braking and banking with its wings cupped like parachutes, and gets about a second's sip before it turns and flies off to make another approach. A better pollinator of the saguaro than the bee or the dove, the bat supplements its diet with an occasional insect and a bit of ripe fruit.

Fur dusted with pollen, a spear-nosed bat hangs from the ceiling of a Trinidad cave (**right**), ready to suckle a pup. Female spearnoses gather in clusters of as many as 100 bats, generally guarded by a single male.

LEPTONYCTERIS SANBORNI, 3 1/8 INCHES; OTIS IMBODEN (FACING PAGE); PHYLLOSTOMUS HASTATUS, 4 3/4 INCHES (ABOVE)

Killer and victim blend in this remarkable photograph of a spear-nosed bat dining on a cavemate, a short-tailed leaf-nosed bat (**right**). The killer's left eye is visible beside the open mouth of its quarry. Photographing bats on the ceiling of a Trinidad cave, photographer Bruce Dale heard squeaky noises issuing from a crevice, and rushed over to make this first known picture of one bat killing another in the wild. The predator ate its victim.

PHYLLOSTOMUS HASTATUS, 4 3/4 INCHES, KILLING CAROLLIA PERSPICILLATA, 2 1/2 INCHES

Large pulp-covered seeds—or the fruit itself—may be carried to the daytime roost or to an alternative nocturnal roost for leisurely eating. The seed is finally discarded and thus dispersed. Some seeds, of course, end up on cave floors, where their future is bleak, but others, by accident or design, are dropped outdoors. I once found a grove of sprouted seedlings growing out of the debris on the loading platform of an Army warehouse.

Some fruit bats feed on flowers as well. They may consume the whole flower, or they may take only the nectar and pollen. In Ceylon and the Philippines, *Rousettus* is also known to steal fermenting palm sap being collected in buckets to make toddy, an alcoholic beverage. Bats that drink it can be identified by their staggering flight.

Among both the Old and New World fruit bats have developed subfamilies that live on flower nectar and pollen. A wide range of plants, dependent on these bats for pollination, has evolved independently in the two hemispheres.

All nectar-feeding bats are small; many are tiny. They lap up the nectar and pollen with greatly elongated tongues (preceding pages). The muzzle of these bats is usually long and conical to house the tongue; the latter's tip often carries a brushlike array of papillae, which may be used for gathering pollen.

Balanced Diet: Pollen and Nectar

Flowers that attract bats bloom mostly at night. Like fruits favored by bats, they often are green or brown, have a rancid, sour, musky, or musty odor, and are likely to be borne clear of the twigs and leaves.

Flowers attractive to bats are seldom borne on the same plants, or even by the same families of plants, as those that bear bat fruit. Bat flowers generally produce abundant nectar, but it is principally a sugar solution, deficient in vitamins, minerals, proteins, and fats. Pollen fills most of these nutritional gaps. Still, the majority—if not all—of the nectar-feeding bats also eat insects, sometimes accidentally.

In recent years my colleagues and I have done most of our collecting in Jamaica. While reviewing the natural history of Jamaica's bats, we had read that the flower bat *Phyllonycteris* was extinct. On the contrary, we've often seen *Phyllonycteris* roosting in a cave with mixed groups of *Monophyllus*, a Jamaican nectar bat, and *Chilonycteris*, the moustache bat. Their light-beige fur makes them easy to spot from the cave floor.

Twice I've discovered such mixed groups close enough to be netted by hand, and twice I've crept up to the best vantage point from which to swing the net most tellingly. Both occasions, three years apart, found me at the same spot in the cave, but I didn't recognize it as such. Both times, as I leaped to swing my net, my head hit the unyielding cave ceiling, which knocked me down and out.

At least once, however, I came to with a *Phyllonycteris* in the net. We have even been able to keep the "extinct" *Phyllonycteris* in captivity and to study some of its behavior.

Bats Thrive on Hummingbirds' Menu

Most nectar-feeding bats thrive in captivity and can present a charming, aesthetic display. We feed them a revised version of a Bronx Zoo recipe for hummingbirds. It consists of honey, condensed milk and milk powder, several powdered diet supplements designed for invalids, and vitamin drops, all dissolved in water to a milk shake's consistency and appearance. Our bats love this nectar-pollen substitute, taking it in flight from small beakers clipped to the wall.

The New World spear-nosed fruit bats have given evolutionary origin to the highly specialized true vampires, of which there are three living species. All inhabit the New World tropics, where they feed on the blood of large mammals and birds.

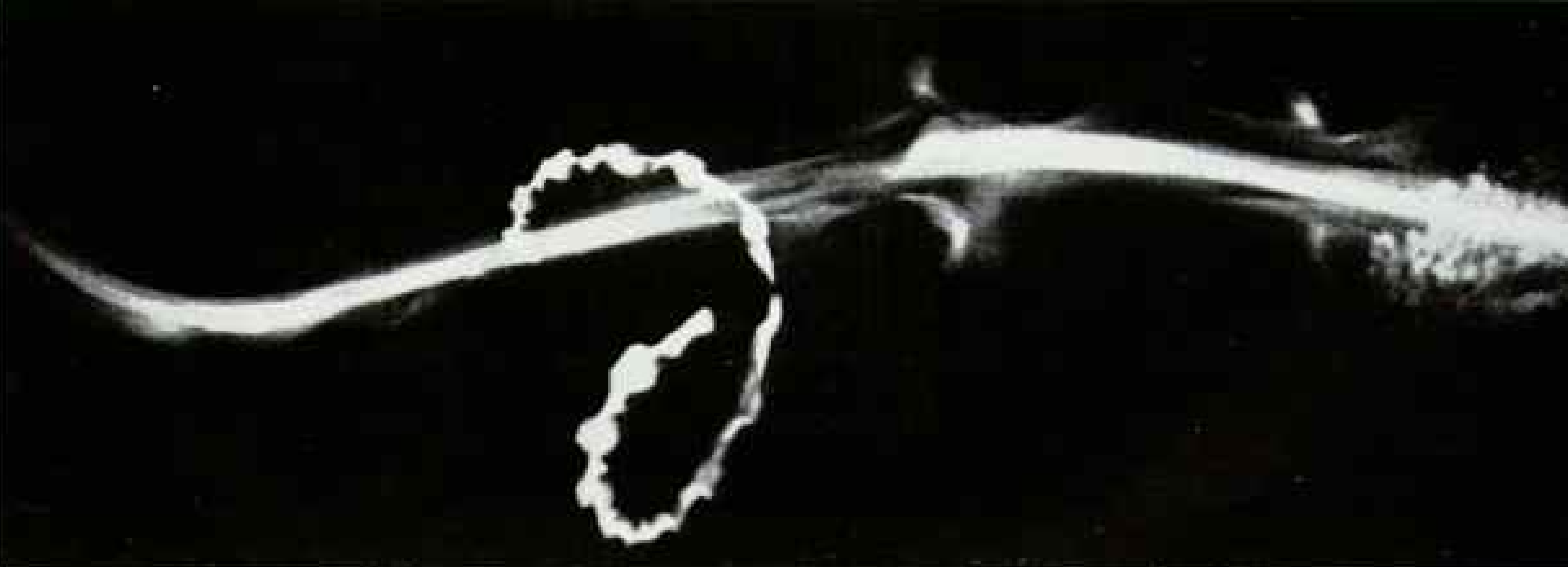
Despite their manner of feeding and their reputation, vampires are very timid bats. They weigh only an ounce and are fragile and delicately built.

Presumably their success in feeding depends on stealth, a light touch, and a quick getaway. Vampires may alight on their intended victims, or they may land near them and either walk or hop cautiously toward and finally onto their prey (page 628).

They then crawl daintily to the neck or back or to some exposed skin—the edge of the ear, around the anus, or the feet. Their specialized sharp incisors inflict a shallow but freely bleeding wound. They do not sink their fangs into jugular veins, as in myth, their teeth being far too short and, of course, incapable of functioning like hypodermic syringes.

Capillary blood flows freely while the bat feeds. Each vampire requires about a tablespoonful a day, a negligible volume to the large hosts. The wound itself generally heals

No fighter pilot pursues his quarry with more accuracy than the little brown bat (**above**) that bags a moth in its tail cup. The bat may also capture prey with one of its wings, like a first baseman scooping up a ground ball. Streaking from right to left in a half-second time exposure (**below**), a red bat intercepts a moth. Hearing the bat's sonar, the moth executes an evasive spiral. The hunter is not fooled; it alters its trajectory slightly as the moth loops, and then dives for the kill.



MYOTIS LUCIFUGUS (UPPER), 2 INCHES; LASIURUS BOREALIS, 2 1/2 INCHES; FREDERIC A. WEBSTER, BOTH

Wall-to-wall bats cover the ceiling of Texas's Ney Cave, summer nursery for an estimated fifteen million Mexican freetails and their young. Some males follow the mothers-to-be

ROBERT W. MITCHELL

northward into the United States, but most remain below the border. At twilight the foraging females stream from the cave mouth with a roar like that of a white-water river.

Dinner bites diner. This spear-nosed bat in the Yale laboratory refused to eat a proffered tidbit. Instead, the lizard bit the bat.

quickly, though many such wounds may reduce the productivity of livestock or make a racehorse irritable. Unfortunately, in some parts of tropical America vampires transmit rabies to cattle.

I'm often asked about the precautions we take against disease in our work. I require all my associates to be vaccinated against rabies.

In 1958, before embarking on a summer's work in Mexico, I had received a series of vaccine injections and shipped off a serum sample to the manufacturer for evaluation. During the course of our explorations we captured and released thousands of bats and, in doing so, I estimate that I sustained hundreds of bites. We sent a small sample of bats from one cave to a scientist in Mexico City who was studying the epidemiology of rabies in bats. Some days later we heard that most of the bats had proved to be rabid.

Having been vaccinated, I felt unconcerned, as did my student associate, Alan Grinnell. A few weeks later we returned to Yale. On my desk I found a letter from the company that had produced the vaccine. It stated quite simply that the vaccine, in my case, had apparently been ineffective.

My antibody titer, an index of immunity, was zero. My worry titer rose rapidly. But nothing happened to any of us.

Blood-bank Dinner for Thirsty Vampires

Vampires domesticate quickly. Most become exceptionally docile, friendly, and interesting laboratory citizens. They readily adapt to taking fresh or refrigerated blood from a dish. Traveling with vampires, however, is difficult. Blood keeps poorly when not refrigerated, and disposing of unconsumed blood is not always easy.

On one occasion I was returning from Mexico by car with eight or ten different species of bats, including vampires. I ran low on palatable blood as I approached New Orleans and telephoned my sister, a physician there, to ask that she have blood of some sort awaiting our arrival. She went to the blood bank at New Orleans Charity Hospital and found that she could obtain outdated blood. But would the vampire bats accept it?

"Do you know," my sister asked the woman technician in charge of the blood bank, "if the anticoagulant changes the taste?"

With an expression of utter horror and revulsion, the technician fairly spat out, "I wouldn't know!"

Ah, well, the bats enjoyed the blood, and we continued our journey uneventfully.

Vampires rarely bite people. In the laboratory, we handle well-adjusted vampires bare-handed with little risk. The eminent ethologist Konrad Lorenz years ago tried valiantly but unsuccessfully to get two of my vampires to bite him. They were too timid.

In Mexico and Panama I've often asked cattle raisers who live close to vampire colonies whether they have ever been bitten. They smile patronizingly at me, as if at a small child, and reassure me that vampires bite animals, not people.

Yet one summer, a student of mine, Gary Nobert, took three of my vampires home to continue his studies of their hearing during spare evenings. The bats lived in his closet, and his heroic mother picked up fresh blood regularly at the slaughterhouse. After some weeks Gary reported that one of the vampires, which were allowed freedom while he studied and read in the evening, had landed by his foot and approached stealthily as if to feed. I was unhappy to hear that he had pulled his foot away, frightening the bat.

Twice subsequently one of the bats approached Gary—but after minutes of surface licking bit into his moccasin rather than into his foot. In spite of my demands and those of science, Gary had been too inhibited to offer his bare skin.

Bats Can Complicate a Traveler's Life

In the field, working at distances from population centers, in diverse cultures, on low budgets, and on tight schedules, we frequently find it necessary to be brazen, forward, and otherwise less than perfect. Conscience is eased by the knowledge that we do no harm. We face these problems repeatedly when shipping our bats (or the mealworms that we feed to insectivorous bats), housing ourselves and our bats, shipping specialized equipment, and crossing borders. Customs officials often interpret the letter of the law in ways that seem tedious, but we must either comply or talk our way out.

Importing mealworms into Mexico, I once declared them as "animal food" (which indeed they were to be). The customs official, however, reclassified them as "live animals," which most of them were. I acquiesced, not realizing that live animals required a certificate of health from a government veterinarian before they could be released.

So, with misgivings, but with the brazenness of need, I carried my bag of perhaps 50,000 mealworms across the airport to the veterinarian's office for examination and certification. He was surprised but not overwhelmed by the challenge and soon issued a certificate attesting to the vigor of all.

Hotels often seem even greater obstacles. The first time we stayed in Jamaica, we chose a resort hotel in Ocho Rios, where we could enjoy good food and comfort while working. Our bat specimens, of course, have to live with us. Newly captured insectivorous bats must be hand-fed for several days, a very slow task, before they learn to seek their own mealworms in a dish. What with traveling back and forth to the caves, collecting, housekeeping for the bats, and hand-feeding, our working days usually stretched to 18 hours.

"Secret" Well Known to Hotel Staff

We liked this hotel but for one inconvenience. The only access route to our quarters was through the lobby and dining room. Since we were collecting at dusk, we would return before the dinner hour had passed. We were an unappetizing group as we came through each evening, smeared and scented with mud, guano, and sweat. No one even noticed our bats. Since it was off-season, the management restrained itself, but our fellow guests would turn away in disgust or horror.

In order to compensate, in part, and to get rid of hundreds of dropped mealworm fragments, each morning before the maids entered we would sweep the floor of our room. Then we would lock everything—bats, mealworms, and equipment—in the closet so as not to alarm or inform them. In fact, I thought our mission was unknown.

The next year we drove up to the same hotel, secure in our self-bestowed anonymity. The desk clerk turned to me with a smile and said, "Will you be keeping the bats again?" A few minutes later, the maid smiled wanly as she saw us moving down the hall with our sundry field gear. "Will you be keeping the bats again?" she asked. And so with the waiter, the assistant manager, and the night clerk.

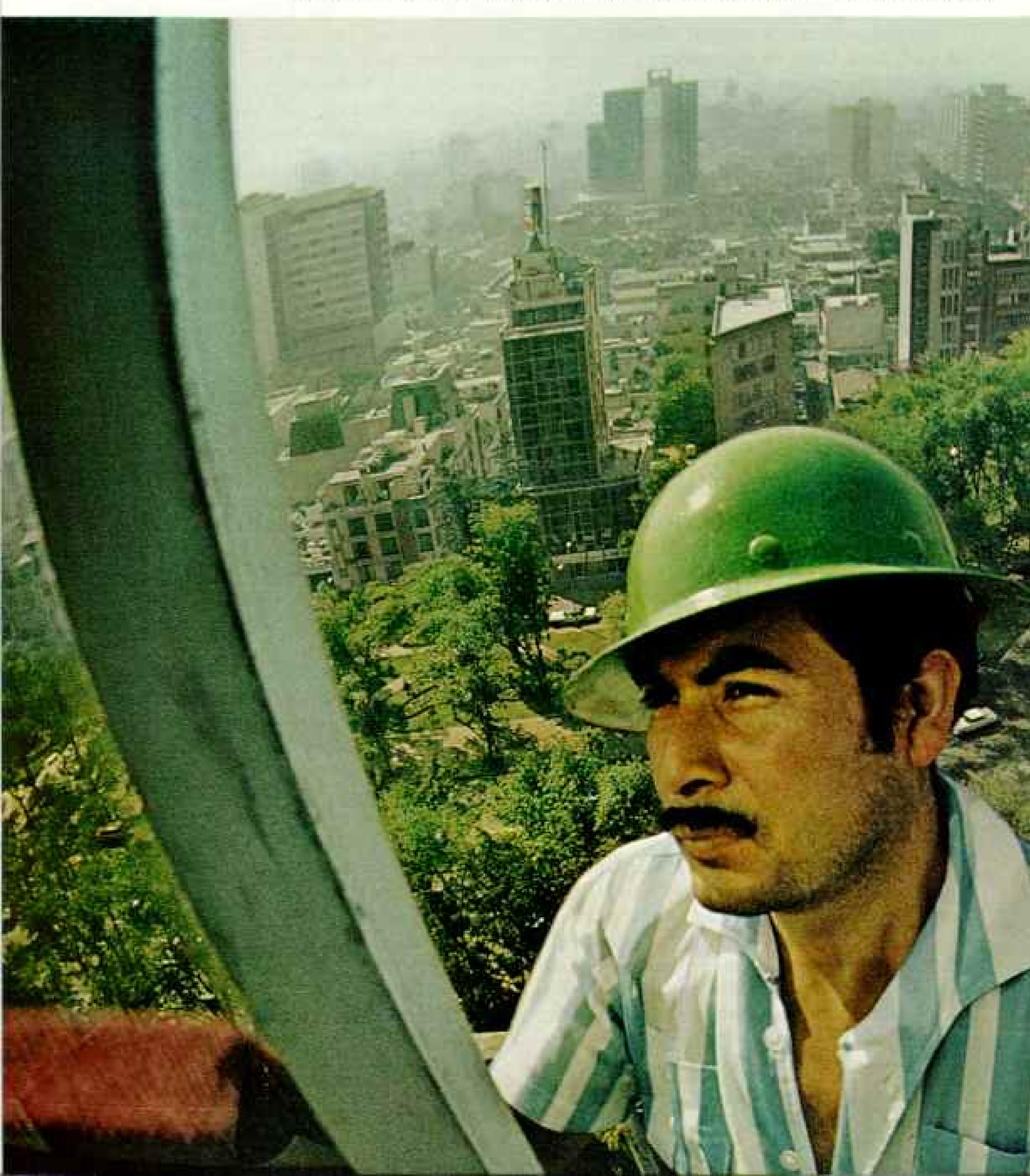
It seems, wherever we go, that people notice us, the oddball batmen. At the same time our understanding of bat sonar, indeed of how the brain processes sensory information, has moved forward. That we work in a field where adventure goes hand in hand with research is our blessing. □

By LOUIS DE LA HABA
NATIONAL GEOGRAPHIC STAFF

Photographs by ALBERT MOLDVAY

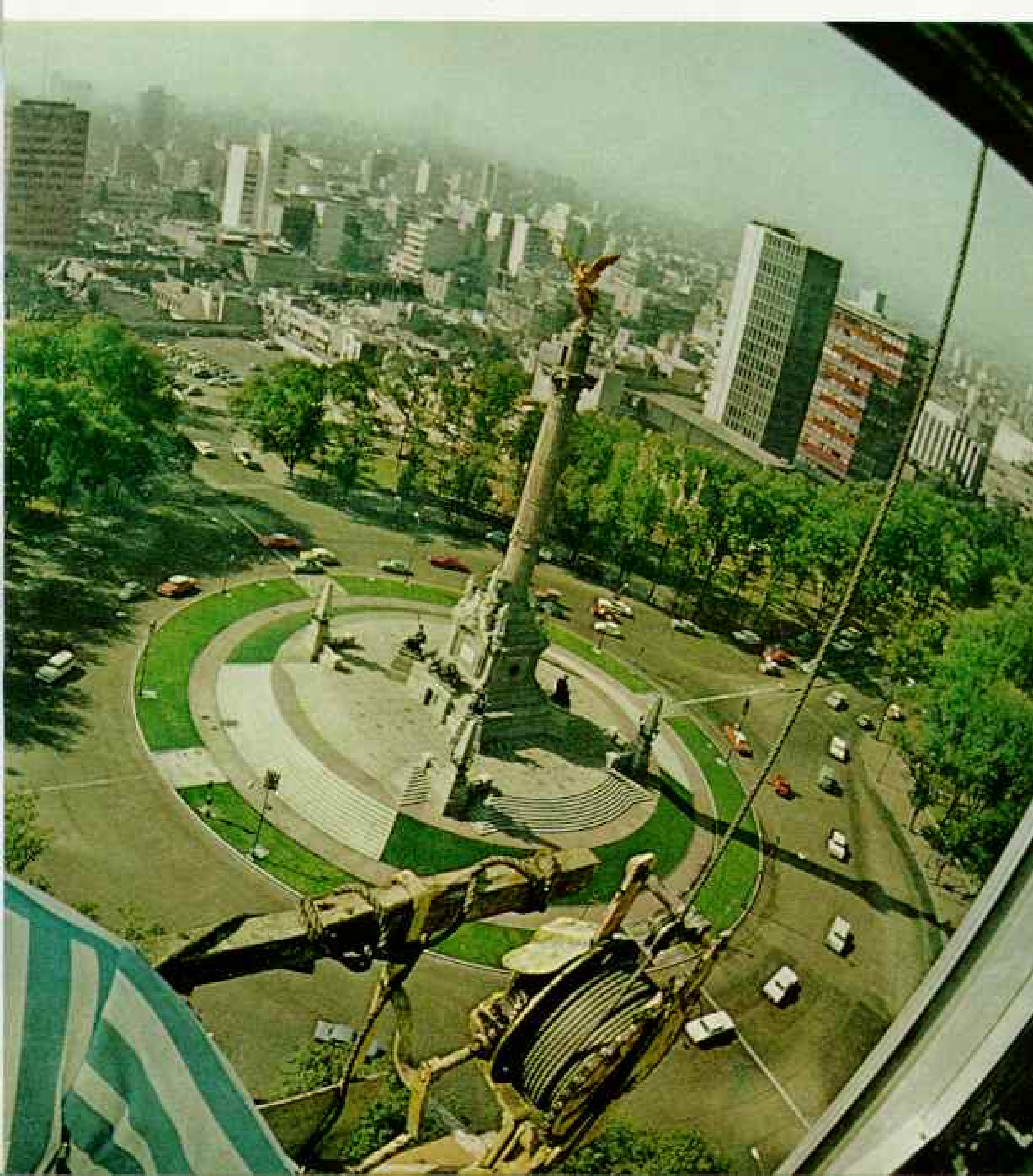
Mexico, the City

Beyond a window washer spreads the vibrant metropolis—North America's



That Founded a Nation

second largest—that has been Mexico's capital for more than six centuries.



Reaching into the nation's past, the Ballet Folklórico de México performs a dance based on the sacred books of the Maya. Translating Indian history into such

modern spectacles, the famed dance company reflects the pride Mexicans take in their heritage.

Mexico, the City That Founded a Nation

AS I SAT DOWN on his folding chair, Juan Rodriguez Lozano, the bootblack who kept station on the sidewalk outside my hotel, handed me the morning's edition of *Novedades*. I had scarcely glanced at the headlines when Juan interrupted his rhythmic brushing to pull a wristwatch from his shirt pocket. I could have it for 200 little pesos, he said, using the Spanish diminutive.

"But Juan," I said, "I already have a watch."

"Yesterday I had a customer who offered to buy it, but he had no money and wanted to owe me. You who can afford it don't need the watch. *Así es la vida*—that's life. As I told you the other day, I have just finished making payments on my little house. Now I need money to pay the lawyer for the paper work."

With pride in his voice Juan had told me of his house. Buying it had been a major event in his life, a turning point. Before, Juan and his wife and twin sons had lived in a city slum, and before that in a poor village.

It was a hard life, shining shoes, but Juan was making progress. And he was doing it in the great city of Mexico.

Exciting and interesting things were always happening here. Juan was in the thick of them, his work station strategically situated near one of the main downtown intersections, where the posh Paseo de la Reforma crosses the businesslike Avenida de los Insurgentes (map, pages 646-7).

On the sidewalks eddied crowds of people who come from every part of the Mexican nation—and indeed, of the world. Within range of our eyes some of the most modern, most audaciously designed buildings to be found anywhere soared over Spanish-colonial masterpieces of outstanding beauty. The very atmosphere pulsated with the hustle and bustle of a people on the go.

Amid all this a policeman stopped the onrushing masses of traffic while a small band of schoolchildren crossed the street to place nosegays before the statue of an imperious-looking Indian. They were commemorating the death of Cuauhtemoc, the last emperor of the Aztecs, who was cruelly tortured and finally killed by the gold-hungry conquistadors from Spain.

It is no accident that Cuauhtemoc should

be honored even as the Spaniard Hernán Cortés is virtually ignored at the scene of his greatest triumph. Though Mexicans are a product of four centuries of Europeanization, not to mention the pervading influence of their neighbor to the north, they do not forget their Indian past. The Spaniard has never quite been forgiven for his depredations, and Mexico City is proud to remain, in a very real way, an Indian capital.

Juan himself is a mestizo, part Indian, part Spanish. As we talked, I sensed his joy in his ancient city and the loyalty it claimed from him. What better place to be on this fine morning? Never mind that he hadn't sold the watch. Someone, surely, would come along and buy it.

Urban Attractions Create Problems

Juan's love of this teeming metropolis is shared by many—some say too many—of his countrymen. Flocking here to the tune of a quarter of a million a year, they have helped swell the population from 4.8 million only a decade ago to the present nearly nine million, making Mexico City, after New York, the continent's most populous metropolitan area.

Lured by the city's glitter, they come from all Mexico—from surrounding farms, the arid north, the Gulf Coast, the steamy Yucatán. To earn a living, they seek jobs in government, in the city's uncounted offices and shops, and in the 50,000 factories that turn out everything from shoes and furniture to elegant copperware and sophisticated electronic components.

But many find no jobs and no place to live —2,200,000 are unemployed. Often newcomers settle in rickety, makeshift neighborhoods aptly named *ciudades perdidas*—"lost cities." Sometimes well-organized bands of squatters move into unoccupied lands to build shantytowns almost overnight.

"We call them *paracaidistas*—parachutists —because they move in so quickly," a municipal official told me. "There isn't much we can do about it. We can't very well chase them out. Where would they go? So we try to provide them with basic services—water and sewage, then electricity, streets, and schools. Traditionally that is one of the ways in which our city has grown, though it is not a very satisfactory way."

As a result, perhaps half the people live in substandard housing. To eliminate slums and to improve the quality of life of its citizens, the Federal District (Mexico City is a federal district, like Washington, D.C.) has been carrying out an energetic program of urban redevelopment, with remarkable results. One exemplary instance is the Presidente Adolfo López Mateos complex at Tlatelolco, which covers more than 300 downtown acres of former railroad yards, warehouses, and the city's worst hovels. Completed in 1965, the project contains housing for nearly 70,000 people—rental apartments for low-income families and condominiums for those who can afford to buy.

Enrique Pérez Romero, a resident, drove me to Tlatelolco in his taxi. I admired the beehive buildings with their clean, modern lines and the green open spaces between. I saw children romping safely in off-street playgrounds. Señor Pérez pointed out convenient stores, sports clubs, nurseries for children of working parents, and schools.

What kind of a place had it been before?

"Truly one of the worst," he said. "It was no place to be. Now we have air and space and decent apartments."

Independence Marks the City's Cabbies

Señor Pérez is one of 20,000 taxicab drivers in the city, and there obviously must be something about the work that accentuates the Mexicans' independence of character. One day, in a rush, I stood on the curb of the tree-lined Paseo de la Reforma desperately trying to hail a cab. Despite my frantic flagging, five or six empty ones passed by. Finally one stopped. I asked the driver why—if he and his colleagues were in the business of transporting people—they chose to ignore potential customers.

"Señor," he said, speaking over his shoulder in calm and measured tones, "I do not know about the others. As for me, I am infirm of my liver. Were I to stop to pick up every fool I see on the street, I would surely die. I prefer to have a little peace."

As for me, I prefer to walk, when time and distance permit. Despite a 7,350-foot elevation that tends to leave a lowlander breathless, Mexico is a city for walking. Around every corner, it seems, lurks some hidden treasure, an exquisitely sculptured baroque facade, a leafy courtyard glimpsed through a massive wooden gate that has been left ajar, a hole-in-the-wall eatery with its piquant offerings, a shop full of appealing folkcraft.

Then there are the people: The laughing

voice that called out "*¡Salud!*" from a balcony several stories above my head late one night when I shattered the peace of a dark and silent street with a mighty sneeze.

Or the elderly couple with the canary. I had been waiting at a corner for a traffic light to change one morning when I noticed them standing next to me. The wife carried a perky, fluttery little bird in a tiny wooden cage. Was it for sale? "Oh, no!" she exclaimed. "It is such a nice day. We have brought him out to enjoy the air."

Plaza Symbolizes Blend of Cultures

There are the monuments and landmarks of the city as well. Tlatelolco holds two important ones. At its western end is a huge A-shaped tower, a 417-foot office building with a carillon at its apex. At the eastern end of the complex is the Plaza of the Three Cultures (pages 648-9).

Here, beside a partially restored Aztec pyramid and *tianguis*, or market, stand the Spanish Church of Santiago and the School of the Holy Cross. Alongside these venerable relics rises the 20-story tower of the Ministry of Foreign Affairs. The three—tianguis, church, and tower—provide a perfect symbol of today's Mexico, a 20th-century American nation whose roots rest solidly in the rich soil of its cultural past, Indian and European.

On the same pyramid whose ruins are seen today, Cortés and his men found grisly evidence of the Aztecs' penchant for human sacrifice. Led by the Emperor Montezuma, they climbed to the top of the pyramid and entered the twin shrines of Huitzilopochtli, the stern war deity, and the god Tezcatlipoca, the mysterious "smoking mirror."

The chronicler Bernal Díaz del Castillo, who was there, described the scene:

"...the figure of [Huitzilopochtli]... had a very broad face and monstrous and terrible eyes, and the whole of his body was covered with precious stones, and gold and pearls.... There were some braziers with incense, which they call copal, and in them were burning the hearts of three Indians they had sacrificed that day...."

Originally a separate city-state, Tlatelolco merged with and became the commercial center of Tenochtitlan, the Aztec capital (map, page 646). Here at Tlatelolco was fought the last battle of the Spanish conquest, after which, on August 13, 1521, Cuauhtemoc, who was Montezuma's nephew and

Strong of back and quick of hand, a lad carries a brother while weaving a frond for Palm Sunday. He works before a massive door of the Metropolitan Cathedral.

"great towers and temples...

... and buildings rising from the water...." Thus a conquistador described the Aztec capital, Tenochtitlan, as it appeared in 1519. The Aztecs had settled on the island in Lake Texcoco 200 years before. By a system of drainage canals, dikes, and causeways, they expanded their city until it held 200,000 people—one of the world's greatest metropolises of the time. In the sacred precinct at center they built lofty temples to their gods, whom they sought to please with burnt offerings of hearts ripped from human breasts. To the north the compound of Tlatelolco embraced a huge pyramid and a vast market, or *tianguis*.

Hernán Cortés led his force of 400 Spaniards over the causeway directly above. The Emperor Montezuma greeted him as a god, but Cortés took the monarch captive. Hostilities flared, Montezuma was injured and died, and the Aztecs almost annihilated the Spaniards on the *Noche Triste*—the "Night of Sadness." Cortés and his men fled, returning a year later to conquer Tenochtitlan, raze it, and build anew upon its ruins.

PAINTING BY STAFF ARTIST NED M. SEIDLER

successor, surrendered to Cortés. Thus fell the mighty Aztec Empire, a dominion that had extended over most of central and southern Mexico. It took Cortés's desperate band of Spaniards less than two years to attain this final victory, of which William H. Prescott, in his monumental *Conquest of Mexico,* wrote: "There is probably no instance in history, where so vast an enterprise has been achieved by means apparently so inadequate."

Tlatelolco was the battlefield, but the prize was Tenochtitlan, center and foundation of the Mexican nation. Prize indeed—a magnificent city of perhaps 200,000, set on an island, gleaming like a jewel in the shallow waters of Lake Texcoco (painting, preceding pages). When first they saw it, on November 7, 1519, the Spaniards were dazzled.

"It was like the enchantments . . . on account of the great towers and temples and buildings rising from the water. . . . things never heard of, nor seen, nor even dreamed," wrote Bernal Díaz.

If Tenochtitlan was the heart of empire, the heart of Tenochtitlan was its great square, the Aztecs' most sacred precinct. A massive, towering pyramid dedicated to Huitzilopochtli, the war god, and to Tlaloc, god of rain and green growth, dominated the spacious plaza. Nearby stood Montezuma's palace, the circular shrine of Quetzalcoatl—the feathered serpent—and residences of the high priests.

Old Stones Now Fill New Needs

Despite their awe and admiration, the Spaniards razed the entire assemblage of pagan buildings and founded their city upon its ruins. On this ground today the National Palace and Supreme Court, the municipal government buildings, and the Metropolitan Cathedral—one of the oldest churches in the New World—face three sides of a vast and empty square called the Zócalo.

Into the construction of these buildings went stones, many of them sculptured, from the demolished Tenochtitlan. In some of the old buildings near the Zócalo can be found

Spreading out from ancient Tenochtitlan (shown in yellow), today's metropolis of nearly nine million rests on the bed of drained Lake Texcoco.

stones carved by Indians in the 14th and 15th centuries in walls erected by their conquerors in the 16th, 17th, and 18th centuries.

A scant block from the National Palace—where President Luis Echeverría Alvarez has his offices—archeologists have exposed a corner of the main pyramid, including one of the huge serpent heads that adorned its balustrade. Next to the serpent, the steep steps of the pyramid rise under Guatemala Street, then end abruptly as they reach street level. In Aztec times the stairway led to a platform perhaps a hundred feet high on which rested the twin shrines of Tlaloc and Huitzilopochtli.

Standing on one of the steps, I thought with a faint chill of the thousands of sacrificial victims whose feet had trodden where mine now rested. One account has it that 20,000 captives were slain to please the gods when this pyramid was dedicated.

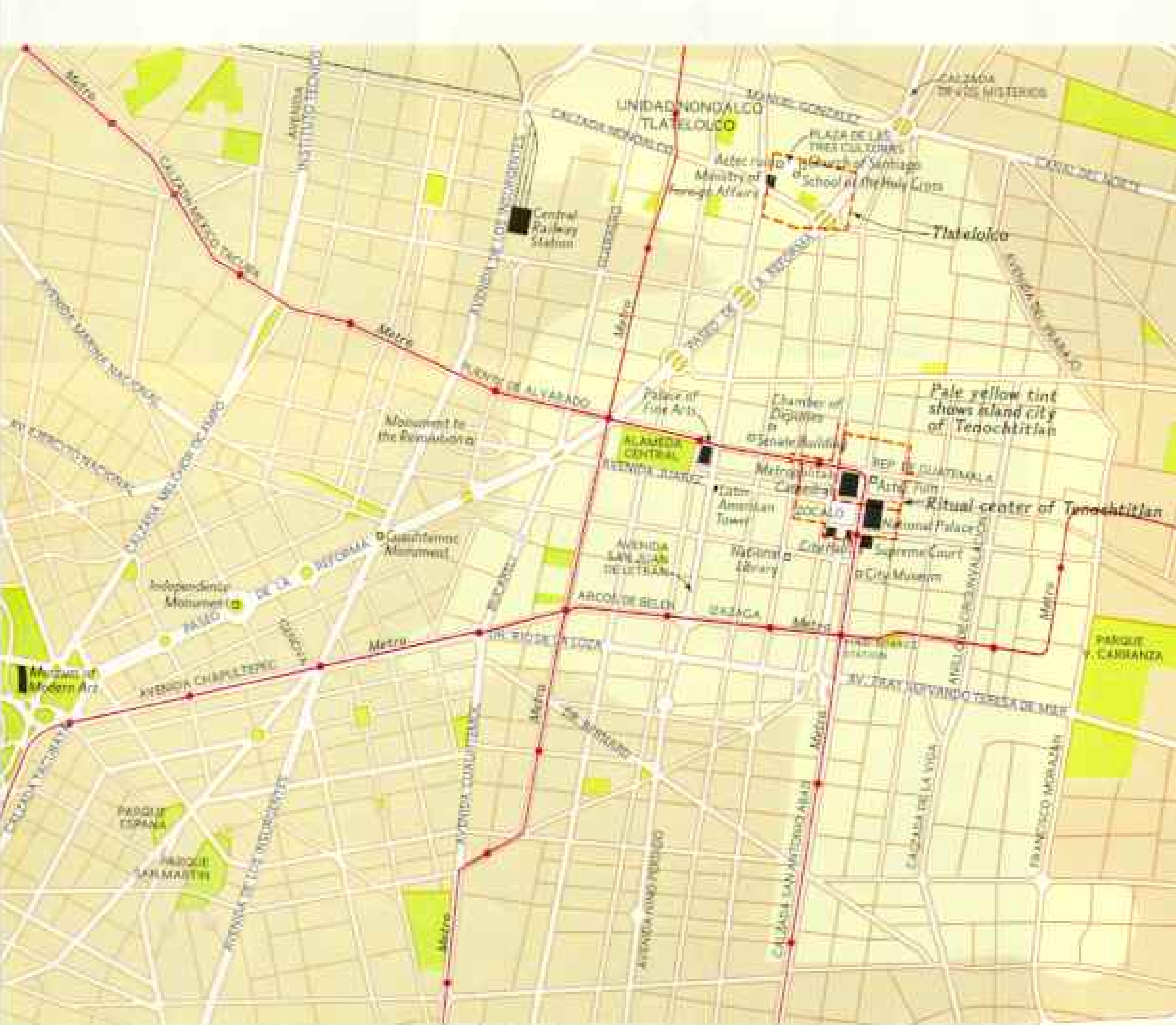
In a small museum next to the excavation, a starkly lighted chamber displays a scale model of Tenochtitlan in all its splendor, its streets and plazas peopled with tiny figures. I had been silently marveling at its beauty and symmetry when I felt the touch of a small brown hand on my arm. It belonged to a slim, smiling youth of about 14.

"Look there," he commanded, pointing to a miniature structure of wooden poles on which were threaded scores of roundish white objects. "That is a *tzompantli*," the boy said. "A skull rack, where they kept the heads of the people they killed.

"And look over there." He raced around to the opposite side of the scale model. "Those small mounds on top of the big pyramid. The priests held their victims down on these to expose their chests, so they could cut them open and tear out the hearts."

The boy spoke with relish, as well as with considerable knowledge, and I asked him if he was employed by the museum.

"No," he said. "But I know everything about this place." He smiled and added, "Visitors usually give me a little something for my explanation." He then went on to give



CHARLES O'REAR (ABOVE)

Plaza lays bare a nation's roots

IN A DRAMATIC EMBODIMENT of history, the Plaza of the Three Cultures (**above**) embraces monuments from Mexico's three epochs. Terraced base of a once-lofty pyramid recalls the Aztecs' grandeur, while the towered Church of Santiago speaks of colonial Spain. The synthesis of these into the mestizo, or mixed, culture of modern Mexico finds expression in surrounding high-rise structures of concrete, glass, and steel. Fittingly, the plaza lies within ancient Tlatelolco, where the last battle of the conquest was fought. "On the 13th of August, 1521," reads a marble tablet, "Tlatelolco . . . fell to the power of Hernán Cortés. This was neither a triumph nor a defeat, but the painful birth of a mixed race that is the Mexico of today."

In a Columbus Day fiesta at the plaza, the daring Papantla Fliers of Veracruz soar around a 100-foot pole on ropes (**upper left**) that gradually lower them to the ground. Before the church (**left**), the Ballet Folklórico entertains with a Peruvian folk dance, part of its repertory of dances of the Americas.

me additional fact, fancy, and gore. I thanked him, tipped him suitably, and left.

Not all the killing was sacrificial. There is a story that an Aztec once was put to death because the smoke from his household fire had soiled his neighbors' air. The tale is probably apocryphal. But it is a fact that 15 years ago the Mexican writer Carlos Fuentes entitled a novel set in Mexico City *Where the Air Is Clear*.

And Prescott described the majestic 17,887-foot volcano Popocatépetl, southeast of the city: "Soaring towards the skies, with its silver sheet of everlasting snow . . . seen far and wide over the broad plains of Mexico and Puebla . . . the first object which the morning sun greeted in his rising, the last where his evening rays were seen to linger."

It is a pity that—because of that blighted child of progress called smog—every neighbor's air today is sullied, Señor Fuentes would now have to choose a different title for his book, and Popocatépetl is seldom seen from one week to the next. I discussed this with Alfredo Pérez de Mendoza, an engineer who has become a student of pollution.

Because of geography and the high level of industrialization in the Valley of Mexico, pollution has reached serious levels. "The enclosed valley is like a stewpot," he said.

CHARLES O'REAR (RIGHT)

Courtly but commanding, a policeman signals "go" to automobiles on busy Avenida San Juan de Letrán. Traffic officers face a superhuman challenge in this car-clogged city, whose streets swirl with darting pedestrians and drivers recklessly weaving from lane to lane.

Finding safety in the eye of the hurricane, a newsboy hawks the latest edition of one of Mexico City's 28 dailies on the Paseo de la Reforma, one of the world's great boulevards.

"High-altitude cold air acts as a lid that holds in increasing amounts of carbon monoxide, sulphur dioxide, ozone, and dust, among other pollutants. Public awareness of this problem is widespread, and everyone is calling for something to be done.

"The question is how much we are willing to pay for clean air, and what level of pollution we are willing to tolerate. Do we want the air as pure as when the Aztecs were here?

"You know," he added reflectively, "the pagans respected nature; with us nature is a slave. Perhaps if we were still heathens, we might hold our environment in higher regard."

One of Mexico's economic mainstays, and one of the primary sources of pollution, is the oil industry. Petróleos Mexicanos, the national oil monopoly, has one of its largest refineries in the northwestern outskirts of Mexico City. Using petroleum piped in from the Gulf Coast, the plant produces everything from jet fuel to lubricating oils to asphalt, processing 100,000 barrels of crude each day and accounting for 60 percent of the petroleum products used in Mexico City and several surrounding states.

At the refinery I witnessed the efforts that were being made to reduce the discharge of pollutants. Among them were a sulphur-recovery plant and a circular building in

which hundreds of flaming jets burned off the refinery's waste gases.

I was introduced to the sulphur-recovery operation with a promise: A Petróleos Mexicanos official told me he would show me "what hell smelled like." At the plant, sulphur—one of the worst pollutants when ingested and oxidized by internal-combustion engines—was being removed from the crude at the rate of 25 to 30 tons a day. Liquid sulphur, dark brown and noisome, steamed in a huge tank where, at the edge, it crystallized into bizarre yellow formations. The stench *was* hellish. I noticed a worker tending an array of valves deep in a cloud of acrid fumes. He wore no protective mask, and I wondered how he could stand it.

"Es un Mexicano muy macho—he's a very manly Mexican," my guide laughed, implying that the worker would have considered it less than virile to wear the masks the company provided. This desire to appear macho, and the whole cult of machismo, can take on many forms other than such pointless disregard for health and safety. It can even be amusing. For example:

A few days earlier I had been walking along Avenida de los Insurgentes, the city's main north-south thoroughfare, when a sign on the wall of a small open-front restaurant caught my eye. It said *"Sopa de Hombres*—Men's Soup."

Intrigued, I sought out the proprietress, a portly lady who showed me a great pot filled with a robust broth made of several kinds of fish, oysters, clams, and shrimp. She let me taste it, and I can testify that it was formidable—truly "Men's Soup."

The kettle simmered over a sooty coal stove. Large numbers of people still cook with wood, charcoal, or kerosene, thus making a further contribution to the layers of smog that float over Mexico City.

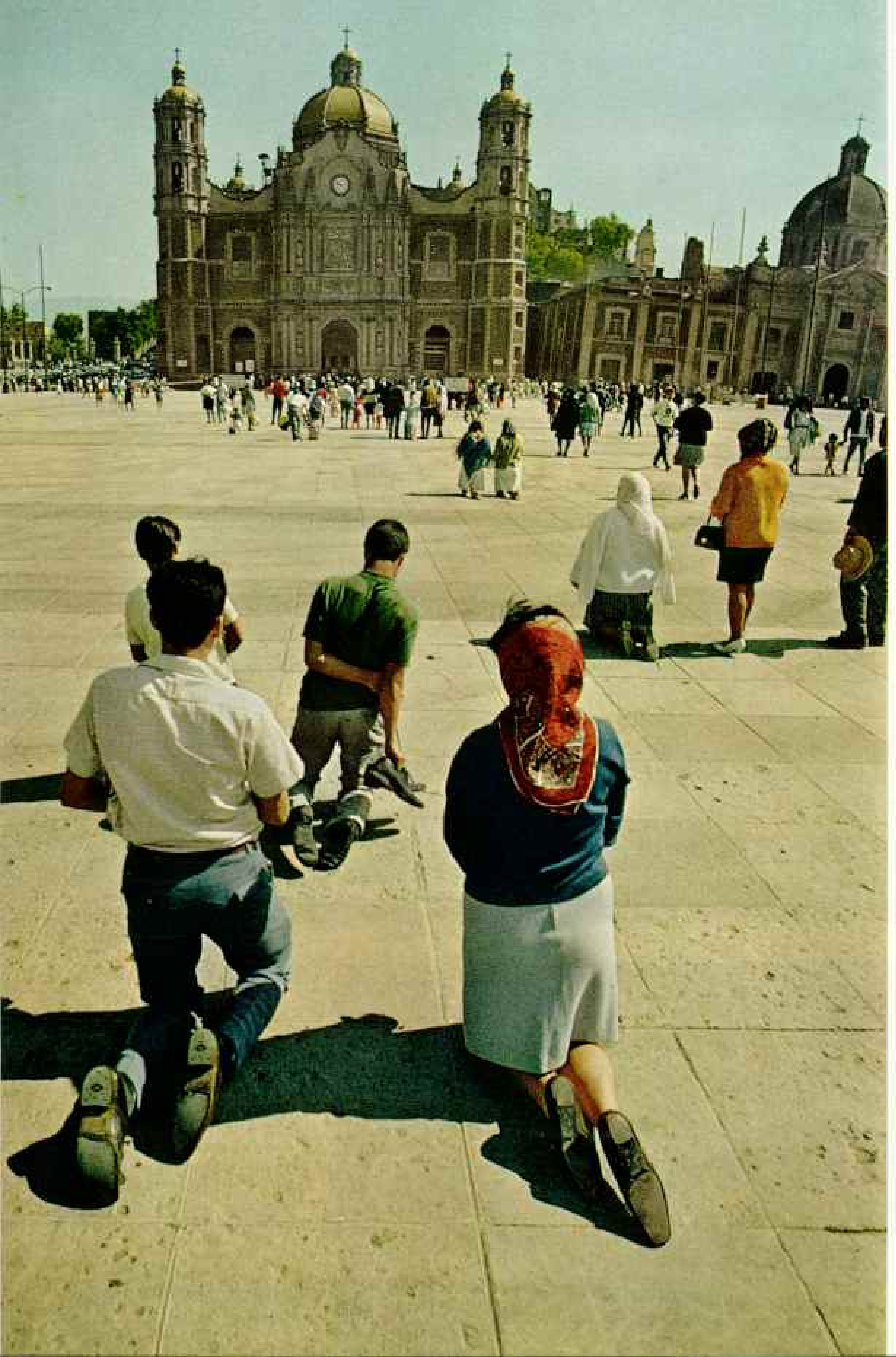
On Sundays, with factories shut down and traffic reduced to a minimum, and with favorable atmospheric conditions, the air clears perceptibly. On long holidays, such as Christmas or Easter, the skies become positively crystalline.

One Easter I went to the Basilica of Our Lady of Guadalupe, Mexico's most important shrine, which commemorates the appearance of the Virgin Mary before the humble Indian Juan Diego in 1531. The apparition had a profound effect on the conversion of Indians to Christianity, flattered as many were by the

Subway ticket to the past: Excavating a station for the Metro, a mechanical shovel scraped against a small circular temple (**above**) dedicated to Ehecatl-Quetzalcoatl, god of the wind. Archeologists, who halted construction whenever artifacts appeared, decided the relic should remain in place. Today it forms the centerpiece for an indoor-outdoor display of other subway-found objects, and the Pino Suárez station doubles as a museum.

Each of the 30 stations in the three-line Metro system has a strikingly different decor and design.

Rescued by the Metro, artifacts found near the center of Tenochtitlan undergo rehabilitation. One technician cleans a polychrome figure of the fire god Huehueteotl, left; the other injects a sculptured frog with chemicals to stabilize its flaking stucco exterior.



fact that one of their own had been so favored by the mother of the Spaniards' god. Bringing the point even closer to home, the color of the Virgin's skin was depicted as being closer to that of the Indians than of the white Europeans.

The vision is said to have occurred behind the present basilica, on a hill called Tepeyac. From this vantage point I looked at the city, flung out over the valley below, its modern skyscrapers gleaming in the morning sunshine, its streets nearly empty of traffic.

On an avenue leading to the basilica, the Calzada de los Misterios (which a friend had quaintly described as "*infestada de monumentos*—infested with monuments"), hundreds of pilgrims made their way to the broad atrium, or courtyard. At the gate they knelt—men, women (some holding infants), children—and on their knees painfully crossed the scorching concrete courtyard to the church.

At the edge of the atrium three Indians wearing feathered ornaments danced to the beat of a small drum. I was almost shocked by the sight, though no one else seemed to be, and I reminded myself that Guadalupe is, after all, the Indians' own shrine.

Yielding Subsoil Imperils Shrine

From the atrium, the basilica and its adjoining chapel seem more like a mirage than a reality. The west side of the basilica, with its bell towers, stands plumb straight; the east towers and the chapel tilt crazily. Great cracks scar the walls. The explanation lies beneath the ground: The west side rests on a solid foundation of rock, the east side on the compressible volcanic clay—the mud bottom of the ancient bed of Lake Texcoco—that underlies most of the city.

I was told, only half in jest, by Señor Raul E. Ochoa, director general of the Federal District's Waterworks Agency, that when Mexicans go to Italy they never bother to visit Pisa. "Our own city is full of leaning towers," he said with a comical shrug.

As Mexico City builds higher and higher—soaring skyscrapers for business and government offices, luxurious hotels for tourists—it also sinks lower (page 659). The subsidence of the soil, as much as 25 feet in some areas since the beginning of this century, creates a particularly complex set of problems. Mexicans are solving them with an ingenuity worthy of their predecessors, the great Aztec architects of Tenochtitlan.

Tunnels Forestall a Dreadful Prospect

In his office Señor Ochoa stated the problem for me:

"The Valley of Mexico contains hundreds of volcanic cones," he said, "and the subsoil is mostly volcanic ash. The structure of this subsoil is somewhat like a honeycomb. But the honeycomb is filled with water. Remember, this was once a lake.

"If you pump out the water, as we did for centuries for our water supply, the ash particles collapse. Our water now comes from other sources, and the rate of sinking has been slowed, but between 1948 and 1950 we were subsiding at the rate of 31 inches a year in places. As more and more water was removed, the effects became more serious. The worst of these consequences was the dislocation of our sewer lines, so that instead of flowing downward out of the city they tilted up and the flow reversed. Now we must pump out our sewage and storm waters.

"If our pumps ever fail, I'm afraid we will all be swimming in sewage. I have been tormented by this staggering possibility for the past 25 years. But now we have a way out: deep tunnels, between 160 and 720 feet below the surface, to drain the existing sewer system. The sewage will flow under the mountains into an arid area north of the city."

With Señor Ochoa's assistant, engineer José Humberto Provencio, I visited some of the works. We descended into sunless shafts almost 200 feet deep and watched men and huge clattering machines digging their way out of the Valley of Mexico. It is an impressive sight with an impressive price tag—136

Inch by painful inch, pilgrims struggle on their knees across a courtyard toward the Basilica of Our Lady of Guadalupe. The basilica stands near a rocky hill where in 1531 an Indian named Juan Diego told of seeing a vision of the Virgin Mary. The event spurred the spread of Christianity across the land. Today devout Mexicans by the thousands arrive each year by bus and car and on foot to worship at this holiest of Mexican shrines. Its western bell towers, built on bedrock in 1709, stand as firm as the faith of its pilgrims, but the eastern towers and adjoining chapel slowly sag—victims of the sinking soil that plagues much of the lake-bed city. NATIONAL GEOGRAPHIC PHOTOGRAPHER GORDON W. GAHAN

GUILLERMO ALDANA E. (LEFT)

Soccer's happy hysteria: Almost hidden by confetti, a capacity crowd packs Aztec Stadium (**left**) for a play-off game in the quadrennial World Cup of soccer, which convulsed Mexico City in 1970. Seeing their own team lose in early rounds, Mexicans shifted their exuberant loyalty to the Brazilian squad, which reached the finals against Italy in an atmosphere of almost unbearable tension. Hopes vaulted as Brazilian superstar Pélé scored (**below**), plunged when Italy drew even, then burst all bounds as a scoring binge routed the Italians four to one. Frenzied fans rushed uncontrollably onto the field to tear shirts and even pants from victorious players, and the city erupted as celebrators drove wildly through the streets (**above**).

million dollars—but the digging must be done if the city is to survive.

I wondered whether, with all this digging, any important archeological discoveries had been made.

"Nothing at all," said Señor Provencio. "We go too deep for that. The archeology lies closer to the surface. The Metro people have found plenty."

The Metro, Mexico's new subway system, is one of the wonders of the city. Its trains are spotlessly clean, fast, and—because they ride on rubber tires—exceptionally quiet. The system covers 26 miles with three intersecting lines that cross the city, roughly, from north to south, from east to west, and from northwest to southeast.

Metro Brought a Cultural Bonus

Excavation for the Metro proved to be an archeologist's dream. For nearly four and a half centuries, treasures of the Aztec capital had lain buried in the mucky soil beneath the streets. Suddenly the city discovered that it was choking to death with traffic and fumes. With a dispatch that put the lie to those who claim this is the land of *mañana*, the orders went out to build a subway. Now the city is happy, and the archeologists ecstatic.

In the area of the Zócalo, magnificent discoveries had been made in the past—including the priceless Sun Stone that today is the centerpiece of Mexico's National Museum of Anthropology.* When the Metro tunneling reached here, expectations ran high.

As engineers worked around the clock, archeological recovery teams under the direction of the museum's Dr. Jorge Gussinyer watched with hawklike intensity. The teams, made up mostly of young graduate students from the museum's own school, were authorized to halt the digging at any time archeological material came to light. A fantastic amount did: painted sculptures, artifacts, bones, 40 tons of ceramic fragments, 380 burials, even a small temple. This was a circular structure dedicated to Ehecatl-Quetzalcoatl that now may be seen enshrined within the Metro's Pino Suárez station (pages 652-3). Most of the material has joined the already-rich collection of Aztec treasures in the vast, strikingly modern museum.

At Dr. Gussinyer's headquarters I visited a laboratory where white-smocked technicians

*See "Mexico's Window on the Past," by Bart McDowell, NATIONAL GEOGRAPHIC, October 1968.

Advancing in disciplined ranks, low-rent apartments invade the dry lake bed near the crouching hulk of Cerro de la Estrella. A quarter of a million persons a year pour in from villages and towns, outpacing an energetic housing program.

Rippling roof lines reflect the city's oozy foundation. Constant removal of water from subsurface volcanic ash has caused some areas to subside as much as 25 feet; new laws forbid further drilling of wells.

This 400-year-old building, now a school, once housed a hospital run by the friars of San Camilo. Their kindly ministrations to the infirm caused the roadway to be named the "Street of the Good Death."

meticulously cleaned the mud-encrusted carvings and artifacts wrested from oblivion. He showed me a huge polychrome frog, and one of the prize finds, a saucy statue of Ehecatl the wind god—gloriously drunk, grinning happily, a bulbous belly on his monkey's body, and an enormous tail jauntily draped over his shoulders.

In one corner of the laboratory a dark-haired technician carefully sprayed a muddy object with an atomizer.

"We wash off the mud very carefully with distilled water," she explained. "City water contains so much chlorine that it might harm the painted decorations on some of these finds.

"Some tourists are afraid of it, but Mexico City's water must be the safest in the world." She laughed. "What germs could live in it? All that chlorine!"

Water Pressure Supports a Skyscraper

When one of my friends began calling me the "underground tourist," I thought it time to balance my outlook. For that I went to the Latin American Tower. This was the nation's tallest building until last year, when the new Hotel de México surpassed it.

There are ample reasons for a visitor to go to the top of the 43-story skyscraper: an excellent restaurant, for one, and for another,

Teen-age breadwinner prepares leather for shoe soles in a small factory. Some 50,000 plants, ranging from such cubbyholes to vast refineries, make the city the nation's most industrialized region—and aggravate its severe smog problem.

Jobless head of a growing household lives in a two-room house with his wife and nine children. As families stream into the capital from the surrounding countryside, many settle in flimsy packing-crate shantytowns known as *ciudades perdidas*—"lost cities."

smog and weather permitting, a breathtaking view of the sprawling city. For me there was a third: How in the name of Newton, I marveled, does this building stand so tall and straight when everything around it gradually sinks and tilts?

Señor Adolfo Zeevaert, the Mexican-born, Mexican-trained civil engineer who directed construction of the building, explained:

"We sank 361 steel-and-concrete piles 108 feet into the ground to anchor the building and support more than half its weight. The rest of the load is literally floating on the muddy subsoil with a boxlike foundation 45 feet below the surface."

In the middle of the arid Valley of Mexico, a monster of a building that actually floats! And suppose the water level drops?

"We keep a constant amount of water in the soil. It is controlled by a float valve like the one in the tank of your toilet at home. When the water pressure beneath the building falls, the float falls too and opens a valve that injects more water. Automatically. We put in about ten gallons a day to restore the pressure."

Señor Zeevaert led me to a window. Below, opposite the east end of the leafy Alameda park, stood the squat, golden-domed Palacio de Bellas Artes, home of the famed Ballet

Folklórico and of a fine collection of murals by such world-renowned Mexican artists as Diego Rivera, Clemente Orozco, David Alfaro Siqueiros, and Juan O'Gorman.

"Bellas Artes represents a load of nine tons per square yard. In the past 40 years it has sunk 13 feet below the level of the original sidewalk around it. The Latin American Tower, with nearly three times the load, has not sunk at all in 17 years. And in 1957 we escaped unscathed from the severest earthquake in Mexican history, while 1,800 other buildings in the city suffered damage."

Power of Herbs Remains a Mystery

The Alameda, far below Señor Zeevaert's window, looked inviting; I decided to walk through it to escape the heat of the day. On the way I passed a *yerbero*, a vendor of herbs, who displayed his medicines on the sidewalk along a wall. I had seen yerberos in some of the markets throughout the city. Their customers swear to the efficacy of the dried plants, twigs, leaves, roots, and pieces of bark in curing all kinds of maladies.

This vendor had packed his herbs in little cellophane bags. Before each bag lay a card, neatly hand-lettered, that stated the purpose of the medicine: "Low Blood Pressure," "Bad Circulation," "Toothache," "To Stop Smoking," "Nerves," "Lack of Progeny," "Bad Memory," "Liver," and dozens more.

I purchased a bag of "To Stop Smoking," and the herb man explained that I had to make a tea of the dried leaves and take it twice a day—in the morning and before retiring. To be sure I followed his instructions precisely, I also bought a bag of "Bad Memory." I never found out whether they worked: I forgot to take the memory medicine and, naturally, didn't remember to make the anti-smoking tea.

In the Alameda I sat on a bench beneath a massive ahuehuete, a tall, old surrealistic-looking cypress. People swarmed around me, while others stretched out on the grass, strolled about, or sat on benches reading the afternoon papers or simply resting.

In Aztec times there was a market on this site. During the Spanish Inquisition the west end of the Alameda became known as the Plaza del Quemadero—Burning Plaza—because heretics were incinerated here. (Were the Spaniards any less murderous than the Aztecs?) Today the Alameda is a place of rest. Every day but Sunday.

From a jeweler's wealth, a gem of a house: It took two years to build, but in the end the family of diamond merchant Porfirio Fenton moved into a 16-room house whose quiet luxury reflects the boldness and taste of the best Mexican architecture. Beyond the bright living room, a door opens onto a balcony that overlooks the city. Two of the Fenton children play beside an indoor pool. Happy for help in their browsing, tame deer (**right**) accept a snack from daughter Maripé on the family's four-acre suburban estate.

On Sundays it becomes a place of wild entertainment. Free concerts (often hard-rock) attract thousands of Mexicans to the amphitheater near the center of the park. Vendors hawk clouds of brilliant gas-filled balloons. Children scamper unrestrained.

To see this same scene immortalized by the hand of a master, you have only to stroll across the Avenida Juárez into the lobby of the Del Prado Hotel, where a 95-square-yard mural by Diego Rivera portrays the Alameda on a Sunday at the turn of the century. There are the trees, the gaudy balloon men, the green-gold of sunlight filtering through leaves, and the masses of people.

But Rivera filled his mural with the giants, and the villains, of Mexican history: the Aztecs, the conquistadors, the missionaries, the early 19th-century revolutionaries, the benign, genius-touched figure of Benito Juárez, who was modern Mexico's George Washington, the hapless Maximilian and his Empress Carlota, whom Napoleon III sent to rule over Mexico in 1864. A lesson in history in one all-encompassing view. And all in the Alameda. On Sunday.

Young Matador Bears Many Scars

For many Mexicans—usually a capacity crowd of 50,000—Sundays mean bullfights at the Plaza México, the world's largest bullring. I went there to see Manolo Martínez perform. At 24, Manolo has become Mexico's highest-paid matador. As I watched him exercise his delicate control over the bull with graceful steps and capework, I remembered what he had told me about bullfighting: "It is a spectacle of art, not a sport."

I had met Manolo a few weeks before at his apartment on a quiet residential street. In

CHARLES O'REAR (ABOVE)

Chapultepec Park—fiesta for everyone. Colliding in a cloud of spray (**above**), young people frolic on one of three lakes that spangle Mexico City's playground for all the people. Covering more than a thousand acres near the city's core, the oasis offers attractions few other parks can rival: boat-filled docks (**right**), the museums of natural history and modern art, the superb Museum of Anthropology, fine restaurants, shaded forest, concerts, and free classes for young and old. One of Chapultepec's two zoos features baby animals for young people—no adults without children allowed.

the lobby his mailbox identified him as "Manolo Martinez, *Matador de Toros*." Upstairs, the spacious living room was filled with mementos of many battles. Manolo had just gotten up, emerging from his bedroom clad only in shorts. Long ugly scars marred his muscular legs, the results of 13 gorings in nearly 500 encounters with brave bulls.

Manolo has been fighting bulls since he was 12, he told me. He became a matador—the highest level of his profession—when he was 18. When I asked him if he was ever fearful, Manolo smiled with his dark eyes.

"*Muy poco*—very little," he said. "One thinks more about the possibility of failure than about danger."

That Sunday Manolo did not fail his enthusiastic followers, who roared "*¡Olé!*" after every pass. The bull's hoofs pounded thunderously, and Manolo stood with his feet firmly planted on the sand, artfully deceiving the beast with his blood-red cape. At the end the judge awarded him the traditional trophy for a good fight—the bull's ears. From the audience came a rain of hats and a bouquet of roses as Manolo paraded around the ring.

For those who don't care for bullfights, there are diversions aplenty in spacious Chapultepec Park. In fact, Salvador Novo, the poet-playwright-novelist who is Mexico City's official historian, once told me that in order to understand his city I had to see Chapultepec on Sunday. So one luminous morning, just as the sun was beginning to warm the thin dry air, I rode the Metro to Chapultepec.

I found the subway quite changed from its workaday aspect. The trains were filled with family groups, many of whom carried picnic baskets. They were all going to the park.

In the grand tradition of Mexico's master muralists, David Alfaro Siqueiros created

this "March of Humanity" for the auditorium of the yet-to-be-finished Hotel de México.

Whetting the appetites of passersby, a woman vends *chalupas*—garnished tortillas—and diced pork *carnitas*—"little meats." Such carryout cubicles abound in the older parts of the city.

Indulging the national craze for color, a barber recruits a tree for his canvas outside his shop on fashionable Genova Street. The Mexicans' passion for bright hues runs riot in their capital, endowing the city with a special flavor.

BOTH BY CHARLES O'REAR

In Chapultepec itself people streamed everywhere—into the Museum of Anthropology, the Museum of Natural History, the Museum of Modern Art, through the zoo, up the hill to the Castle of Chapultepec. Couples rowed in the lakes. Beneath century-old ahuehuetes, a small oom-pah-pah brass band struck up a lively, if slightly off-key, tune.

The crowds seemed thickest in one section of the park, near one of the lakes. There, dozens of picnic tables were set on the turf beneath the trees. At each a teacher supervised the work of a score or so of pupils—men, women, and youths. Each section studied a different subject—paper-flower making, watch repairing, beadworking, weaving. I eavesdropped on an English class.

"One—*uno*," the teacher called out.

"One," the class repeated obediently.

"Two—*dos*."

"Two," the class echoed.

"Three—*tres*. For 'three' you have to stick out your tongue, otherwise the word comes out 'tree.' Try it. Don't be afraid to make a mistake."

"Three," the class chorused.

Open-air School Brings Hope to Many

I sought out Señora Abad Guerrero de Gómez, who with her late husband, Adán, founded this unique school. I found her, a plump lady with lovely eyes, wandering among the classes.

Señora de Gómez told me how she had started the school in 1965 with eight teachers and 108 students. The idea had been to train unskilled people—especially women—so they could become self-supporting.

The project had received enthusiastic encouragement from the city authorities, from dozens of volunteer teachers, and from the public. Seven thousand students were now enrolled and, though they now were charged tuition, it was only three pesos (24 cents) a year to cover administrative costs.

"It wasn't easy at first," Señora de Gómez said. "We had to reach the hearts of the people. We had to make them realize how important it is to work hard and to learn. So we won't be poor. So our children will be better off. So our Mexico will be great."

From the dedicated bustle around us it was obvious that Señora de Gómez had reached the hearts of her people. And I felt that this proud and lovely city had unexpectedly revealed its compassionate heart to me. □

LULU

Bicycles Are Back— and Booming!

By NOEL GROVE
NATIONAL GEOGRAPHIC STAFF

Photographs by
MICHAEL PFLEGER

WITHOUT LOOKING, I know that the motorist behind me is angry. The rushing murmur of tires sounds too near, and the car engine revs and subsides with growing impatience as he tries to pass my bicycle on the narrow, curving road. Locked to my speed, about 18 miles an hour, we move together through a parkway's leafy tunnel of green toward downtown Washington, D.C., unwilling companions in a commuting cavalcade.

At the first open space he roars past, neck twisted for a final glare, lips moving in epithets I understand but cannot hear. I, too, am often a motorist who knows the frustration

Bumper crop of multigeared bikes decorates a car in Oregon. Fascination with these lightweight 10-speed machines has helped launch a cycling mania unmatched in the United States since horse-and-buggy days.

of restless horsepower. But, like millions of other Americans, I have mounted again the toy of my youth and found it an exhilarating new transportation tool.

Bikes are back, piloted by legions not limited to motorless youngsters; more bicycles were sold in 1972 for use by adults than by children. Europe, that bastion of bikedom, has now fallen behind the United States in total production. In 1972 an astounding 76 million men, women, and children in the U. S. had bikes to call their own. By sheer weight of numbers, they are slowly gaining acceptance in American traffic.

If they irritate the impatient, bicyclists also inspire, by the slight drama of their physical struggle, a brief camaraderie with many a fellow journeyer. Pedaling more than 1,000 miles during a summer of exploring the two-wheeled phenomenon, I encountered countless acts of motorized courtesy in Washington, New York, Boston, San Francisco, Houston, scores of small towns, and on long stretches of major highways. I basked in friendly waves and approving grins from gracious car drivers, and the almost inevitable greetings from lawn and front-porch spectators. Even the staff of New York's stately Waldorf-Astoria was seemingly non-nonplussed when I stabled my 10-speed in my room. Not a question was asked as I walked it through the opulent lobby, skinny tires mushing into thick carpets, freewheel clicking in friendly duet with a tinkling chandelier.

Cyclists Roll Up Support

As I cycled with members of the League of American Wheelmen in rolling, emerald countryside west of Salem, Oregon, an elderly sunbonneted woman hoeing a garden raised her arm in a puzzling but agreeable clenched-fist salute. Bike Power?

Bike power indeed: A growing number of municipalities are barring whole streets and parks to motorized traffic to accommodate the floods of weekend pedalers. Legislators are beginning to think bikeway as well as highway. San Francisco's Bay Area Rapid Transit system includes special lockers for commuters who cycle to the train. Most airlines will fly your bike with you for a minimal charge (under $10 for a coast-to-coast flight).

Bike power is beginning to penetrate legislative halls throughout the land. "All but a few states had some kind of bike bill proposed in the past year," said a spokesman for the Bicycle Institute of America, a New York-based trade association. "Oregon, Washington, and California passed model laws that let them use a percentage of state highway funds for bikeway construction."

Nonpolluting bikes are attractive to federal legislators as well. Last year an attempt was made in Congress to divert money from the Highway Trust Fund into bike paths. It failed, but its sponsors expect to try again. The legislation would provide at least ten million dollars annually for the states to spend on safe, separate routes for bicycles.

Oregon Leads the Way

First to break the piñata of gas-tax cash was Oregon State Representative Don Stathos, author of the law that allots one percent of that state's highway funds for bikeways.

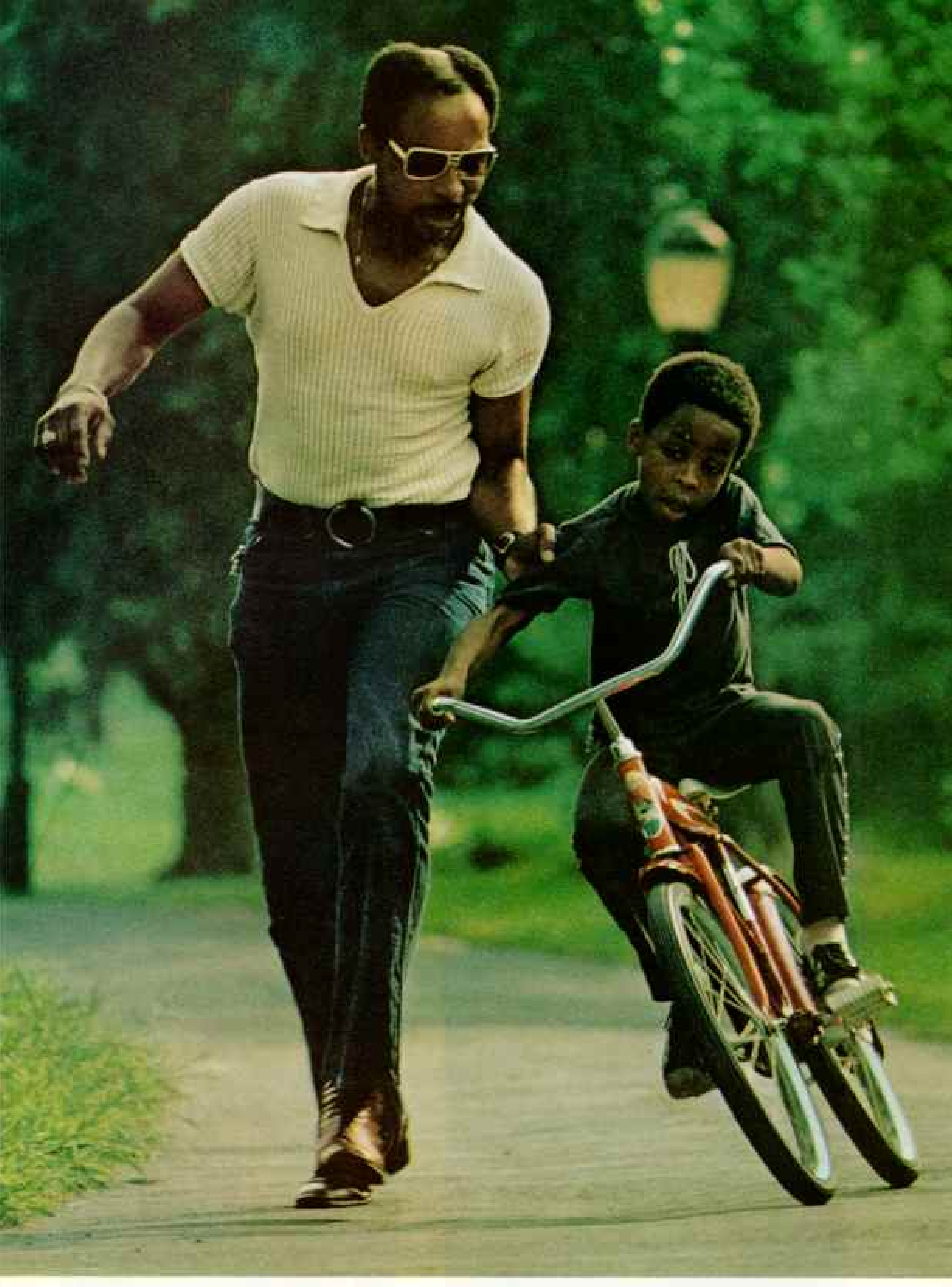
"In this country we have created a life-style that exalts comfort and then built health spas to recapture our lost vitality," said the steely-haired legislator as we joined a thousand other cyclists for a bike-promoting ride through Salem.

"The question really is, what is technological advance? It doesn't just mean how fast you can get from one point to another. It also means what kind of mental and physical condition you are in when you get there, and how you enjoyed your trip, and what kind of effect you had on your fellow citizens along the way."

One of the largest boosts to noiseless transportation stems from America's discovery of Europe's lightweight, multigeared machines. American bike makers belatedly challenged and overtook their European counterparts with superlight models of their own. "Seventy percent of our production now is in 10-speeds, which are ridden mostly by adults," said Keith Kingbay, bike promoter for Schwinn Bicycle Company.

At first glance the gear arrangement on a 10-speed appears primitive. The *dérailleur* simply moves the drive chain off one sprocket onto another of different size, changing the power ratio and thus the amount of strength required to move the vehicle forward. The finely tooled machine, however, invites prideful ownership. As a Houston cyclist told me, "The 10-speed is the sports car you always wanted but could never afford."

For many, it is also a worthy steed in the search for the Holy Grail of health. "Many forms of exercise are strenuous—sometimes



Teetering novice gets a helping hand in New York City's Central Park, where hordes of weekend pedalers glide over six miles of paths reserved for cyclists.

A toy finds a place in traffic

PROLIFERATING CYCLISTS in Central Park police their own ranks: Jay Hemphill (**right**) of the park's volunteer bike patrol hears a pedestrian's complaint. Hemphill's two-seater bristles with mirrors, flashing lights, siren, and a two-way radio. Burgeoning bike thefts have prompted compulsory registration in many states.

Long considered a youngster's plaything, the bicycle increasingly enters main streams of American traffic, for business as well as for pleasure. A postman (**upper left**) in Coconut Grove, Florida, spares his back and speeds his rounds by bike express; smaller front wheel and reinforced front fork support the heavy mail load in his wire basket and pouch.

In the abbreviated jeans of the casual cyclist, students poise at a stoplight (**upper right**) at the University of Wisconsin in Madison. More than a dozen colleges in the United States now offer courses in bike history, riding, and maintenance.

A shirtless New Yorker (**lower right**) hauls a four-footed passenger, secured with an elastic cord. Featherweight contender in Manhattan's traffic arena jockeys for a lane change in front of a taxicab (**lower left**).

Glutted roadways, ecological concern, the quest for healthful recreation, and the sophistication of geared machines have all contributed to a flood of cycling activity that has yet to ebb. In 1972, for the first time since World War I, more bikes were sold than cars. More than 40 percent of the nation's population are cyclists.

Peek at the rear in a dental-size mirror saves this cyclist a balance-threatening turn of the head. The pedaling boom has inspired an explosion of such specialized cycling equipment.

Riders fill a street in Columbus, Ohio (**opposite**), for the annual Tour of the Scioto River Valley, largest cycling event in the U. S. About 80 percent of some 2,200 entrants complete the two-day, 210-mile trip to Portsmouth and back.

NOEL GROVE (ABOVE) AND [illegible]

even painful—yet unrewarding in terms of seeing prompt results and having fun," said Dr. Sam Fox, a Washington cardiologist and a member of the President's Council on Physical Fitness and Sports. "It takes a long time before previously sedentary persons can gain the skill really to enjoy tennis or downhill skiing, and by that time many of them have given it up. Almost anyone can learn to ride a bicycle, which allows him to view his surroundings in leisurely perspective and gives him exercise at the same time."

Just how good is that exercise? For the answer I went to the man most credited with launching the boom in adult cycling. When noted heart specialist Dr. Paul Dudley White was medical consultant to President Dwight D. Eisenhower, he prescribed a sport that was rejected by his patient but adopted by millions. "I suggested bicycle riding, but he preferred golf," said Dr. White in his Boston office, where at 86 he still sees patients four days a week.

"They're both good exercise, of course. When we contract our leg muscles, they squeeze the veins and serve as excellent pumps to aid the heart in moving blood upward against gravity."

Although pleased at the thought of millions of pairs of pumps flexing on bicycles in the United States, the sprightly octogenarian is greatly concerned for cyclists' safety.

"I'm in favor of bicycling, but not on the same streets with cars," he said.

Bicycle Lobby Prompted Paved Roads

I once heard the same philosophy shouted in slightly bluer language from a passing car. The driver probably reflected the view held by many motorists—that bicycles are intruders and latecomers to the world of hard-top roads. In fact, the reverse is true.

Considered a novelty during its first 50 years in the United States, the bicycle finally erupted on the American market in the early 1880's. Horses and carriages were expensive to maintain in the cities, and automobiles were but the dreams of tinkers. Henry Ford was a machinist's apprentice in Detroit when the powerful League of American Wheelmen, one of the nation's first bicycling organizations, was busy pressing Congress for pavement—and getting it.

In those high-wheeled days when bikehood was first in flower, a fist-size rock could spell disaster for a rider who sat almost directly

DAN BURDEN

Cooling shower served up by a friend refreshes a rider in the 87-mile Labor Day race around Montana's Flathead Lake. Helmet of cushioned strips atop his cap protects the head in case of spills.

over a towering front wheel, with only a small pram-type wheel behind. Broken limbs caused by taking headers from these "ordinaries" were as common as nosebleeds in a pasture football field.

In one enchanting day I rode through the evolution of the bicycle, mounted on antiques stored in a 212-year-old barn near Hadley, Massachusetts. Roger Johnson bought his first old bicycle in 1924 and now owns nearly six dozen leg-powered contrivances. I straddled his copy of Baron Von Drais's 1817 "Draisine," little more than a hobbyhorse mounted on wooden wheels, without pedals. As a history book suggested, I proceeded to "strike the feet alternately upon the ground," and produced a jerky, rumbling, laborious motion with all the physical comfort of riding out of town on a self-propelled rail.

French carriage makers Pierre Lallement and Pierre Michaux are credited with engineering the first popular bicycle by equipping the front wheel with foot-powered cranks. Though the feet were off the ground, the wheels' size limited speed. The answer was enlargement, and bicycling entered an era of high adventure.

"Any suggestions for a safe way to handle one of these?" I asked Mr. Johnson as I pushed an ordinary out of his barn.

"Yes, take it back inside," he answered, only half in jest. Over his high-wheelers a sign tallies the seven fractures, six sprains, and numerous cuts and bruises suffered by guests adventuresome enough to ride.

Under his tutelage I placed one foot on the tiny back step, hopped three times on the other foot to gain speed, and vaulted into the saddle for a cruise in shimmying peril. Yet the ride was exhilarating, with my head nearly eight feet in the air as the 60-inch wheel churned beneath me. It was understandable why the first low-wheeled, chain-driven "safeties"—the prototypes of today's bikes—were not an instant success.

Lower Bikes, Higher Hemlines

"The men on the high-wheelers thought the dwarfish safety was for sissies," said Mr. Johnson. Speed altered their bias, for the stable safety left the lumbering high-wheelers in a tiny plume of dust.

Something else may have helped bring them down. Low-altitude cycling attracted women to the sport and rocked the foundations of the Victorian era. Up came hemlines so skirts wouldn't catch in the drive chain, and Mrs. Amelia Jenks Bloomer's dream of women in "bifurcated garments" finally came to fruition. Couples pedaled their way through two-wheeled courtships, leaving portly chaperones behind on foot. The graceful tandem bike, a symbol of happy union, still glides through our national memory to the strains of "A Bicycle Built for Two."

An era of cycling contests inspired by the low-wheelers' speed reached its zenith of masochism with six-day races—body-racking events where riders, pedaling 20 or more hours on each of six consecutive days, had to log at least 1,350 miles. Humanitarian legislation by several states soon forced the brutal sport to assume milder forms.

The magnet of man-powered speed, however, is still at work among cycling ranks.

The Amateur Bicycle League of America recognizes more than 400 annual races in the United States. For one of the most grueling contests in a sport characterized by self-torture, I went to Idaho Springs, Colorado, where 27 bikers pitted their stamina against the 14,264-foot peak of Mount Evans, and each other. From the edge of the town the route snakes upward for 28 miles, narrowing in the last punishing minutes to a frost-heaved washboard, stair-stepped with hairpin turns.

"In bicycle racing you reach a pain point, and to finish well, you've just got to push right on through it," Dave Meyers of Boulder told me the day before the race.

Rhythmic Pedaling Delays Weariness

Fatigue is a lurking foe to anyone who undertakes travel under his own power. I learned how to delay its heavy hand from Rolland Hoverstock, young owner of The Spoke bicycle shop in Boulder and employer of both Dave Meyers and another racer, Bob Poling. As I cranked my pedals at what I considered a reasonable speed in the foothills of the Rockies, he pulled alongside and suggested that I shift down one gear.

"It's harder work, makes me pedal too fast," I objected.

"Never mind," he answered. "Just count every time your right pedal reaches the bottom, until I say stop."

After 15 seconds I had turned 20 pedal strokes. "That's 80 strokes a minute, not a bad pace," he said. "Road racers go as high as 150. Try to stay at the same pace all the time by shifting down when you go uphill, and you won't get tired as fast."

I began training myself to the 80-stroke cadence. With my body grooved to a machine-like rhythm, I both increased my cruising speed and relaxed to enjoy my surroundings.

For all their steadiness the Mount Evans racers found no time for relaxation or for enjoying the spectacular views in the attic of the Rockies. Despite the freezing heights, perspiration soaked their bodies, and their eyes glazed in agonized concentration.

After the two-hour, 28-mile grind uphill, the race was decided in a near dead heat between The Spoke's Bob Poling and gutsy Mike Tinney of Aspen. Bob sprinted across the finish line a few feet ahead.

I had never witnessed a contest in which losers were so heralded. The windswept summit erupted with cheers as ashen-faced racers finishing 15 to 20 minutes behind the leader were applauded for their heroic battle against time and gravity.

Earlier in the summer I had watched a strange race in which riders seem to battle for second place. In late June, 60 regional bike-race winners seeking 14 berths on the 1972 Olympic team gathered for a showdown on the banked track at San Jose, California. One of the events, the matched sprint, pits two riders against each other for three laps, one kilometer. In the first two and a quarter laps they jockey for position at a pace that could easily be matched by a youngster on a balloon-tired street bike.

"The secret of track racing is to remain in the pocket of reduced air resistance right behind the leader until the last moment," I was told by 26-year-old Bill Harrison, a former Olympic candidate, as we watched from the track infield. "The man in front, serving as windbreak, is working at least 18 to 20 percent harder than someone right behind him."

In the battle for the wind shadow the period of the artful pause ends on the last lap. In all-out bursts of pedal-blurring speed, the riders explode across the finish line at speeds up to 45 mph.

"Riding second doesn't always work," said Harrison. "If the leader jumps out too far, the man behind loses the vacuum, and the advantage."

Accidents Await the Unwary

Few losses in the sport could be more complete than that suffered by this young onetime racer. Eight years earlier, at another Olympic tryout, a car struck Harrison as he warmed up on a street near the stadium, knocking him from his bicycle and into a wheelchair. There he remains, possibly for life.

For all the caution exercised by both pedalers and motorists, bicycle accidents have soared in grisly step with the increase in bikes. The National Safety Council estimates that bike-related injuries totaled some 40,000 in 1972. Fatalities rose to almost 900, nearly double the number a decade ago.

Pedaling proponents are calling for stricter traffic-law enforcement, for the biker is often his own worst enemy. Compensating for their disadvantage in weight, power, and speed, riders often violate traffic rules—ignoring red lights and stop signs, and riding against the flow of traffic, usually without fear of official reprimand.

For a look at successful two-wheeled integration into traffic I went to Davis, California, where a network of bikeways has become the model for bike-conscious municipalities. A mind-settling calm more typical of streets decades ago pervades this city of some 28,500, for here the cacophony of roaring engines and honking horns is giving way to the whisper of gum-wall tires.

On many a broad tree-lined avenue, two of the four lanes are marked for bicycles only. At the junction of a bike path and a four-lane highway, I negotiated my first bicycle interchange, a concrete arch across the thoroughfare, with curved ramps at each end to feed cyclists onto roadside trails. Shoppers with wire baskets mounted on their bicycles glided silently into the main business district from sprawling suburbs. A young mother took a break from midmorning chores for a cruise through a flower-trimmed park, her two sight-seeing children perched contentedly in seats fore and aft.

Long-range Solution to Traffic Woes?

As I pedaled through town, I lost, for the first time, the subconscious guilt of being a slow, foot-powered alien in a motor-mad world. In Davis's quiet streets lay ample evidence that the bicycle can help loosen the snarls and irritations of urban transportation.

"Highway statistics show that 43 percent of all urban work trips by car in this country are of four miles or less," said Marie Birnbaum, the U. S. Department of Transportation's bicycling-program officer. "If we could get that many people on bicycles, think of what it would mean to our traffic problem. As for parking, you can put 40 bicycles in the space required for two cars."

The possibilities intrigue visionary young pedalers. "We see cities eventually growing vertically, not horizontally," said 26-year-old Peter Fromm of Eugene, Oregon, a photographer and longtime cyclist. "That way you could leave large tracts of rural areas unspoiled for people to enjoy, and help keep the compact cities pleasant by depending on bikes for intown mobility."

Giant beehive cities may be far in the future, but assimilation of the bicycle with today's other means of transit seems well on its way. With bikeway construction and ecological concern marching hand in hand, America's bicycling boom could harbinger a whole new era in transportation. □

Bike becomes a crutch for author Noel Grove after loose gravel threw him onto asphalt on a downhill run near Frederick, Maryland. In ballooning accident statistics, most serious bike injuries and nearly nine hundred annual deaths result from collisions with cars. The unequal encounters have spurred construction of more than 20,000 miles of bikeways since 1962.

Cyclists claim two out of four lanes (**upper right**) in the eight miles between Alexandria, Virginia, and George Washington's Mount Vernon. A bike-mounted camera (**lower right**) captures the perils of pedaling amid roaring juggernauts in urban traffic.

ALAN W. WRIGHT (OPPOSITE) AND H. S. UZZELL III, N.G.S. STAFF (BELOW)

Bikepacking Across Alaska and Canada

ARTICLE AND PHOTOGRAPHS
BY DAN BURDEN

Afoot in a sea of mud, adventure-bound cyclists push their mounts over a rain-softened, unfinished highway in British Columbia, en route from Anchorage, Alaska, to Missoula, Montana. On more heavily traveled roads, their pennants signal their presence to motorists.

The 3,103-mile journey marks the first leg of Hemistour, an expedition launched by Dan and Lys Burden and Greg and June Siple. The ultimate goal of their 20,000-mile trip: the tip of South America.

MUD, bicycling's old nemesis, gripped us in a stranglehold. Clogging our wheels, it had slowed us to a walk on a newly bulldozed track that ripped through the wilderness like a raw wound. Now it clutched at our ankles, slopped at our knees, and pulled Greg and me to a stop in front of a wide syrupy pool. "It looks at least waist-deep in there," Greg said.

Summer downpours had softened this uncompleted gap in British Columbia's Stewart-Cassiar Highway, and heavy road-making equipment churned it into a ribbon of slate-gray muck. To our left the roadway dropped off into dense forest. On the right loomed a steep, slippery embankment. Perhaps the store owner at Dease Lake, a hundred miles back, had been right. "You're going to cross the gap with those?" he exclaimed, eyeing our equipment-laden 10-speeds. "Impossible!"

A highway worker on a completed stretch of road had taken a more optimistic view. "On bikes, well . . . you might make it through."

We needed no more encouragement; months of planning a bicycle trip from Alaska to the tip of South America had prepared us for difficult terrain. In our first 1,640 miles we had dodged rocks and chuckholes of wilderness gravel roads and strained over steep mountain passes that left us rubbery legged and gasping. We would not be stopped by a few miles of soupy bog.

"The girls have gone around it," I said, pointing. Fifty yards ahead, we saw our wives

clambering along the steep bank above the mud pool. Skittering and scrambling after them, we half-pulled, half-lifted our bikes along beside us. Under the weight of nearly 50 pounds of supplies, the tires knifed into the sticky soil. Our drive chains and gear-change mechanisms were sheathed in sludge.

Safely past the wide pool, we descended to the road for another quarter mile of quagmire. After washing in a mountain stream, we mounted again on a firm track. One more hurdle crossed—and 18,688 miles to go.

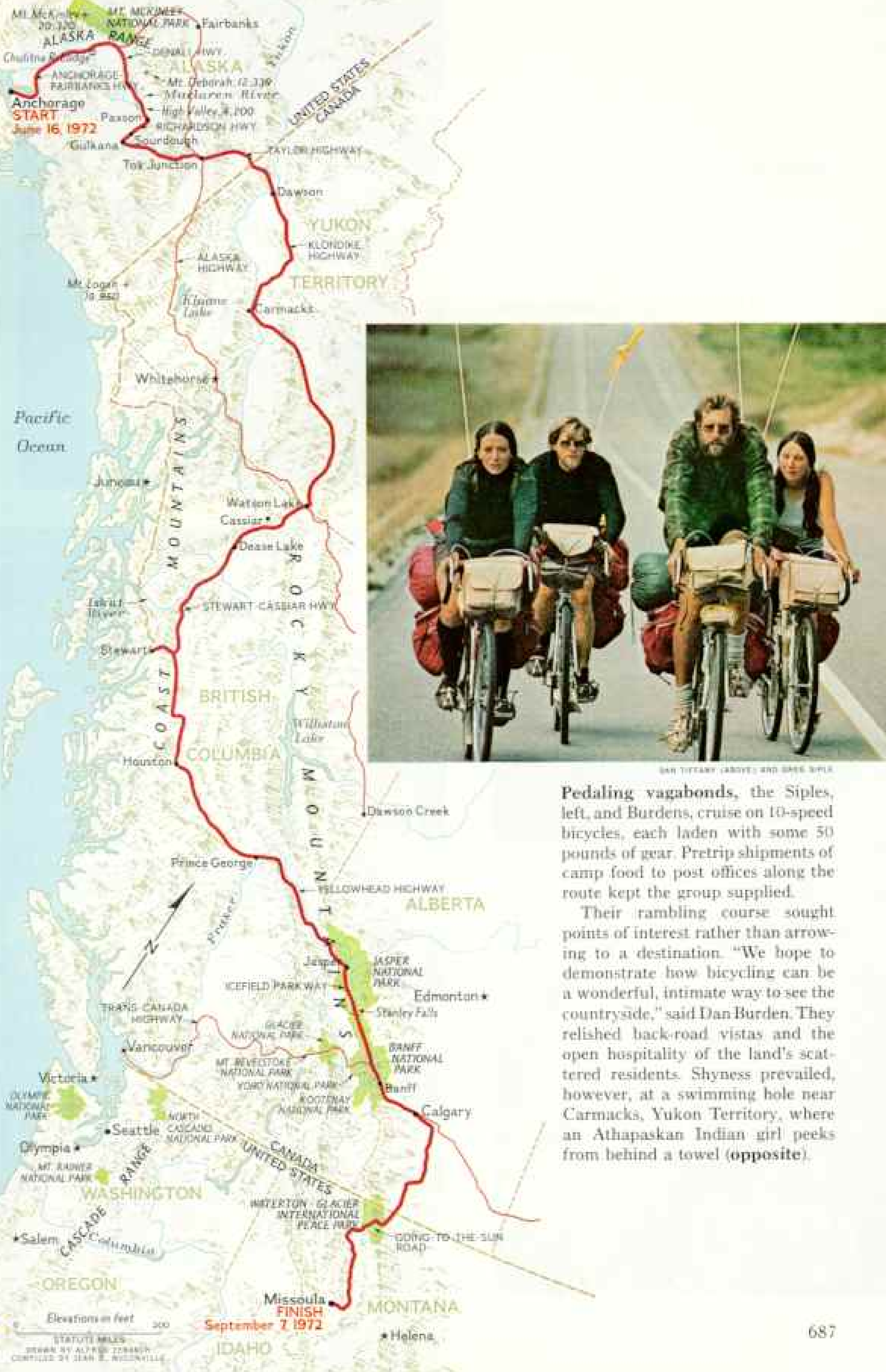
The four of us—Greg and June Siple, Lys and I—need never have seen the Stewart-Cassiar's river of mud. Easier and more direct passages exist for our two-wheeled 20,000-mile odyssey along the backbone of two continents. But we seek neither speed records nor a shorter route to Tierra del Fuego. If we are trailblazing, it is only in demonstrating the bicycle's use as an enjoyable means of transportation, simple and inexpensive.

With camping equipment and food in our rear panniers and handlebar bags, we are completely self-sufficient for a week at a time. Rain suits and down jackets let us wheel along in a wide range of climatic conditions. Best of all, we gain an intimate knowledge of the countryside from our open-air vantage point.

Six years ago I began dreaming of an extended bike trip that would span extremes of climate and culture. I soon gained a partner in Greg, 27, a longtime friend probably best known as originator of the annual Tour of the Scioto River Valley in Ohio, the biggest bicycle tour in North America (page 677). In the years of planning for our trip—now dubbed

(Continued on page 689)

Stairway to the clouds dwarfs one of the Hemistour riders near Paxson, Alaska. The road veered away from 8,000-foot Icefall Peak, right, but steep climbs challenged the group throughout most of their 84-day ride to Missoula. During a sunny rest stop, tents dampened by rain are spread to dry by Lys Burden, right, and John Likins of Cambridge, Massachusetts, one of several cyclists to join the tour for long stretches.



Pedaling vagabonds, the Siples, left, and Burdens, cruise on 10-speed bicycles, each laden with some 30 pounds of gear. Pretrip shipments of camp food to post offices along the route kept the group supplied.

Their rambling course sought points of interest rather than arrowing to a destination. "We hope to demonstrate how bicycling can be a wonderful, intimate way to see the countryside," said Dan Burden. They relished back-road vistas and the open hospitality of the land's scattered residents. Shyness prevailed, however, at a swimming hole near Carmacks, Yukon Territory, where an Athapaskan Indian girl peeks from behind a towel (**opposite**).

Road-sign confusion seems to reach its zenith at Houston, British Columbia, where a question mark brings June Siple to a puzzled halt. Canadian travelers recognize it as the announcement of a tourist information booth a short distance ahead.

A gazetteer of place-names amuses Greg at Watson Lake in the Yukon (**below right**). A workman tacked his hometown sign here 30 years ago while building the road, triggering expressions of municipal allegiance that now span some 50 yards.

A broken bike along British Columbia's Iskut River threatened to maroon Dan some 200 miles from a repair shop. Roadmakers hauled the vehicle (**below**) to a maintenance truck, where it was welded together.

GREG SIPLE (ABOVE AND TOP)

Hemistour—we met two other bicyclists who shared our enthusiasm for the project. Lys and June became our wives and, later, our companions on the long trek.

Our starting point was Anchorage, Alaska, on June 16, a date calculated to hit summer's brief "weather window" at some of the high Alaskan passes. This first leg of the three-part journey would take us to our homes in Missoula, Montana (map, page 687). At least half of this stretch would be over unpaved roads in vast uninhabited regions—a severe test of both our equipment and our wills.

After waiting out a passing storm for a more auspicious beginning, we left Anchorage in early evening.

Accompanying us during our first eight weeks on the road was John Likins, a 30-year-old librarian from Cambridge, Massachusetts, one of several bikers who joined us for segments of our route. Like most of the part-time Hemistourers, John outrode us. With our modest physiques and merely adequate stamina, we four offer living proof that long-range biking is more than a vainglorious exhibition by an athletic elite.

In the semidark of the Alaskan summer evening, we rode until midnight. Mosquitoes at our camp along Mirror Lake, 26 miles out of Anchorage, soon drove us into our tents. Exhausted from excitement, pedaling, and the lateness of the hour, we all slept soundly. Too soundly.

"Dan, where are the bags?" John called to me the next morning. The innocent question spawned an icy dread. Scrambling from my tent, I stared at the picnic-shelter roof where I had placed the saddlebags the night before, beyond the reach of prowling bears but not of greedy men. Gone were spare bike parts,

At nature's desk in a green-laced clearing, Greg pauses to write home. By careful timing, the Hemistourers sandwiched their travels into the brief northland summer, with its long days and its opulence of alpine poppy, tundra rose, Labrador tea, and lupine.

Healing carpet of fireweed, territorial flower of the Yukon, brightens a forest ravaged by flame. On the advice of Alaskan friends, salads of fireweed and other edible wild plants sometimes augmented Hemistour meals of dehydrated foods.

specialized tools, half our film, cooking utensils, a week's supply of food, and even our dirty dishes.

After phoning friends back home and requesting more supplies, we pedaled on, our loads distressingly lightened. By noon we were headed north toward Mount McKinley National Park on the new Anchorage-Fairbanks Highway.

Four days and 135 miles out of Anchorage we reached our first unpaved road: coarse gravel, loosely packed. We found it treacherous at first, like negotiating a sand beach littered with golf balls. Traction eluded us on steep climbs. Large rocks and deep gravel pockets foiled our balance. After several days we learned to pick a way through the fickle surface almost instinctively. On some 1,500 miles of soft-top road, we were to experience only one serious spill. Lys sprouted a goose-egg bump on her head, a black eye, and painful scrapes after a truck crowded her onto a soft shoulder that threw her out of control.

Cyclists Get Tips on Nature's Menu

Early on the fifth day we encountered a sign that spelled out the wilderness to come: "No gas, food, or lodging next 100 miles." We were to find many similar warnings in the northland, most of them true. A few miles beyond this one, however, we found the Chulitna River Lodge, a log building beside an airstrip.

"Motorists borrowed so much aviation fuel from us that we finally installed a gas pump," said owner and bush pilot Kent Smith, as his wife, Martha, served us breakfast.* Later she advised us about the kind of roadside fuel that would help keep our human engines burning.

"You'll find plenty of fireweed for salads in cleared areas," she instructed. "Arrowroot along the riverbanks tastes like turnips, and fiddleheads taste like asparagus. But watch out for this one," she said, pointing to a plant with spiraled leaves. "It's hellebore . . . highly poisonous."

New panniers, tools, and a week's supply of food from home were waiting for us at McKinley Park. After a day of relaxing there, we set out on the Denali Highway. Motorists had warned us to avoid its 100-plus miles of thick gravel, deep potholes, and steep climbs, but our struggles against rain and a depressing headwind were not in vain. Above timberline, we reveled in looking down on forested valleys threaded with shining rivers and dotted with crystal lakes. To the north, ice fields and glaciers cloaked Mount Deborah and Hess Mountain in the Alaska Range. "How can anything so big be so quiet," Greg mused.

Our timing was critical at this point. At the Maclaren River Lodge, where we stopped after four days on the Denali, we were told that three weeks earlier the snow had been banked five to seven feet high along the highway.

Even without snow, the skyline routes of the Alaska Range slowed us considerably. Late that afternoon we topped 4,200-foot High Valley, the loftiest road pass in Alaska. All the way up we jounced over and around large

*The Smiths' homesteading experiences were described in "Alaskan Family Robinson," in the January 1973 GEOGRAPHIC.

Off-wheel adventures in Alberta include biking up Parker Ridge in the barren splendor of the Canadian Rockies (**upper**). During an overnight stay in a Jasper youth hostel, Greg splits firewood (**above**) while houseparent Dave Schleich coaches. Cascading waters of Stanley Falls in Jasper National Park serenade Lys Burden (**opposite**) after a tingling bath in snow-fed Beauty Creek.

stones jutting from the road. Now the usual downhill relief was denied us as well. The rock-knobbed surface jolted our wheels from side to side so that steering was painful and tiring, and braking was frequent. It was an exhausting afternoon.

Bone-shaken but triumphant, we pulled onto the cushioned velvet of paved Richardson Highway on June 26. After dropping south through Paxson, Sourdough, and Gulkana, we angled northward toward Tok Junction, 75 road miles from the Canadian border. Cruising on pavement seemed almost too easy; during our second day on smooth surface, we covered 86 miles. But we had not seen the last of high passes. We rested at Tok Junction, then tackled the galloping ridges of Taylor Highway en route to Dawson.

Although we had carefully timed our passage to avoid snow, we found another seasonal hazard above timberline. Summer made a sauna of the treeless Alaskan tundra, draining our energy and raising painful sunburn blisters on our arms and thighs.

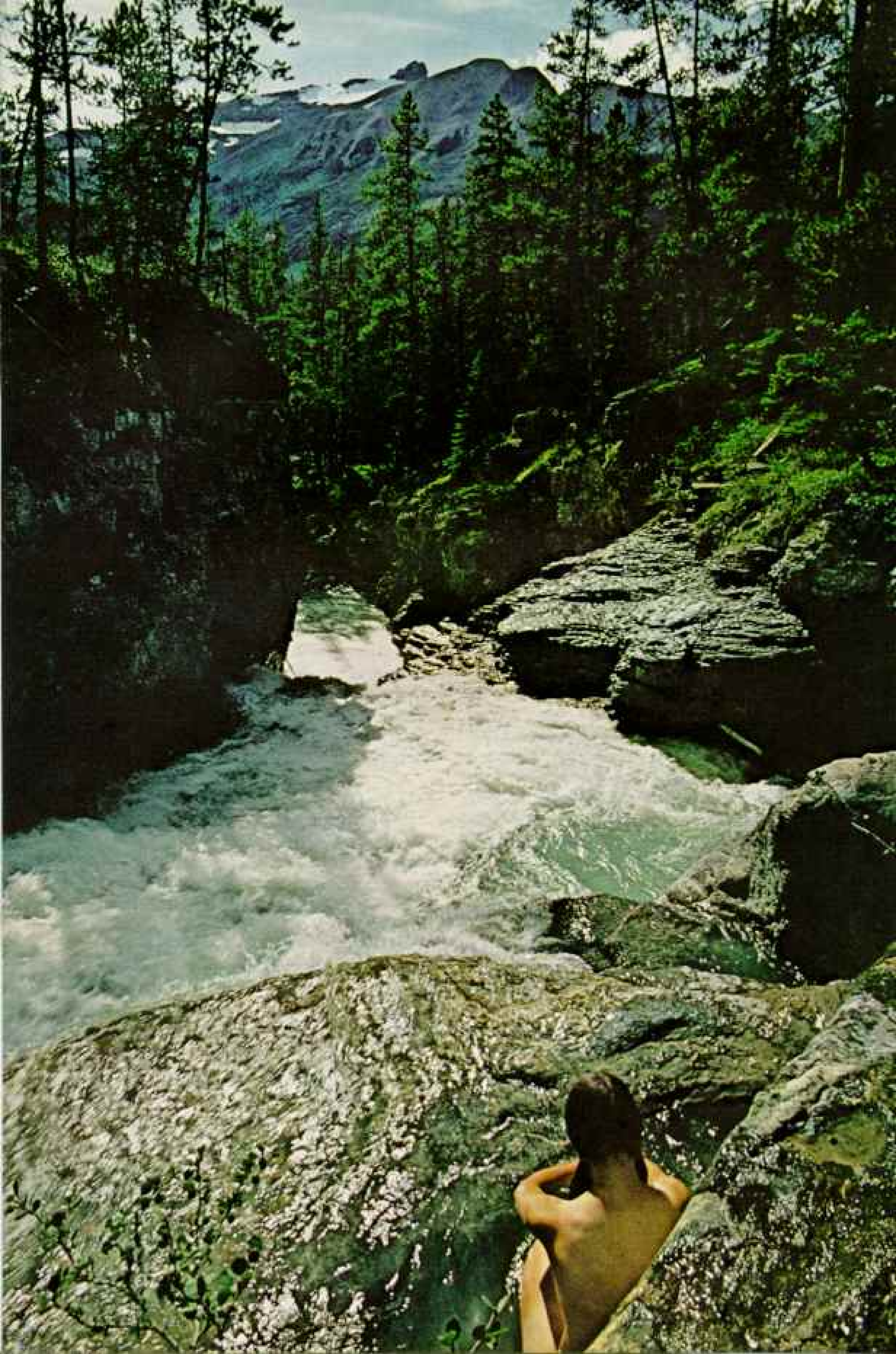
When the sun finally settled back to the horizon, the color and fragrance of abundant alpine flowers refreshed us as we set up our tents on the storied Klondike Trail. We were in the old gold-rush country, but the wealth we felt that night was in the cooling waters of Bruin Creek.

Sights and Sounds Shared at Mealtime

We celebrated the Fourth of July in Dawson, Yukon Territory, with the Tim Dennings, a hospitable family of seven who settled us into a barbershop converted into a gospel hall. After days of tenting, occasionally in the rain, its dry, windless quiet was like an answer to our own prayers.

Beyond Dawson we left the highland tundra and descended into fringes of scrubby spruce. Three days of frontier-town bustle were soon forgotten as we passed once again through the hushed wilderness. To the steady crunch of fine gravel, crackling like static beneath our tires, we often rode for hours without sighting another human being, including each other. Each rode at a different pace, and the day's adventures were recounted at lunch break and the evening rendezvous.

"I saw a moose!" reported June at the end of one day. "It scared me when it laid back its ears and spooked into the brush." We sighted numerous bears, coyotes, foxes, deer, and a lynx in the northland. But the only



creature that showed any aggression was a three-inch shrew that snarled and clicked its teeth ferociously at Greg's foot during a rest stop.

At tiny Watson Lake we were faced with a sobering fact: "We've run out of back roads," exclaimed map-watcher Lys.

Ahead lay 600 miles of the dusty, graveled Alaska Highway. Cars were coming from both directions, and the yellowish-brown haze each one stirred up hung in the air for five minutes. While talking to a truck driver, however, June learned of a new highway under construction that might return us to the wilderness quiet and clarity we had grown to relish. "The Stewart-Cassiar is primitive in places, but there is only one gap near the middle where there is no road," he told her.

Wilderness Biking Not for the Naïve

Buoyed by our successes with the Denali and rugged Yukon passages, we opted for bumps and mud against traffic and dust.

We bought topographic maps of the route from Si Mason-Wood, Lands and Mining Office agent. In recent years, Si told us, he has sold numerous maps to young people who seek land as far from civilization as they can get. "They are tired of cities, but not ready for the wilderness," he said. "Some have to be rescued, or their bodies hauled back." Week-long rescues that interrupt work have soured many residents on young outsiders, he added. I recalled the words of Ed Fortier, executive editor of *Alaska* magazine, before we left Anchorage. "Be sure to point out the hazards of bicycle travel in the north. We don't want to be inundated by dingbats."

No rescue was necessary in our journey down the unfinished Stewart-Cassiar. After our squishy victory over the gap, we were treated to hot showers, laundry, a dry place to sleep, and all we could eat at a construction company's camp.

In our final 130 miles of wilderness travel we wound across country on logging roads to reach pavement again. As I pulled onto Yellowhead Highway leading to Prince George, I saw what northlanders mean when they refer to the "Outside." Apart from the obviously higher speed of travel, the whole pace of life quickened. Now cars whizzed by, drivers staring straight ahead or honking at us to get out of their way. The change was dramatic, and we began to recall with fondness the difficult gravel roads.

The beautiful Canadian Rockies slowed us again, for we became sidetracked with day hikes to their alpine meadows, canyons, and mirror lakes. Here we discovered again the most valuable asset a bike can offer—freedom. At the cost of physical exertion and some small discomforts, the biker finds great rewards far off the car-beaten track. We felt the landscape belonged to us, just as the early trappers and mountain men must have felt it belonged to them. At night the desire for comfort and companionship lured us to the many youth hostels just off the main roads (page 692).

On August 24, 70 days and 2,651 miles into our ride, we left the mountains when we reached Calgary, Alberta. Fortune piled upon fortune, for almost immediately we picked up a tail wind that virtually whisked us across the prairie. Not that we dislike crossing mountains on bicycles. As Greg once put it: "The very struggle to get over them gives you a more intimate understanding of their size. You become acutely aware of the contours, even of the changes in temperature and environment as you change altitude."

Camp Food Takes Its Toll

Yet the prairies offered a welcome change, for our bodies were rebelling against nearly three months on an irregular diet. As we entered Montana, stomach disorders plagued the group. We pedaled laboriously in our weakened condition, and Waterton-Glacier International Peace Park's Going-to-the-Sun Road seemed no exaggeration in height.

But the home stretch gave us strength. Entering Missoula valley, we traveled our longest distance in a single day—104 miles.

In 84 days we had covered 3,103 miles, and put our equipment, ourselves, and our entire Hemistour concept to a firm test. The first leg of our odyssey was behind us. □

Bicycling virtuoso, June plays one-handed harmonica on a deserted stretch of highway. After a month's rest in Missoula, the Hemistour riders were eager to continue their southbound journey. "We are neither expert cyclists nor physical-fitness fanatics," says Dan. "We simply see the bicycle as an excellent tool for more fully appreciating our environment."

THE CAMARGUE

France's Wild, Watery South

By WILLIAM DAVENPORT

THOMAS NEBBIA

As if born of the sea's foam, half-wild horses dash across a marsh in the Camargue, heart of the Rhône River Delta. The cowboy, or *gardian*—a mounted Neptune with trident for a prod—drives the animals to one of the communal pastures serving the region's 55 *manades*, or ranches. Cherishing their solitary wilderness, their bloodless bullfights and religious pageantry, the Camarguais hold to a distinctive and independent way of life.

"THROW YOURSELF to the ground. Roll yourself into a ball. The bulls and horses won't step on you. It's an instinct they have."

This advice was given to me free of charge by a native of the Camargue, the lagoon-laced delta that the Michelin guide calls "one of the strangest, most solitary, most original regions of France."

I had seen the wild black bulls and the famous white horses of the Camargue grazing on succulent samphire, a marsh plant that cloaks this vast, soggy plain. But when I saw those savage bulls stampeding toward me at the *abrivado* at Saintes Maries de la Mer, I decided to throw myself not to the ground but into my car, from which I had a box seat for one of the wildest melees I have ever witnessed.

Saintes Maries, a Mediterranean village of 2,300 souls, is the "capital" of the Camargue. The abrivado is the galloping of bulls through the streets of the town to the arena. The road in front of Boisset's café was jammed with a throng in holiday mood for the Pentecost, which the Camarguais celebrate with High Mass—and bloodless bullfights.

"Look out! Here they come!"

The coffee-sipping tourists on the café terrace rose expectantly. Strolling crowds divided like the waters of the Red Sea before six black bulls charging down the street, flanked by six *gardians*, or cowboys, astride their fast little white horses. Armed with long tridents, the gardians looked grim beneath their wide-brimmed hats, determined to drive the herd intact into the arena.

Crutches and Flour—and a Custard Pie

The crowd was equally determined to separate at least one bull from the rest and enjoy the ensuing pandemonium. A thousand aficionados were now waiting, armed with firecrackers, bags of flour, sticks, and even crutches to trip the horses.

THOMAS HOBBIA (OPPOSITE) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER BATES LITTLEHALES

The firecrackers boomed, the flour bombs burst in the gardians' faces. One lad threw a custard pie. Then, to my amazement, two brawny young men *did* throw themselves under the thundering hoofs. When the clouds of flour, dust, and firecracker smoke cleared, they were not only alive—Saintes Maries is a town of miracles—but they had succeeded in detaining one of the bulls. One boy was wrestling its horns, the other yanking its tail. After about five seconds they relinquished their holds and ran for their lives.

The outraged bull charged the clients on

Hilarious melee highlights the *abrivado,* the running of bulls from ranch to arena. Here at Saintes Maries de la Mer, youths bait a snorting dynamo with firecrackers and tail pulling. Spirited Camargue bulls star in rings throughout southern France.

Little Rome of Gaul, the ancient city of Arles (**left**) marks the Camargue's northern limit. In Roman days crowds filled the Arles arena to cheer chariot racers and gladiators; today they throng to bullfights.

NATIONAL GEOGRAPHIC PHOTOGRAPHER OTIS IMBODEN (ABOVE), BATES LITTLEHALES (BELOW), AND THOMAS NEBBIA

Camaraderie at roundup: Gardians toast one another, the bulls, and the Camargue at an open-air breakfast before an abrivado at Aigues Mortes. Then the horsemen gallop their horned charges past the 13th-century walls and through a gantlet of daredevils. Once in the ring, the bulls reign. An announcer calls out each animal by name for a contest that pits him against about twenty young men. Their goal: to rob the bull, not of life, but of a small rosette strung between his horns. One challenger quits the ring in a frantic leap (**below**). A good bull can "see with his horns," say the Camarguais; if he keeps his decoration for 15 minutes, he wins the crowd's respect and the "fight" is over.

Boisset's terrace. Half of them rushed into the café. The rest scrambled to the roofs of nearby cars. The local traffic policeman found refuge in a tamarisk tree. The bull gored the chairs and tables on the terrace, turning them over with a great clatter. Then the gardians rode up with their tridents and goaded the bull to the small whitewashed arena at the edge of the Mediterranean.

The sea is the southern boundary of the 289-square-mile Île de la Camargue, heart of the Rhône Delta. The river divides above the old Roman city of Arles. The Grand Rhône flows southeast, the Petit Rhône southwest, to sculpture a water-spangled plain of great diversity (map, page 705).

Rice and Salt Pour From the Camargue

In the northern part of the plain and in the Petite Camargue on the Little Rhône's right bank, 100,000 acres are planted to rice, grapes, and other produce. The Camargue grows 100,000 tons of rice a year, enough to satisfy the needs of all France. Thirty thousand acres of the coastal area shimmer with the salt flats exploited by the company Les Salins du Midi, yielding 1,700,000 tons of sea salt annually.

Yet the productive region shelters a 26,000-acre wilderness, a paradise for migratory birds: the Zoological and Botanical Reserve of the Camargue, run by the French National Society for the Protection of Nature.

The rest of the Camargue, including 4,000 acres of communal grazing grounds and 55 ranches, is consecrated to the raising of bulls, which have always fascinated Mediterranean peoples. There are bulls, escorted by horses, painted 15,000 to 30,000 years ago on the walls of the Lascaux Cave in France. The veterans of Caesar's Sixth Legion fought under the emblem of the bull. They were given land in the Insula Camarica after helping conquer Marseille in 49 B.C. One of their favorite gods was Mithras, whose sacred bull symbolized virility and courage.

The cult of the bull is still strong in the Camargue. I followed the crowd to the arena to watch a Provençal bullfight, which the Camarguais call a *course libre*, a free-for-all: some twenty unarmed men pitting their speed and courage against the brute strength and agility of the bull.

The bulls wear a *cocarde*—a rosette—tied between their horns, as do certain bull statues of ancient Greece. A prize goes to the best bull of the day, who usually keeps his cocarde intact during his 15 minutes in the ring.

The men who attempt to snatch the cocarde are called *razeteurs*, a Camargue word for those who come as close to the bull as a razor to the skin. Dressed all in white, they fight for glory and a pittance, a few dollars, put up as a prize by local merchants. The razeteurs take all the risks, like dancers in a dangerous ballet. It is no disgrace to flee before the bull. The red badge of courage is often a bloodstained rip on the back side of a razeteur's white pants as he leaps across the safety barrier.

The bulls are the kings of the ring. They get all the publicity, with their names in headlines, followed in smaller type by the name of the *manade*, or ranch, from which they come. The *manadier*, the ranch owner, gets from $100 to $500 each time one of his bulls appears in the ring. The price depends on the local fame and pugnacity of the bull. Some manadiers must supplement their income by renting horses to tourists, operating small dude ranches, and selling their less pugnacious cattle to the abattoir.

Did Greeks Bring Bull-leaping to France?

The star of that Pentecost afternoon was a fast and aggressive bull named Tamarisso. With a long narrow face and lyrelike horns, he looked more like the sculptured bull's head of the 16th century B.C. dug up at Mycenae than one of the massive, broad-headed victims of the ritual butcheries of Spain. His physiognomy and the resemblance of the course libre to 3,000-year-old frescoes in the palace of King Minos of Crete, showing bull dancers vaulting over the backs of charging bulls, suggest that perhaps Greeks brought this type of bull and bullfight when they founded Marseille about 600 B.C.

Tamarisso was a terror. When he charged the razeteurs, they dispersed like white lights bursting from a Roman candle. They leaped the wooden safety barrier with the grace of

A man to tramp the marshes with: Francis Barre's knowledge of the delta's watery terrain and rich wildlife earned him a post as gamekeeper for a hunting club. Birds displayed on the walls represent some of the dozen species of ducks that winter in the Camargue.

OTIS IMBODEN

Flamenco rhythms and fanciful predictions fill the streets when Gypsies come to Saintes Maries de la Mer. Young guitarists, strumming, singing, and dancing as they go, serenade a happy couple celebrating the christening of their infant. A fortune-teller (**right**) pauses over a palm, scanning the horizons of her mind. Horse traders, car dealers, and musicians, the Gypsies enjoy a special affinity with the Camarguais, who also distrust any authority that would curb their free ways.

Two arms of the Rhône, which divides above Arles, trace watery boundaries for the 289-square-mile Île de la Camargue, almost half the marshy delta. Lakes, salt plains, and sand dunes have yielded in many areas to dikes, canals, and fields. Now wine, and rice enough to feed all France, pour from the land, and prosperity grows, though many lament the loss of wilderness. But vast seaward sweeps remain a wildlife sanctuary, banned to casual visitors.

OTIS IMBODEN (LEFT) AND BATES LITTLEHALES

Olympic hurdlers. Once Tamarisso hurdled the barrier himself. In the ensuing bedlam, the bull galloped down the safety corridor, while photographers dived under and over the fence.

Tamarisso kept his cocarde, and was proclaimed the best bull of the afternoon. The spectators were then invited to descend into the ring to fight with a frisky young bull with his horns encased in leather. The two boys who had captured the bull at the abrivado jumped into the ring and performed a hilarious parody of Spanish matadors, replete with the overweening, strutting pride of that species. But one of the boys didn't run fast enough. He was tossed high into the air and landed almost in the spectators' laps.

I interviewed these two suicidal fellows after the free-for-all, and learned that they were waiters in a local hotel. Ahmed was an Algerian; Bonito was an Andalusian Gypsy; both were Camarguais by adoption.

"We could make twice as much money in Paris," Bonito said, "but here we can run with the bulls, the most exciting thing in the world. In the Camargue one is free."

"One of the Rare Countries"

Bonito's phrase echoed a sentiment I had read in a book, *Magic of the Camargue*, by Denys Colomb de Daunant, a leading manadier of the delta: "I have one sole passion, that of the free life in one of the rare countries where a man can still be free."

That night my wife, Roselle, and I went to dine with Denys Colomb at his Manade de Cacharel. We drove past a solitary black-thatched gardian's cabin into the private road of the Cacharel Ranch. To the northeast lay the Étang de Vaccarès, the huge brackish lagoon that is the heart of the Camargue. It is also the center of the 26,000-acre Zoological and Botanical Reserve, refuge for some 300 species of birds, including ducks, purple herons, egrets, and flamingos.

On our left among the ferny tamarisk trees and marsh samphire, a herd of white horses glimmered under the gathering cloak of night like figures in a classic frieze. Utterly placid, the lagoon on our right had turned wine dark. A white heron, motionless as a statue in a garden pool, suddenly swept upward into the vast stillness of the night sky. Then, under the silence, we heard the croak of a frog, a splash in the dark water, mysterious murmurs—the night music of the Camargue evoking the submerged origins of life in marshes such as this.

Denys Colomb de Daunant received us in the comfortable living room of his white-washed ranch house. A well-groomed gray-bearded man in his 50's, he was dressed in

OTIS IMBODEN (ABOVE) AND BATES LITTLEHALES (OPPOSITE)

Master of his craft, saddler Jean Mison shows a 6-year-old grandson the result of a hundred hours of hand labor. The Camargue saddle, with its high pommel and cantle and cagelike stirrups, helps absorb the rough jolts that go with breaking horses and herding bulls. The narrow seat resembles that of Crusader saddles.

Keeper of tradition, Denys Colomb de Daunant writes poems about the Camargue, records its glories on film, and raises bulls for its rings. Saddles line a hallway beyond a photograph of a 1911 abrivado.

the formal attire of a gardian: moleskin pants, boots, a printed Provençal shirt with a scarf, and a black velvet jacket. His brown eyes, the eyes of a mystic, were as warm as the fire in the grate.

We dined on locally produced mullet, asparagus, rice, and strawberries, complemented by the salt of the Camargue and a fine dry rosé wine from the Petite Camargue.

"I am a manadier," Denys said. "It is my duty to raise and preserve the bulls that are the oldest symbol of our way of life."

We learned that the 55 manades in the Camargue have 12,000 bulls and some 3,000 of the swift white horses which the gardians use to herd them (pages 696-7). There are approximately a thousand bullfights a year in the Camargue and in the neighboring region of Languedoc.

"All arrangements for our bullfights are made by verbal agreement," Denys said. "We don't like paper work. We detest the central bureaucracy of Paris and anything else that threatens our traditions. There are no stud fees for our horses or bulls: You lend your stallion to your neighbor if he wants your stallion's blood. Either a man knows how to live or he doesn't."

Denys spoke with admiration of the Gypsies and their imminent annual pilgrimage to

Like a vision from a vanished world, Camargue horses splash across a

THOMAS NEBBIA

flooded plain. The white breed has flourished here since Roman times.

Saintes Maries to honor their patron saint, Sarah the Egyptian.

"There will be about 15,000 of them from all over Europe," he said. "They are great horse traders, and we honor them for their pride and independence. A Gypsy will never steal more than he needs," he added.

Manadier-Poet Became a Hero

As we left, our host gave us a book written in Provençal, the old local language. It was an anthology of poetry: *Flowering of the Gardian Nation, Poems Inspired by the Camargue and Its Bulls.* The most impressive poems were by Denys's grandfather-in-law, the Marquis Folco de Baroncelli-Javon, greatest manadier of the Camargue. He founded La Soucieta de la Nacioun Gardiano in 1907 "to maintain and glorify faith in the bull, the Arlesian costume, the traditions of the Camargue, and the flowering of the Provençal tongue."

Like most poets, Baroncelli was a prophet. When agricultural developers first tried to "reclaim" the primitive wilderness of the Vaccarès, Baroncelli sounded a tocsin that foreshadowed our contemporary concern with ecology: "Go back, foolish destroyers! Do not pass the limits of Nature. If you think yourselves masters, just wait until the end."

Baroncelli, who died "in exile" in Avignon in 1943 during the Nazi occupation of his beloved Camargue, remains a dominant spirit 30 years later. Exhumed in 1951, his remains were escorted by the gardians of the Camargue to a final resting-place at Saintes Maries. As the cortege entered the Camargue, the bulls joined it, bellowing in the lugubrious *ramadan* with which they mourn the death of a fellow bull.

I have heard no one in the delta refute this story. The Camargue is a place where legends remain alive and miracles are real.

The most famous miracle took place about A.D. 40, when Mary Salome and Mary Jacobe, both close followers of Christ and first at the scene of His Resurrection, were set adrift from the Holy Land in a boat without sails, oars, or provisions. The two Saint Marys arrived in the Camargue, accompanied, according to an old Gypsy tradition, by their black servant, Sarah.

Once ashore, the saints built an oratory over a miraculous spring that still exists inside the splendid 12th-century fortress-church of Saintes Maries. When they died, after converting the local Gallo-Romans to

"Long live the Holy Marys!" Fervent worshipers carry statues to the sea on May 25, climax of one of France's oldest pilgrimages. The crowd honors Mary Salome and Mary Jacobe, who bore witness to Christ's Resurrection and, says a Camargue tradition, came here accompanied by a servant girl, Sarah. Gypsies venerate Sarah as their own patron saint and join the crowd, raising the joyous shout, "Long live Sarah!"

NATIONAL GEOGRAPHIC PHOTOGRAPHER GORDON W. GAHAN

Christianity, they were buried in the oratory. In 1448 their bones were exhumed by King René of Provence, "authenticated," and placed in a double reliquary in the upper chapel of the church. These relics (no trace of the faithful Sarah was found) are let down by ropes from the high chapel on special days three times a year.

Though never canonized, the mysterious Sarah is venerated by the Gypsies. Every time somebody chants *"Vivent les Saintes Maries,"* they shout a fierce antiphony, *"Et Sainte Sarah!"*

Statues of the two Marys stand enshrined in their sculptured boat in the nave of the church, but Sarah's dark effigy is ensconced in the shadowy crypt next to a pagan altar with a depression that once received the blood of bulls sacrificed to Mithras.

On the night of May 23 I joined the Gypsies in the church for their all-night vigil. A thousand candles burned in the crypt, their flickering light reflected in dark Gypsy eyes. While the tapers melted to hot coils of wax in the stifling heat, the Gypsies vied with each other in providing Sarah with suitable raiment: pink satin dresses, blue rayon capes, seed pearls, rhinestone diadems, and all the

tinseled frippery so dear to Gypsy hearts.

In the morning, after the relics of the two Marys had been let down on ropes from the high chapel, Sarah was dressed to her eyes. The Gypsies, escorted by Denys Colomb de Daunant and 18 mounted gardians, carried their patron saint to the beach to be sprinkled with the Mediterranean water that allegedly brought her to Provence.

Fortune-teller Adds to Her Fortune

That night, while Boisset's café throbbed with flamenco music and the staccato *tapateo* of Gypsy dancing, the inevitable happened: I was accosted by a Gypsy fortune-teller.

"Don't be afraid of the Gypsies," she said, grabbing my hand.

Dressed in bright emerald green, she had a time-ravaged face and a glass eye, in spite of which disability she read my hand in record time. I was a stranger from a far-off land, she said, and I would have a long and happy life. I proffered five francs for this remarkable divination and cheerful prophecy, but that was not enough.

"Monsieur," she said plaintively, catching my hand again as though in a steel trap, "I have many children, many mouths to feed."

Not wishing to incur a malediction, I gave her five more francs. This was satisfactory. I watched her stroll across the café terrace in her swinging green skirt and needle heels. When she reached the curb, she stuck my five-franc notes into her emerald-green stocking, got into a late-model emerald-green Mercedes 220, the kind I have always yearned for, and drove off.

Roll on, little Romany cavaran!

May 25, the feast day of Saint Mary Jacobe, was an occasion of far greater ecclesiastical splendor than that accorded Sarah. The Archbishop of Aix en Provence was there, dressed in vermilion taffeta with a miter of scarlet and gold. Many of the pilgrims were turned out in full Arlesian fig, the women in long skirts of blue, black, or burgundy velvet, their bodices set off by flattering fichus of white lace, their hair swept up under white organdy caps.

Thirty-two gardians escorted the images of the two Marys, inseparable in their sculptured boat, to the beach. Then the cavalcade splashed into the water (preceding pages). From the beach the Archbishop of Aix blessed the sea, while the saints stared out at the horizon, serenely impervious to the devotion they inspired.

When the two Marys were restored to the church, I talked with the curé, Father André Heckenroth, about Sarah's inferior status.

"There's no evidence of her existence," Father Heckenroth said, "so she can't be canonized. But the church is pragmatic. If the idea of a Saint Sarah helps the Gypsies to pray, so much the better."

"The Gypsies are very touchy about Sarah," a townsman added. "In 1967 the national Chaplain of the Gypsies came here from Paris and tried to desanctify Sarah. He told the Gypsies her existence was doubtful and that she would be replaced in the crypt by the Virgin Mary. The Gypsies didn't like it. They grabbed the chaplain and threw him into the sea. He stayed there a long time; the Gypsies were waiting on the beach with their knives out. The Archbishop of Aix had to rush to the scene and reassure the Gypsies: Sarah would not be replaced."

No wonder the gardians like the Gypsies, passionate traditionalists like themselves!

How to Confuse the Tax Collector

As we continued to explore the Camargue, we met people whose passion for individual freedom sometimes bordered on anarchy. At Aigues Mortes, the walled town built by King Louis IX as embarkation port for the Seventh Crusade in 1248, we met two adopted Camarguais, a sculptor and his wife living on a barge on the Rhône-Sète canal.

"We worked for three years in Lyon to buy our barge," the sculptor said. "Now we're here in the Camargue and live the way we like. We're independent. Our domicile can move around. That confuses the tax collector."

The tax collector. The Camarguais, with his resentment of the centralized bureaucracy of Paris, must be the national champion of evasion. One manadier told us with obvious glee about one of his tax-dodging gardians.

Arch of tridents honors Olivier Pastré and his bride as they leave the 12th-century fortress-church at Saintes Maries; the colors of the Counts of Pastré flutter from the poles. A company of horsemen in broadbrimmed hats and black velvet jackets adds drama to every event in the Camargue, from christenings to funerals.

OTIS IMBODEN

Lazing in the sun, the fishing port and resort of Le Grau du Roi straddles a shallow barge canal that runs to Aigues Mortes. In the 13th century all the surrounding countryside swarmed with armored warriors. Planning the Seventh Crusade, King Louis IX used these sheltered lagoons as rendezvous for his fleet. For decades after, ships loaded with silks and spices from the Levant sailed through Camargue waterways to Aigues Mortes.

Mellow glow of candles lights a dinner party in the Listel Winery near Aigues Mortes. In these huge oak casks age 500,000 gallons of *vins des sables,* "wines of the sands." To remove sea salt from sandy low-lying fields, vintners flush them with Rhône water twice a year. On other fields, the salt itself is the crop. The winery's parent company, Les Salins du Midi, takes some 1.7 million tons of salt a year from pans in the delta. Last year the company, owner of a third of the Camargue, donated its wilderness property around Étang de Vaccarès to the French Government for a permanent wildlife preserve, the National Nature Reserve of the Camargue.

BOTH BY OTIS IMBODEN

"Jacques was put in jail for not paying his taxes," the manadier said. "After he got out, he received a second notice of payment due. He wrote on the envelope, 'Deceased January 19, 1969,' and sent it back to the Minister of Finance. He hasn't been bothered since.

"Down here it's a point of honor to avoid taxes. After all, even a sheep won't bring his wool voluntarily. Only a human being will do that."

77-year-old Heroine of the Camargue

The most venerable incarnation of the Camargue spirit is a *manadière*, a lady named Fanfonne Guillierme, still in the saddle at 77. Hailed half a century ago as "Queen of the Gardians" by the Languedoc poet Paul Vezian, Fanfonne was the first woman to ride astride in the Camargue. She received me in the vaulted Gothic salon of her house, once part of the 13th-century Abbey of Psalmody.

"My grandfather was a lawyer in Paris," said Fanfonne, "but my heart was always here in the south where our family had its roots. I rode horseback almost before I could walk. When I entered a salon in Paris, my mother used to say, 'Bring her a saddle if you want her to stay.'

"Back in 1904 she gave me a calf for my very own. That was the beginning. Now I have 172 bulls on my manade. Having bulls is like being under the protection of God.

"I was like a daughter to Baroncelli. Back in 1907, a flood swept his manade and killed half his bulls. They brought the rest here, including the famous Prouvènço. He was a splendid bull. His name on a poster was enough to pack the Roman arena of Nîmes with 18,000 people.

"Of course he was just a young bull when he came here. One of our men tried to pat him. With a buck of the head, Prouvènço nicked him in the hand. It was very disagreeable for our gardian," Fanfonne said with a wicked smile, "but we knew we had a good bull. The important thing is for a bull to be pugnacious. They get a good start at the *ferrade*. Have you seen a ferrade?"

I had seen this branding of yearling bulls at the Thibaud Manade, and that brush with the human race should be enough to make a young bull combative for the rest of his life. The gardians separate a yearling from the herd and drive him with their tridents into the waiting arms of assorted adolescent bipeds. These seize him by his budding horns and baby tail, wrestle him to the ground, and sit on him until the branding is accomplished. Then he is thoroughly teased and baited before being allowed to scurry back to his mother. If a Camargue bull has any memory at all, he will not be sweetly disposed to the razeteurs. He will feel toward them about the way a Camarguais does toward Paris bureaucrats.

Fanfonne cast new light on the old conflict between Paris and the southern provinces. "The central government decided to exterminate our mosquitoes," she said, "to promote tourism on the beaches. They sent a 'demosquitoing expert' to spray the region. Of course they never consulted *us*. They never thought about spoiling our crops with chemicals and killing the fish and frogs that

BOTH BY HANS W. SILVESTER, RAPHO GUILLUMETTE

White thunderbolts, stallions spar and parry in a contest over a mare. Well adapted to the delta's marshy ground, the agile horses avoid treacherous bogs as if by instinct while carrying gardians across the Camargue. To keep these males from harming each other, they were separated and sent, each with a harem of 20 mares, to different pastures.

Born in the wild, a foal will not feel the saddle for three years—about the time its coat begins to turn white. The ponies are so independent, a local legend holds, that when Napoleon ordered some and confined them to stables, they refused to eat and died.

In an Eden of swaying reeds, a young horse feeds on tender shoots. Gardians

HANS W. SILVESTER

once built entire houses of the stiff grass, and still thatch their roofs with it.

feed on mosquitoes. This government expert was flying around in a plane spraying our fields without so much as a by-your-leave.

"We were all grumbling, shaking our fists, and holding protest meetings when a student from Pérols grabbed his rifle, took a bead on the plane, and shot. He's a very good shot: He punctured the gas tank, and the expert had to make a forced landing. There was an investigation, but nobody would divulge that boy's identity. As far as I am concerned, they should erect a statue to him. One must strike a blow for tradition."

Camargue Museum Honors Its Own

Another gardian traditionalist, Joseph Dupin, better known as *Lou Boumian*, Provençal for "The Gypsy," created the Wax Museum of Saintes Maries. He conducted Roselle and me through his exhibits. Among the best are Vincent van Gogh painting the red and green boats he immortalized in his *Les Barques aux Saintes Maries*, and the effigy of the Marquis de Baroncelli in his typical whitewashed gardian's cabin.

"Look at this," Lou Boumian said, as we came to a lively tableau of the Boisset café in the old days. "Everybody is real. I knew them all. There I am myself, working as a waiter. That's old man Boisset at the cash register. He was a lousy boss, very stingy. I always managed to bang him with my tray as I passed by.

"Here are the Holy Marys of the Sea," he announced, as we stopped before two waxen figures in a boat with a sail.

"You have downgraded the miracle," I protested. "The legend says the Holy Marys were set adrift with neither oars nor sail."

"Monsieur," he replied, "let's be logical. One does not come all the way from Palestine to Provence without a sail. *Je suis un peu athée*," he added—"I'm a bit atheist."

The most striking scene in the wax museum is not in wax. It is a masterpiece of taxidermy called the Council of the Egrets. Thirty of these snow-white crested birds are perched in the bare ruined choir of a leafless tree.

"I hunted those birds and stuffed them myself," said Lou Boumian. "If the egret ever disappears, my egrets will be here to show people what they looked like. It's against the law to hunt them," he added, "but I did it."

This local penchant for independent action was affirmed a few days later by Jacques de Caffarelli, curator of the Zoological and Botanical Reserve of the Camargue, as we waded hip-deep through its marshes.

"The Camarguais feel that law and legality are for others—not for them," he said. "Le Grand Caf," as this 71-year-old is affectionately called, was referring to poaching.

"Though there is little poaching any more, we can't entirely stop it," he said. "We have only three guards, and our local poachers know the reserve as well as the guards do. They come at night, hunt at dawn: duck, goose, beaver, even wild boar, of which there are only about a hundred left. One of the local hotels serves a dish plainly marked '*Terrine de sanglier de la réserve:* Terrine of wild boar from the reserve.' They say it's rather good," he added wistfully.

But poachers are the least of Caffarelli's problems. He worries about jet planes that frighten the nesting flamingos, the gull-billed terns, the pratincoles, and the squacco herons. He is troubled by the thousands of camper vehicles and trailers that are turning the 30-mile-long beach of Saintes Maries into a "sewer." And he is concerned about the rice planters, whose plantations already encompass more than 50,000 acres of the Camargue.

Rice-growing Threatens the Marshes

"The planters use the water of the Rhône," said Caffarelli. "They also use hormones and herbicides for more efficient production. When the rice water is drained off into our ponds, it affects the vegetation and fish and upsets the ecology. What is needed is a big new pumping station to pump the effluents back into the Rhône. It would do little further damage to that much-polluted river. There is already too much buildup of herbicides and hormones in the Vaccarès. If this is not stopped, the whole existence of the Camargue as a natural wilderness is in jeopardy."

André Daher, a retired Marseille ship owner, was recommended to me as a model rice planter: "He doesn't pollute. His effluents go directly back into the Rhône."

A big bright-eyed man of 82, André Daher received me in his "bungalow," a two-story house on the left bank of the Grand Rhône. Adopting the Camargue 27 years ago at the age of 55, Daher bought 60 acres and now has 825, planted to wheat, alfalfa, and rice.

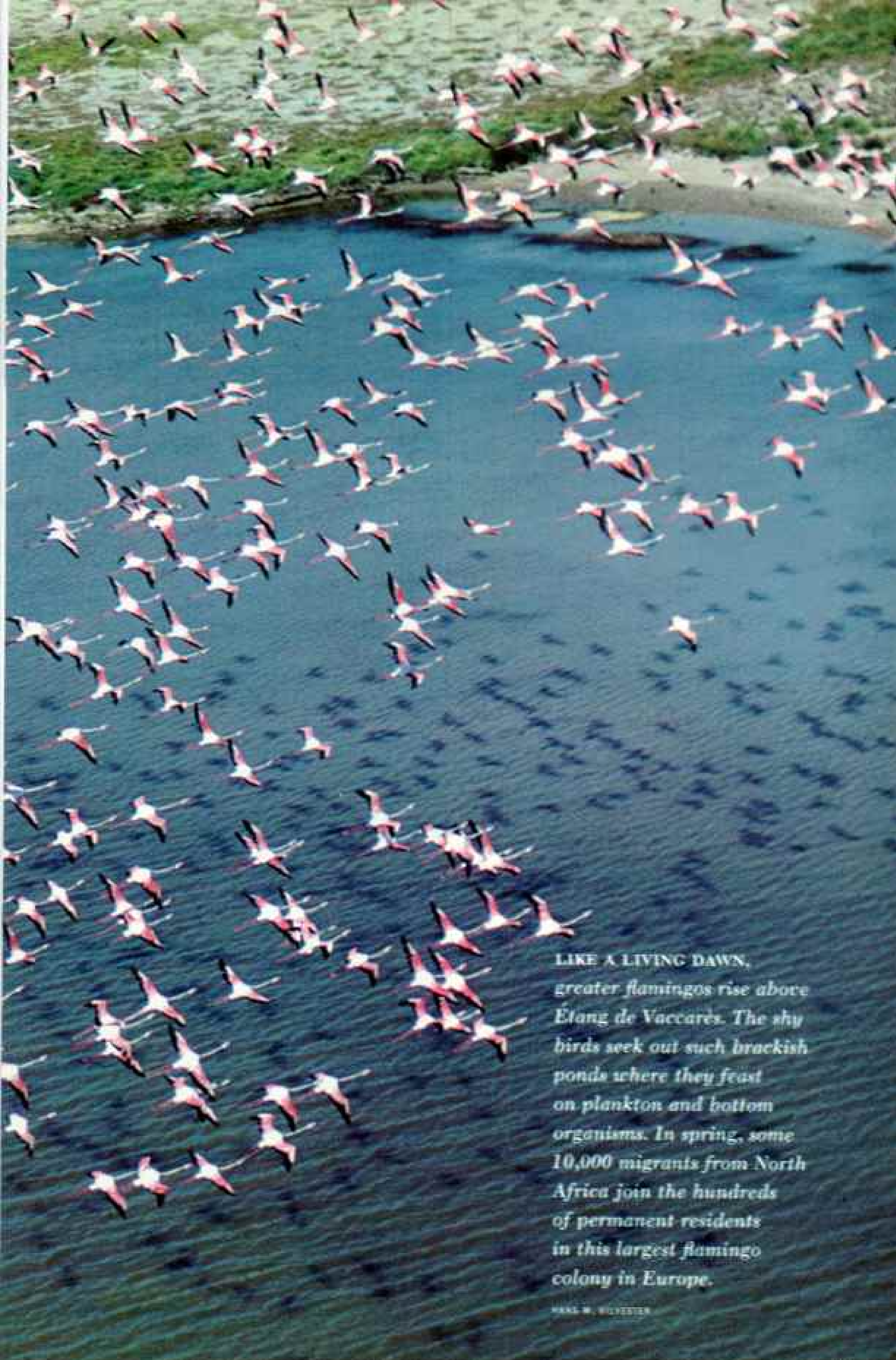
"When André brought me here, I cried for two years because of the isolation and solitude," Mrs. Daher told me. "Now if I had to leave the Camargue, I would cry for ten."

HANS W. SILVESTER (ABOVE AND BELOW) AND OTIS IMBODEN (RIGHT)

Whooping harbinger of spring, a hoopoe announces the arrival of millions of birds coming to nest in the Camargue, one of the world's great avian sanctuaries. Different degrees of salinity create a choice of habitats. This distinctive flier prefers grassy fields for chasing insects and tiny lizards. Terns, gulls, and plovers nest on islands in brackish lakes; egrets and night herons seek out riverside thickets; snipes and wood sandpipers shelter in freshwater marshes.

Furry and fleet, a hare bounds through marsh grass. Though rarely seen, many mammals thrive in the delta—beavers, badgers, foxes, hedgehogs, and even some surviving wild boars, but otters and European polecats have all but disappeared.

Report card on a tiny visitor enters the files of the Biological Station at Tour du Valat. To learn the habits and movements of migratory birds, British ornithologist John Walmsley and his colleagues band 20,000 a year, recording species, sex, age, weight, condition, and location. His subjects have been recovered as far away as Siberia and South Africa.



LIKE A LIVING DAWN, *greater flamingos rise above Étang de Vaccarès. The shy birds seek out such brackish ponds where they feast on plankton and bottom organisms. In spring, some 10,000 migrants from North Africa join the hundreds of permanent residents in this largest flamingo colony in Europe.*

Daher proudly showed me a tractor that he had equipped to sow seed, kill weeds, and fertilize the soil at the same time. It had extra wide wheels for the wet paddies. We watched the foreman as he drove it through a rice field, disturbing a family of ducks. "Enjoy yourselves," said Daher to the quacking ducks. "You can pay us back in the fall."

"They love my rice," he said. "So when hunting season comes around, I don't feel so bad about killing a few."

A Hunter Still at Age 86

The most redoubtable hunter of the delta is another octogenarian, Auguste Malauzat, a young man of 86, a retired magistrate from Marseille. He bought his property, Le Canaverier—The Reedery—46 years ago, and has 2,000 acres, of which 500 are planted to rice.

"But my house is really a hunting lodge," he said. "I have never lost the instincts of primitive man. I am a hunter."

"And this is Urielle," said Madame Malauzat, indicating a small black Labrador retriever, atwitch with excitement at our arrival. "Urielle only bites people who are not properly dressed."

Wondering what constituted proper dress, I noticed that our host, a short dynamic man with bristling iron-gray hair and moustache, was turned out in rumpled army fatigues and an oilskin hat. Monsieur Malauzat wore his costume with a certain magisterial elegance, however, and Urielle obviously approved. He also spoke magisterial French, even to the dog. "Urielle," he said, as he got behind the wheel of the jeep, "you are hereby authorized to accompany us."

Urielle jumped in, and Madame Malauzat kissed her good-bye. "Urielle is a lovely dog," she said, "and an excellent retriever. I'm afraid she steals from the neighbors. Sometimes she brings home a big beefsteak or a morsel of cheese. It's embarrassing, but we don't reprimand her. My husband doesn't want her to lose her instincts."

"As man has lost his," said Monsieur Malauzat. "I renew my instincts in September when the hunting season opens," he continued, as we drove through the reeds. "I sit there," he said, indicating a barrel protruding from a pond. "I get up at dawn and shoot for about five hours. It is utterly absorbing,

Sunlight casts a silver net over fishermen harvesting eels, the delta's most valuable catch. Centuries ago,

OTIS IMBODEN

Petrarch captured the spell of the Camargue in his paean to the Rhône: "Tarry thou awhile," he pleaded with the river, "where grass is greenest in the stillest air, before thou yield'st . . . to the all-embracing sea."

a total immersion in nature, a complete renewal of primitive impulse."

Auguste Malauzat's Reedery was laced with canals. We followed these silver ribbons to a pumping station, where my host showed me the pumps that bring 250 gallons a second from the Little Rhône to his paddies.

Two fishermen were casting their lines in one of the canals. One held up a silvery black bass, still wriggling.

"What a pleasure to see them immersed in nature," said Malauzat, "fulfilling themselves with a free primal urge to fish and feed themselves. How I love this place!"

His gray eyes glistened with all the reflected light of the Camargue. "I've been offered money for my land," he said, "but I will never sell. Big companies would pay any price. But the important thing is to be free, and I remain free with my ducks, my mosquitoes, my bulls, my beavers, and my dog."

Busy Scientist Studies the Delta

Perhaps the most ardent, certainly the most influential of the adopted sons of the Camargue is Dr. Luc Hoffmann, founder and director of the Biological Station of the Tour du Valat, which bands more than 20,000 migratory birds a year. Dr. Hoffmann is also executive vice president of the World Wildlife Fund. He first came to the Camargue in 1946 as a graduate student from his native Basel. He set up his research station in 1954 and employs a dozen dedicated biologists and technical aides in his unremitting effort to conserve the wildlife of the Camargue.

While I talked with the doctor, the phone rang constantly. Within five minutes he answered as many calls, cheerfully agreeing to preside at ecology meetings in England and Spain; to appear on German television to dissuade tourists from stealing flamingo eggs; to aid and comfort a local gamekeeper whose wife had just run off with another man.

"We want to protect the diversity of nature," Dr. Hoffmann told me. "In the Camargue we have a marvelous mixture of wild and cultivated habitats. The cultivated habitat actually makes an improvement in diversity. The ducks and the egrets love rice fields, for example. The flamingos and avocets love the salt ponds. The bird population is in balance now. The rice fields are not a menace except for toxic chemicals. And we have proposed a drainage system in which all the effluents will be pumped back into the Rhône.

"The French Government has approved a plan for an expanded National Nature Reserve of the Camargue. This will encompass 200,000 acres and include the present reserves. The plan must reconcile the conflicting interests of agriculture, the salt industry, and the naturalists.

"The government and the international wildlife people will have to compensate private owners in cases where conservation inhibits private enterprise. We want to act fast. The water level in the Vaccarès has risen so high from agricultural runoff that the flamingos are leaving it.

"But in the Étang du Fangassier," Dr. Hoffmann said, "conditions are still ideal. It's a good year. There are 3,000 nesting flamingo couples, and the chicks are already two weeks old. We have set up a telescope on the sea dike."

Driving south from the Tour du Valat, we saw the nesting flats, a solid-pink mass in the long rosy light of evening. In the distance the birds looked like a herd of grazing sheep. Suddenly, on some mysterious communal impulse, a thousand of them took off in horizontal streaks of vivid coral. Then they veered back to settle on the mud flats.

Dr. Hoffmann's telescope provided an almost startling invasion of flamingo privacy. As the brown chicks settled down for the night in their mud-pie nests, I saw the parents taking turns feeding their young.

Proud Gardian of a Wildlife Preserve

As the light began to fade on "one of the strangest, most solitary, most original regions of France," I talked with the young man in charge of the telescope. His name was Georges Vlassis. Born in Arles in 1950, he had the dark eyes and Hellenic features of the Arlesian.

"Vlassis is a Greek name, isn't it?" I asked.

"Yes."

"But you are French."

"I am Camarguais," Georges replied.

Georges works at this solitary spot seven days a week, sleeping in a one-room cabin with only books and a radio for company.

"Does it get lonely?" I asked.

"Not if you like your work," he said.

"You work for Dr. Hoffmann?" I said.

"I work *with* Dr. Hoffmann," he corrected.

We stood on that lonely spit of land, the Insula Camarica between sky and sea, happy to have the free spirit of the Camargue summed up in a preposition. □

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

GILBERT HOVEY GROSVENOR

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

THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D. C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization for increasing and diffusing geographic knowledge and promoting research and exploration. Since 1890 the Society has supported 872 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; more than 30 million maps distributed each year; its books, globes, atlases, and filmstrips; 30 School Bulletins a year in color; information services to press, radio, and television; technical reports; exhibits from around the world in Explorers Hall; and a nationwide series of programs on television.

Articles and photographs of travel, natural history, and expeditions to far places are desired. For material used, generous remuneration is made.

MELVIN M. PAYNE, President
ROBERT E. DOYLE, Vice President and Secretary
LEONARD CARMICHAEL, Vice President for Research and Exploration
GILBERT M. GROSVENOR, Vice President
THOMAS M. BEERS, Vice President and Associate Secretary
HILLEARY F. HOSKINSON, Treasurer
OWEN R. ANDERSON, WILLIAM T. BELL,
LEONARD J. GRANT, W. EDWARD ROSCHER,
C. VERNON SANDERS, Associate Secretaries

BOARD OF TRUSTEES

MELVILLE BELL GROSVENOR
Chairman of the Board and Editor-in-Chief

THOMAS W. McKNEW, Advisory Chairman of the Board

LEONARD CARMICHAEL, Former Secretary, Smithsonian Institution
LLOYD H. ELLIOTT, President, George Washington University
CRAWFORD H. GREENEWALT Chairman, Finance Committee, E. I. du Pont de Nemours & Company
GILBERT M. GROSVENOR Editor, National Geographic
ARTHUR B. HANSON, General Counsel, National Geographic Society
CARYL P. HASKINS, Former President, Carnegie Institution of Washington
CARLISLE H. HUMELSINE President, The Colonial Williamsburg Foundation
CURTIS E. LeMAY, Former Chief of Staff, U. S. Air Force
H. RANDOLPH MADDOX Former Vice President, American Telephone & Telegraph Company
WM. McCHESNEY MARTIN, JR. Former Chairman, Board of Governors, Federal Reserve System
BENJAMIN M. McKELWAY Former Editor, Washington *Star*
MELVIN M. PAYNE, President, National Geographic Society
LAURANCE S. ROCKEFELLER President, Rockefeller Brothers Fund
ROBERT C. SEAMANS, JR. Secretary of the Air Force
JUAN T. TRIPPE, Honorary Chairman of the Board, Pan American World Airways
FREDERICK G. VOSBURGH Former Editor, National Geographic
JAMES H. WAKELIN, JR., Former Assistant Secretary of Commerce for Science and Technology
EARL WARREN, Former Chief Justice of the United States
JAMES E. WEBB, Former Administrator, National Aeronautics and Space Administration
ALEXANDER WETMORE Research Associate, Smithsonian Institution
LLOYD B. WILSON (Emeritus) Honorary Board Chairman, Chesapeake & Potomac Telephone Company
CONRAD L. WIRTH, Former Director, National Park Service
LOUIS B. WRIGHT, Former Director, Folger Shakespeare Library

COMMITTEE FOR RESEARCH AND EXPLORATION

LEONARD CARMICHAEL, Chairman
ALEXANDER WETMORE and MELVIN M. PAYNE, Vice Chairmen
EDWIN W. SNIDER, Secretary

BARRY C. BISHOP, National Geographic Staff, GILBERT M. GROSVENOR, MELVILLE BELL GROSVENOR, CARYL P. HASKINS, THOMAS W. McKNEW, T. DALE STEWART, Physical Anthropologist Emeritus, Smithsonian Institution, MATTHEW W. STIRLING, Research Associate, Smithsonian Institution, JAMES H. WAKELIN, JR., FRANK C. WHITMORE, JR., Research Geologist, U.S. Geological Survey, CONRAD L. WIRTH, FREDERICK G. VOSBURGH, and PAUL A. ZAHL

Assistant Secretaries of the Society:
FRANK S. DELK, JOSEPH B. HOGAN,
RAYMOND T. McELLIGOTT, JR., EDWIN W. SNIDER
Assistant Treasurer: WARD S. PHELPS

Leonard J. Grant, Editorial Assistant to the President; Edwin W. Snider, Richard E. Pearson, Administrative Assistants to the President; Judith N. Dixon, Administrative Assistant to the Chairman and Editor-in-Chief; Lenore W. Kessler, Administrative Assistant to the Advisory Chairman of the Board

SECRETARY'S STAFF: *Administrative:* Earl Corliss, Jr., Harriet Carey, Frederick C. Gale. *Accounting:* Jay H. Givans, George F. Fogle, Alfred J. Hayre, William G. McGhee, Martha Allen Baggett. *Membership Promotion and Statistics:* Charles T. Kneeland (Chief), Thomas M. Kent. *Payroll and Retirement:* Howard R. Hudson (Supervisor); Mary L. Whitmore, Dorothy L. Dameron (Assistants). *Procurement:* J. P. M. Johnston, Thomas L. Fletcher, Robert G. Corey, Sheila H. Immel. *Membership Fulfillment:* Geneva S. Robinson, Paul B. Tylor, Peter F. Woods. *Computer Center:* Lewis P. Lowe. *Promotion:* Robert J. Warfel, Towne Windom, F. William Rath. *Printing:* Joe M. Barlett, Frank S. Oliverio. *Production Control:* James P. Kelly. *Personnel:* James B. Mahon, Adrian L. Loftin, Jr., Glenn G. Pepperman, Nellie E. Sinclair. *Medical:* Thomas L. Hartman, M.D. *Translation:* Zbigniew Jan Lutyk

COVER: Free-spirited as their masters, stallions clash in France's Camargue (page 717). HANS W. SILVESTER

POSTMASTER: SEND CHANGE OF ADDRESS FORM 3579 AND UNDELIVERED COPIES TO NATIONAL GEOGRAPHIC MAGAZINE, 17TH AND M STS. N.W., WASHINGTON, D. C. 20036

NATIONAL GEOGRAPHIC MAGAZINE

MELVILLE BELL GROSVENOR Editor-in-Chief and Board Chairman
MELVIN M. PAYNE President of the Society

GILBERT M. GROSVENOR Editor

FRANC SHOR, JOHN SCOFIELD Associate Editors

Senior Assistant Editors
James Cerruti, W. E. Garrett, Kenneth MacLeish
Jules B. Billard, Robert L. Conly, Allan C. Fisher, Jr.

Assistant Editors: Andrew H. Brown, Joseph Judge, Edward J. Linehan, Samuel W. Matthews, Carolyn Bennett Patterson, Howell Walker, Kenneth F. Weaver

Senior Editorial Staff: William S. Ellis, Rowe Findley, William Graves, Bryan Hodgson, Robert P. Jordan, Nathaniel T. Kenney, Bart McDowell, John J. Putman, Gordon Young; Senior Scientist: Paul A. Zahl

Foreign Editorial Staff: Luis Marden (Chief); Thomas J. Abercrombie, David S. Boyer, Howard La Fay, Volkmar Wentzel, Peter T. White

Editorial Staff: Harvey Arden, Kent Britt, Thomas Y. Canby, Louis de la Haba, Mike W. Edwards, Noel Grove, Alice J. Hall, Werner Janney, Jerry Kline, Michael E. Long, John L. McIntosh, Elizabeth A. Moize, Ethel A. Starbird

Editorial Layout: Howard E. Paine (Chief); Charles C. Uhl

Geographic Art: William N. Palmstrom (Chief). *Artists:* Lisa Biganzoli, William H. Bond, John W. Lothers, Robert C. Magis, Robert W. Nicholson, Ned M. Seidler. *Cartographic Artists:* Victor J. Kelley, Snejinka Stefanoff. *Research:* Walter Q. Crowe (Supervisor), Virginia L. Baza, George W. Beatty, John D. Garst, Jean B. McConville, Dorothy A. Nicholson, Isaac Ortiz (Production)

Research: Margaret G. Bledsoe (Chief); Ann K. Wendt (Associate Chief); Newton V. Blakeslee (Assistant Chief for Geographic Information), Carolyn H. Anderson, Alice M. Bowsher, Bette Joan Goss, Jan Holderness, Lesley B. Lane, Levenia Loder, Frances H. Parker. *Correspondence:* Carolyn F. Clewell, Clifford R. DuBois

Library: Virginia Carter Hills (Librarian); Patricia Murphy Smith (Assistant Librarian), Melba Barnes, Louise A. Robinson, Esther Ann Manion (Librarian Emeritus)

Editorial Administration: Joyce W. McKean, Assistant to the Editor; Marie L. Barnes, Virginia H. Finnegan, Winifred M. Myers, Shirley Neff, M. Jean Vile, Inez D. Wilkinson (Editorial Assistants); Dorothy M. Corson (Indexes); Lorine Wendling (Files); Evelyn Fox, Dolores Kennedy (Transportation); Jeanne S. Duiker (Archives)

ILLUSTRATIONS STAFF: *Illustrations Editor:* Herbert S. Wilburn, Jr. *Associate Illustrations Editor:* Thomas R. Smith. *Art Editor:* Andrew Poggenpohl. *Assistant Illustrations Editors:* David L. Arnold, O. Louis Mazzatenta, Charlene Murphy, Robert S. Patton, Elie S. Rogers, W. Allan Royce, Jon Schneeberger, Mary Griswold Smith. *Layout and Production:* H. Edward Kim (Chief). *Picture Editor:* Bruce A. McElfresh. *Research:* Paula C. Simmons, Barbara A. Shattuck (Asst.). *Librarian:* L. Fern Dame

Engraving and Printing: Dee J. Andella (Chief); John R. Metcalfe, William W. Smith, James R. Whitney

PHOTOGRAPHIC STAFF: *Director of Photography:* Robert E. Gilka. *Assistant Directors:* Dean Conger, Joseph J. Scherschel. *Photographers:* James L. Amos, James P. Blair, Victor R. Boswell, Jr., Bruce Dale, Dick Durrance II, Gordon W. Gahan, Otis Imboden, Emory Kristof, Bates Littlehales, George F. Mobley, Robert S. Oakes, Winfield Parks, Robert F. Sisson (Natural Science), James L. Stanfield, Lilian Davidson (Administration). *Film Review:* Guy W. Starling (Chief). *Photographic Equipment:* John E. Fletcher (Chief), Donald McBain. *Pictorial Research:* Walter Meayers Edwards (Chief)

Photographic Laboratories and Phototypography: Carl M. Shrader (Chief); Milton A. Ford (Associate Chief); Herbert Altemus, Jr., David H. Chisman, Lawrence F. Ludwig (Assistant Chief, Phototypography), Claude E. Petrone, J. Frank Pyles, Jr., Donald E. Stemper, George V. White

RELATED EDUCATIONAL SERVICES OF THE SOCIETY

Cartography: William T. Peele (Chief); David W. Cook (Assistant Chief). *Cartographic Staff:* Margery K. Barkdull, Charles F. Case, Ted Dachtera, Richard J. Darley, John F. Dorr, Russel G. Fritz, Richard R. Furno, Charles W. Gotthardt, Jr., Catherine M. Hart, Donald A. Jaeger, Harry D. Kauhane, James W. Killion, Manuela G. Kogutowicz, Charles L. Miller, David L. Moore, Robert W. Northrop, Richard K. Rogers, John F. Shupe, Charles L. Stern, Douglas A. Strobel, George E. Stuart (Archeology), Tibor G. Toth, Thomas A. Wall, Thomas A. Walsh

Books: Merle Severy (Chief); Seymour L. Fishbein (Assistant Chief), Thomas B. Allen, Ross Bennett, Charles O. Hyman, Anne Dirkes Kobor, David F. Robinson, Wilhelm R. Saake, Verla Lee Smith

Special Publications and Educational Filmstrips: Robert L. Breeden (Chief); Donald J. Crump (Asst. Chief), Josephine B. Bolt, David R. Bridge, Linda Bridge, Margery G. Dunn, Johanna G. Farren, Ronald Fisher, Mary Ann Harrell, Margaret McKelway Johnson, Geraldine Linder, Robert Messer, Cynthia Ramsay, Philip B. Silcott, Joseph A. Taney

Recording Division: John M. Lavery (Chief)

School Service: Ralph Gray (Chief and Editor of National Geographic School Bulletin); Charles H. Sloan (Assistant Chief), Joseph B. Goodwin, Ellen Joan Hurst, Veronica Smith, Janis Knudsen Wheat

News Service: Windsor P. Booth (Chief); Paul Sampson (Assistant Chief), Donald J. Frederick, William J. O'Neill, Robert C. Radcliffe; Isabel Clarke

Television and Educational Films: Dennis B. Kane (Chief); Sidney Platt (Supervisor, Educational Projects), David Cooper, Carl W. Harmon, Jr., Arthur P. Miller, Jr., Patricia F. Northrop; Marjorie M. Moomey (Research)

Lectures: Joanne M. Hess (Chief); Robert G. Fleegal, Mary W. McKinney, Gerald L. Wiley, Carl E. Ziebe

Explorers Hall: T. Keilor Bentley (Curator-Director)

EUROPEAN OFFICE: W. Edward Roscher (Associate Secretary and Director), Jennifer Moseley (Assistant), 4 Curzon Place, Mayfair, London, W1Y 8EN, England

ADVERTISING: *Director:* William A. Boeger, Jr. *National Advertising Manager:* William Turgeon, 1251 Ave. of the Americas, New York, N.Y. 10020. *Regional managers—Eastern:* George W. Kellner, New York. *Midwestern:* Robert R. Henn, Chicago. *Western:* Thomas Martz, San Francisco. *Los Angeles:* Jack Wallace. *Canada:* Robert W. Horan, New York. *Automotive:* John F. Grant, New York. *Travel:* Gerald A. Van Splinter, New York. *International Director:* James L. Till, New York. *European Director:* Richard V. Macy, 21 rue Jean-Mermoz, Paris 8e, France. *Production:* E. M. Pusey, Jr.

COPYRIGHT © 1973 NATIONAL GEOGRAPHIC SOCIETY, 17TH AND M STS. N.W., WASHINGTON, D. C. 20036. ALL RIGHTS RESERVED. REPRODUCTION OF THE WHOLE OR ANY PART OF THE CONTENTS WITHOUT WRITTEN PERMISSION IS PROHIBITED. PRINTED IN U.S.A. SECOND-CLASS POSTAGE PAID AT WASHINGTON, D. C., AND ADDITIONAL MAILING OFFICES. COVER DESIGN AND TITLE PROTECTED BY U. S. AND FOREIGN TRADEMARK REGISTRATIONS. $9 A YEAR, $1 A COPY.

At 60 mph, the glider registers a quiet 67 decibels on General Radio Company's sound level meter.

Earthbound Ford LTD at 60 mph registers an even quieter 65 decibels.

At 60 mph this 1973 Ford rode quieter than an airborne glider.

'73 LTD 2-door Brougham with optional white sidewall tires, deluxe wheel covers, deluxe bumper group and vinyl roof.

In a test held in Southern California, this new Ford LTD actually rode quieter than an engineless glider. That kind of ride is the result of Ford's attention to every engineering detail, from LTD's new suspension geometry to computer-tuned body mounts.

Outside, the LTD has been completely restyled for 1973. Power front disc brakes, power steering and automatic transmission are all standard. And you can personalize your LTD with such options as a power sunroof and the new Power Vent Window.

See the beautiful '73 LTD at your Ford Dealer's now.

This may be one answer to America's energy crisis.

It's called resource recovery, or saving what is worth saving from your trash and garbage.

There are hundreds of reclamation centers throughout the United States, in areas where there are enough all-aluminum cans in circulation to make them feasible. Also, where solid waste recovery plants are either operating or being planned, the recovery of aluminum is expected to pay much of the cost. Used all-aluminum cans are worth as much as $200 a ton.

So resource recovery is possible. And the high scrap value of aluminum makes it practical. And the tremendous savings in energy make it even more practical. Alcoa has the technology to recycle used all-aluminum cans with just 5% of the energy it takes to make them the first time.

There's not another beverage packaging material quite like aluminum. Only aluminum has all these things going for it: it's lightweight, chills quickly, keeps things fresh, opens with a snap, has high scrap value and can be recycled repeatedly.

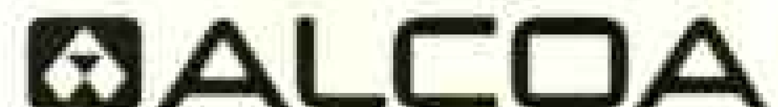
Alcoa will pay as much as $200 a ton to any community reclamation center for all the used aluminum cans they can collect. We'll pay it because aluminum is a very practical packaging material to recycle.

Alcoa is doing something to help stop the energy drain. We would like to tell you more about it.

Write for our free brochure on energy and aluminum. We'll also send you a list of America's aluminum can reclamation centers and information on how many communities have established them.

Aluminum Company of America, 815-E Alcoa Building, Pittsburgh, Pa. 15219.

Aluminum: Pass it on



DENNIS BURKHART (ABOVE) AND GALEN B. RATHBUN

Meet the golden-rumped elephant shrew

LEAPING FOR SCIENCE, a little-known African mammal demonstrates its fast footwork to zoologist Galen B. Rathbun (**above**). Yellow rump and long flexible snout explain the popular name of insect-eating *Rhynchocyon chrysopygus* (**left**). Not a true shrew, the elephant shrew is considered by some scientists to be more closely related to the lower primates, such as the monkey-like lemur. During a 20-month study in Kenya, aided by a National Geographic Society grant, the young University of Nairobi investigator banded his mouse-size subjects so that he could identify individuals as he traced their daily activities. You support such gains in knowledge when you nominate a friend for membership.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

$7.50 **CALENDAR YEAR 1973 MEMBERSHIP DUES INCLUDE SUBSCRIPTION TO THE NATIONAL GEOGRAPHIC.**

Annual dues in the United States and throughout the world are $7.50 U.S. funds or equivalent. To compensate for additional postage and handling for mailing magazine abroad, please remit: for Canada, $8.65 Canadian or U.S. funds; for all other countries, $9.50 by U.S. bank draft or international money order. 80% of dues is designated for magazine subscription.

18-MONTH MEMBERSHIP: Applicants who prefer delivery of their NATIONAL GEOGRAPHIC to start with the July 1973 instead of the January 1973 issue may *upon request* become members and receive the magazine for 18 months from July 1, 1973, through December 1974. Upon expiration, such memberships will be renewable annually on a calendar-year basis. For 18-month membership check here ☐ and remit: for U.S. and its outlying areas, $11.25 U.S. funds or equivalent; for Canada, $12.95 Canadian or U.S. funds; for all other countries, $14.25 by U.S. bank draft or international money order. *This is 1½ times the annual fee.*

Life membership is available to persons 10 years of age or older. The fee for U.S. and its outlying areas is $200 U.S. funds or equivalent; for Canada, $216 Canadian or U.S. funds; for all other countries, $250 (U.S. bank draft or international money order).

Mail to: The Secretary
National Geographic Society
Washington, D.C. 20036

CHECK ONE

I WISH TO JOIN the NATIONAL GEOGRAPHIC SOCIETY and enclose my dues $______ (Fill in at left.) ☐

(GIFT MEMBERSHIP) I nominate and enclose $______ for dues of the person named at left. Send gift card signed: ☐

I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.) ☐

NEW MEMBER ________________
PRINT NAME OF AN INDIVIDUAL ONLY (MR., MRS., MISS)

STREET

CITY, STATE, ZIP CODE

MY NAME ________________
PLEASE PRINT (MR., MRS., MISS)

STREET

CITY, STATE, ZIP CODE

00373

Polaroid®

We'll give you 60 seconds to make somebody happy.

The giving season's here again. And here's a whole family of Polaroid 60-second cameras to help you bring it to life—at prices within anybody's budget.

Big Shot. Under $20.

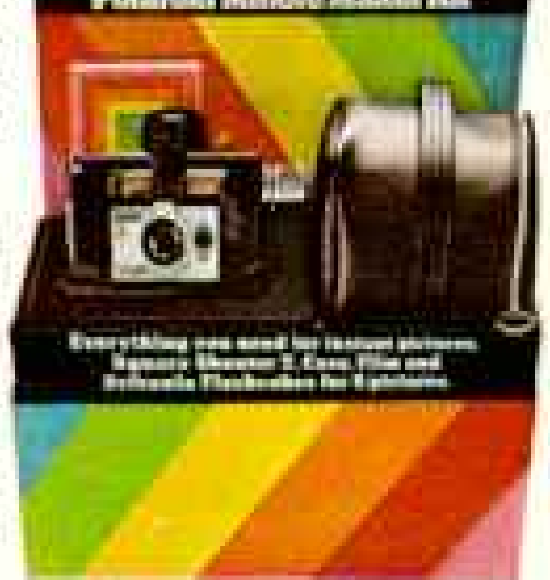
We made it for just one kind of picture: beautiful head and shoulder color portraits in 60 seconds. Built-in flash. Focusing system so simple you just walk into focus. Built-in development timer.

Square Shooter 2. Under $25.

Our most inexpensive all-purpose color camera. Uses our economical square film so you can save up to 25%* per shot. Electric eye coupled with electronic shutter. 3-element lens. Built-in flash.

Minute Maker Kit. Under $36.

Everything you need to take instant color pictures. Square Shooter 2 camera, Sylvania Blue Dot flashcubes, Colorpack film, sturdy carrying case with shoulder strap.



Model 420. Under $71 with Focused Flash**

Our most economical folding camera. Big color pictures in one minute, black-and-whites in seconds. Focused Flash system automatically controls the flash as you focus. Automatic electronic exposure system for other shots. Dual-image rangefinder-viewer. Detachable cover and carrying strap.

Model 430. Under $91 with Focused Flash**

Built-in mechanical timer buzzes until picture's developed. Transistorized electronic shutter. Dual-image coupled rangefinder-viewer. Uses optional filters.

Model 440. Under $111 with Focused Flash**

Fold-down, dual-image coupled rangefinder-viewer. Transistorized electronic shutter can take exposures up to 5 seconds automatically. Mechanical development timer. Uses optional portrait and close-up lens attachments.

Model 450. Under $176 with Focused Flash**

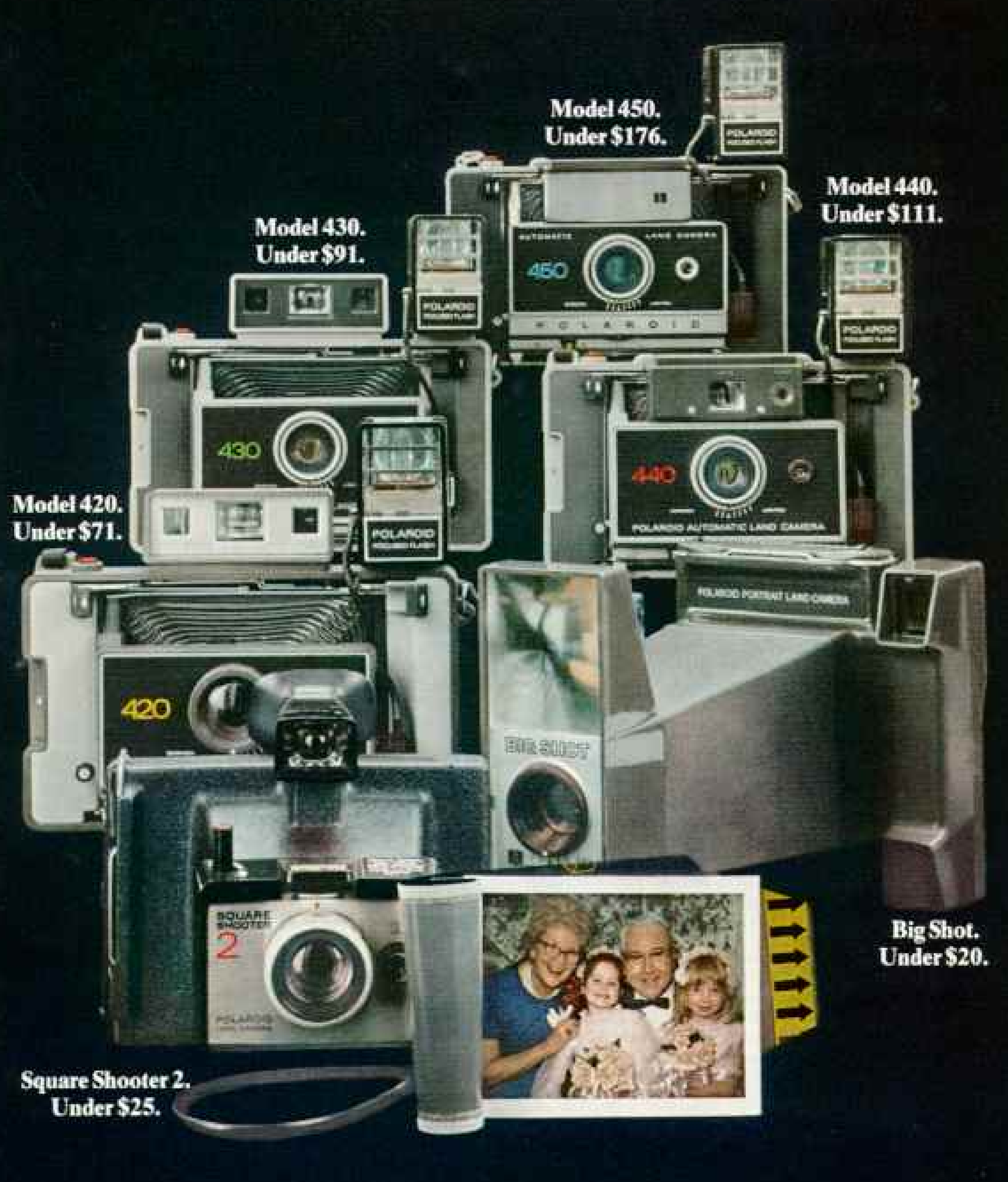
The deluxe 400-series model. Electronic development timer beeps when your picture's ready. Automatic electronic exposure system. Zeiss Ikon single-window rangefinder-viewer. Black all-metal body with brushed chrome finish. Uses every kind of Polaroid camera accessory.

Colorpack Film.

Eight colorful gifts in every pack. Type 88 film for Square Shooters. Type 108 film for our other pack cameras.

Polaroid Land Cameras from under $20.
For mothers, fathers, brides, grooms and graduates.

*Comparison based on suggested list T88/T108 film. **About $11 less without Focused Flash.


Model 450.
Under $176.
Model 440.
Under $111.
Model 430.
Under $91.
Model 420.
Under $71.
Big Shot.
Under $20.
Square Shooter 2.
Under $25.

If you don't show your kids California, who will?

The giant redwoods.
See them on an American Airlines Fly/Drive Vacation.

Wouldn't it be a shame if your kids grew up without ever having seen the redwoods?

Or a sunset on the beach at Monterey?

Or Disneyland?

California has so many things for families to see and do.

And this summer, we're giving you a chance to see them.

We've put together what we think are, dollar for dollar, the best Fly/Drive Vacations any airline has ever offered.

They start at $178 and run to $238 for a week. And they all include an Avis or Hertz car with unlimited mileage. (You pay for gas.) Plus 6 nights' accommodations for up to a family of four at Sheraton Inns, Holiday Inns and Hyatt Houses. Air fare, of course, is extra (e.g. New York to Los Angeles is $234* for adults and we have special fares for children).

Our $187 vacation, for example, gives you an Avis car for a week and 6 nights' accommodations at many of the Holiday Inns around the State of California.

So you can do as you please, see whatever you please for as long as you please.

If you're in San Francisco, you might drive out to Yosemite for a picnic. And do a little hiking to work it off.

If you're in Los Angeles, you could head out to a movie studio and show the kids what the real world isn't like.

In San Diego, you might drive out to see a man ride a killer whale at Sea World. Or let the kids ride a burro at Calico, a restored mining town.

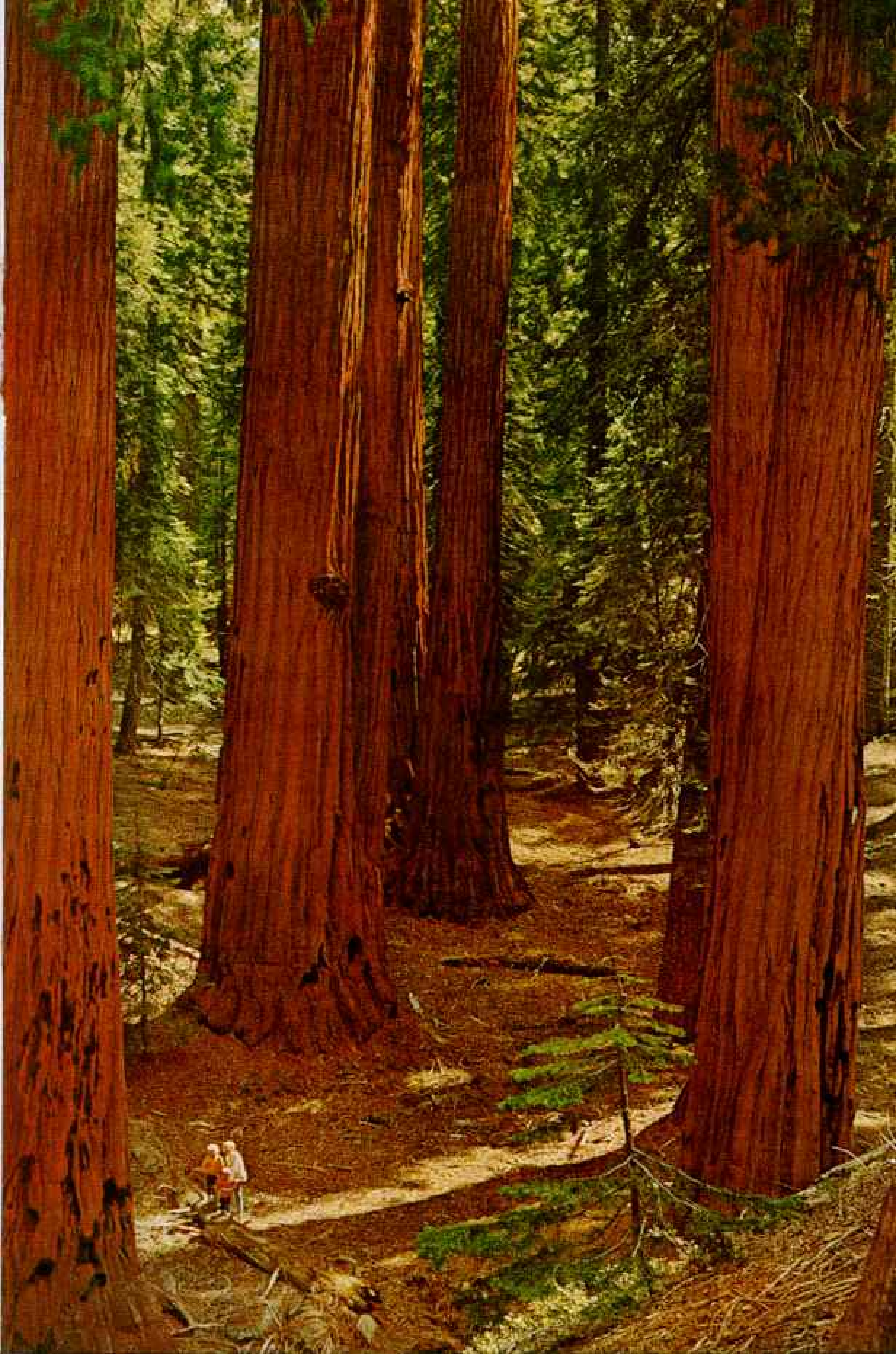
Why not talk to your Travel Agent. And ask him about our Fly/Drive Vacations, including auto-tape tours, to San Francisco, Los Angeles and San Diego. (If you like, you can fly into one city and fly home from another.)

There's nothing we'd like better than to make this summer's family vacation one you'll always remember. And one your children will never forget.

American Airlines
To The Good Life®

"The Good Life" © 1963, Paris Music Co., Inc. Used by permission

*Prices quoted are special tour basing round trip coach airfares, subject to change without notice.



GE builds three distinct lines of Central Air Conditioners.

General Electric has three lines of central air conditioners. Regardless of the size of your pocketbook, or the size of your house, there's a General Electric central air conditioner just right for you.

We start with the Standard. A good honest unit at a modest price. We make them in seven sizes from 12,500 and 47,000 btu/h to suit most homes. It has a compact cabinet, simple styling, a one speed fan and operating economy equal to the industry average.

Standard
TA 736 B1A

Deluxe
TA 836 R1C

Executive
TA 936E

Next up is our Deluxe. This model comes in six sizes from 24,000 to 60,000 btu/h. We charge a little more for the Deluxe because it has a larger condensing coil (which helps make it more economical) and an automatic two-speed fan which lets it run at a quieter low speed.

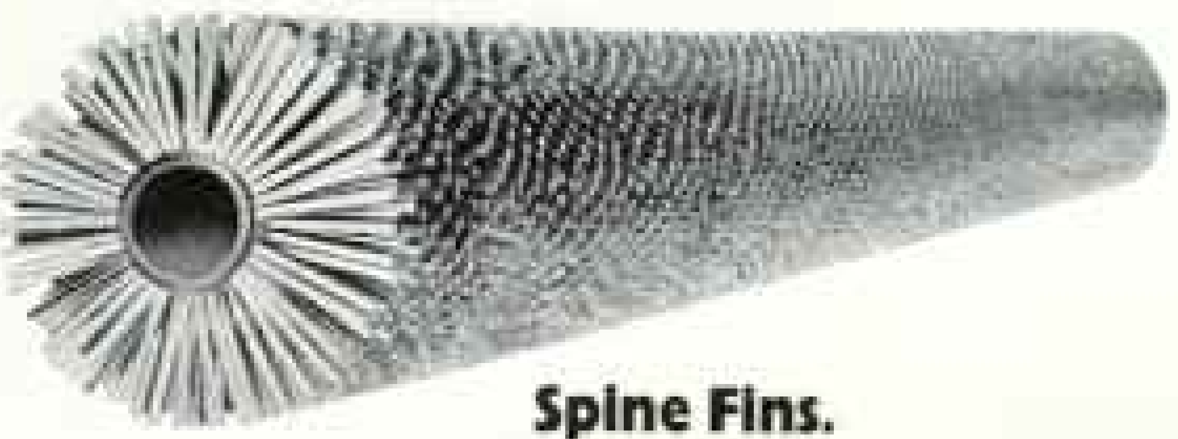
Finally, we have our top-of-the-line Executive. In the Executive, we use an even larger condensing coil than we use in the Deluxe, and an automatic two-speed fan, in a large, attractive, champagne colored cabinet.

This model comes in three sizes, 37,000, 49,000 and 60,000 btu/h. In these capacities, the Executive's large condensing surface, together with the efficiency of the Spine Fin™ condenser coils, make this the most economical operating CAC, and quietest outside, too, listed in the January 1, 1973 Air Conditioning and Refrigeration Institute Directory. This data is for electric split system, air-cooled condensing units with coil alone (type RCU-A-C).

We put our exclusive quality components in all of them.

As you can see, there is a wide selection of sizes, performance features and prices, but don't think that our Standard is, in any way, a stripped down version of our Deluxe or Executive models.

Every General Electric central air conditioner—regardless of size or price, has GE's exclusive Spine Fin condensing coils, and our exclusive Climatuff™ compressor. In addition, all GE condensing units have a liquid line filter-drier and compressor heat. These two items also help add assurance of reliability.



Spine Fins.

Spine Fins are tiny aluminium fins, permanently bonded to continuous copper or aluminium tubing. This eliminates almost all joints where leaks can occur and cause failures.

The Climatuff

Climatuff is more than a name; it's a concept of manufacturing and design. It has design features like a built-in centrifugal oil pump, quick-action thermal overload, a super strong motor insulation that resists refrigerant contamination and voltage surges.

We've built over 750,000 Climatuff compressors and they've had a remarkable record of reliability.

Climatuff compressors and Spine Fin coils make an air conditioner reliable—and they're in every General Electric central air conditioner.

Just in case: General Electric's National Service Contract.

Every GE central air conditioner comes with a one year, parts only warranty. Then, for the second through fifth year, you can buy (directly from the General Electric Co.) the National Service Contract for an attractive low price: $109.00 (plus local or state taxes) on a 36,000 btu/h system. It covers service, both parts and labor, required as a result of normal usage from the second through fifth year from the date the equipment is installed.

Service is performed by an authorized GE Central Air Conditioning servicer of your choice. (Be sure to read the contract for details of coverage and exceptions, such as normal maintenance, and filter replacement.)

"There is the right road"

©Peter Hurd

New Datsun 610 Hardtop. An original portrait by Peter Hurd.

We asked Peter Hurd, one of America's best-known artists, to portray the new Datsun 610 for several important reasons. His career has given us a treasure of landscapes and portraiture. His is an intensely personal style that we felt could best portray the unique, personal nature of our newest automobile. The result is shown here, a Datsun Original by Peter Hurd.

The 610 2-Door Hardtop is a luxury economy car. It has an 1800 cc overhead cam engine, solid unibody construction. Power-assist front disc brakes. Fully independent suspension. Plus luxury touches like vinyl upholstered interior with fully reclining bucket seats and center console, tinted glass, full carpeting and more, *included* in the price. Mr. Hurd has found the real essence of our car. A test drive will bring the same rewarding experience to you.

Own a Datsun Original.

From Nissan with Pride

Some young men are ready to take full advantage of college right out of high school.

Some would be better off postponing it. For reasons of interest, maturity, affordability, whatever.

For the latter, today's Army represents a rewarding pre-college alternative. More rewarding in many ways than pumping gas, bagging groceries, or marking time in the company mailroom.

Today's Army is more than a place to mark time. It's a place where a young man can train, learn, have a responsible job, meet people, travel, and find himself in the process.

Then, for the young man who successfully completes his three-year enlistment, there's 36 months of financial assistance at the college of his choice.

For further information on "Today's Army as a Pre-College Alternative," send us the card or write: Army Opportunities, P.O. Box 5510E, Phila., PA 19143.

Today's Army wants to join you.

For many young men and women, today's Army can be a meaningful pre-college alternative. We offer: A starting salary of $307.20 a month before deductions. Free food, housing, medical and dental care. 30 days paid vacation each year. Over 200 job-training courses, and many in-service educational opportunities.

For more information, fill out and mail this card today for our free booklet. No obligation. No postage necessary.

Please send me your free booklet.

Mr./Miss________ Date of Birth________

Address________

City________ County________

State________ Zip________ Phone________

Soc. Sec. No.________

Education________

(Please print all information) 2NQ 5-73-E

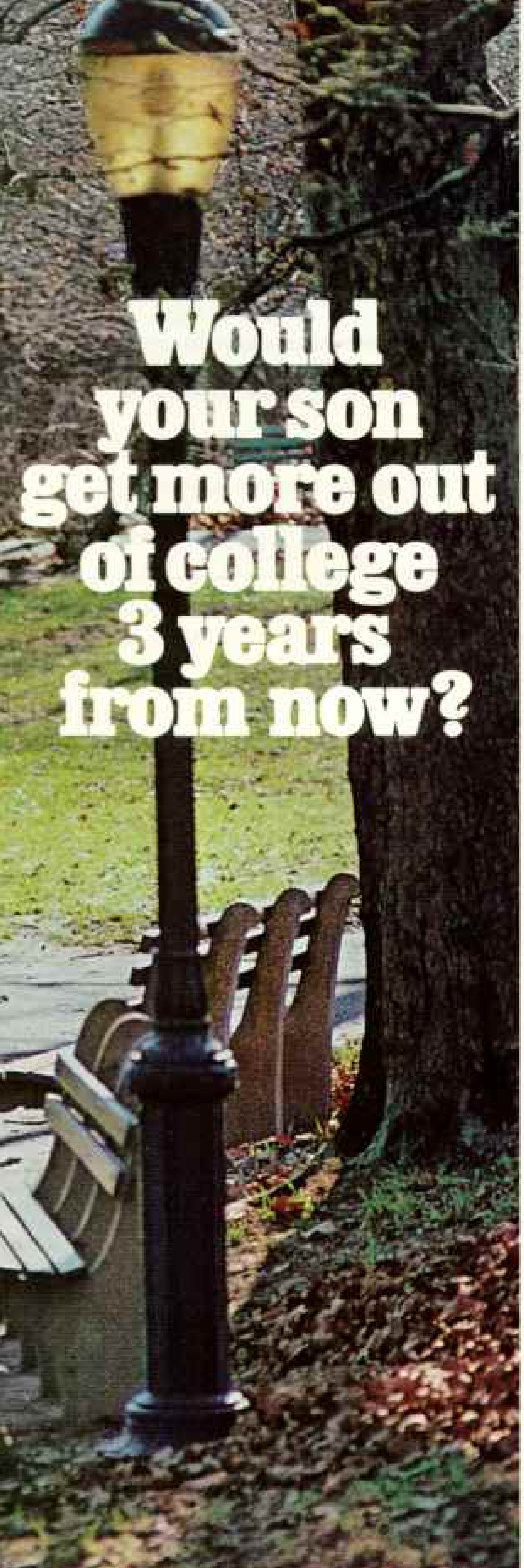
Tear out this entire flap from the magazine. Fold on solid line. Then staple or tape at the bottom and mail.

Postage and Fees Paid
Department of the Army
DOD-314

Department of the Army
HQ US Army Recruiting Command
Hampton, Virginia 23369

Official Business
Penalty for private use, $300

Army Opportunities
P.O. Box 5510
Philadelphia, PA 19143



Unusual Offer...

during May only you can buy up to
$5000 worth
of First National City Travelers Checks
for a fee of only $2

You can save up to $48 in May.

Even if your trip is months away—whether in the U.S. or overseas—buy up to $5,000 worth of First National City Travelers Checks in May and save as much as $48.

YOU CAN BUY THEM EVERYWHERE.
Thousands of banks in the U.S. and Puerto Rico are participating in the Unusual Offer. Ask for them at your bank.

YOU CAN SPEND THEM ANYWHERE.
At millions of places in America and around the world.

YOU CAN REPLACE THEM ANYWHERE.
If they're lost or stolen, you can get them replaced, on-the-spot, at more than 35,000 refund points in the U.S. and overseas . . . the most extensive refund service in the travelers check business.

IT'S THE BEST WAY TO PROTECT YOUR MONEY.
Whether you're traveling in America or abroad—or keeping money at home or in the office.

AND... if you buy First National City Travelers Checks in May, you can save up to $48. Don't miss this chance.

See How Much You Can Save.

Amount of Travelers Checks	Usual Fee	May Fee	YOU SAVE
$ 300	$ 3.00	$2.00	$ 1.00
500	5.00	2.00	3.00
1,000	10.00	2.00	8.00
2,500	25.00	2.00	23.00
5,000	50.00	2.00	48.00

Offer good only in the U.S. and Puerto Rico—and ends May 31st, 1973. So, to protect your cash against loss or theft—and save money, too—act now.

First National City Travelers Checks

Ask For Them At Your Bank

DISCOVER REAL TRAVEL ADVENTURE!

Want to visit exciting new places? Or maybe you'd prefer sunbathing in Florida or relaxing beside some inviting stream? Perhaps you know a road somewhere you'd like to follow to the end. It's all the same with an Airstream Land Yacht . . . good beds, bathroom, hot and cold water, refrigeration, heat and light independent of outside sources wherever you go — for a night, a week, or a month. Airstream Land Yachting means real travel independence — no timetables, tickets, packing. You just tow your Airstream lightly behind your car and follow your travel whims wherever they urge you to go. Yes, it's the exciting, better way to travel anywhere in the world. For extra fun join a Wally Byam Caravan.

Write for free new color catalog — Thrilling as a world cruise

AIRSTREAM®
TRAVEL TRAILERS

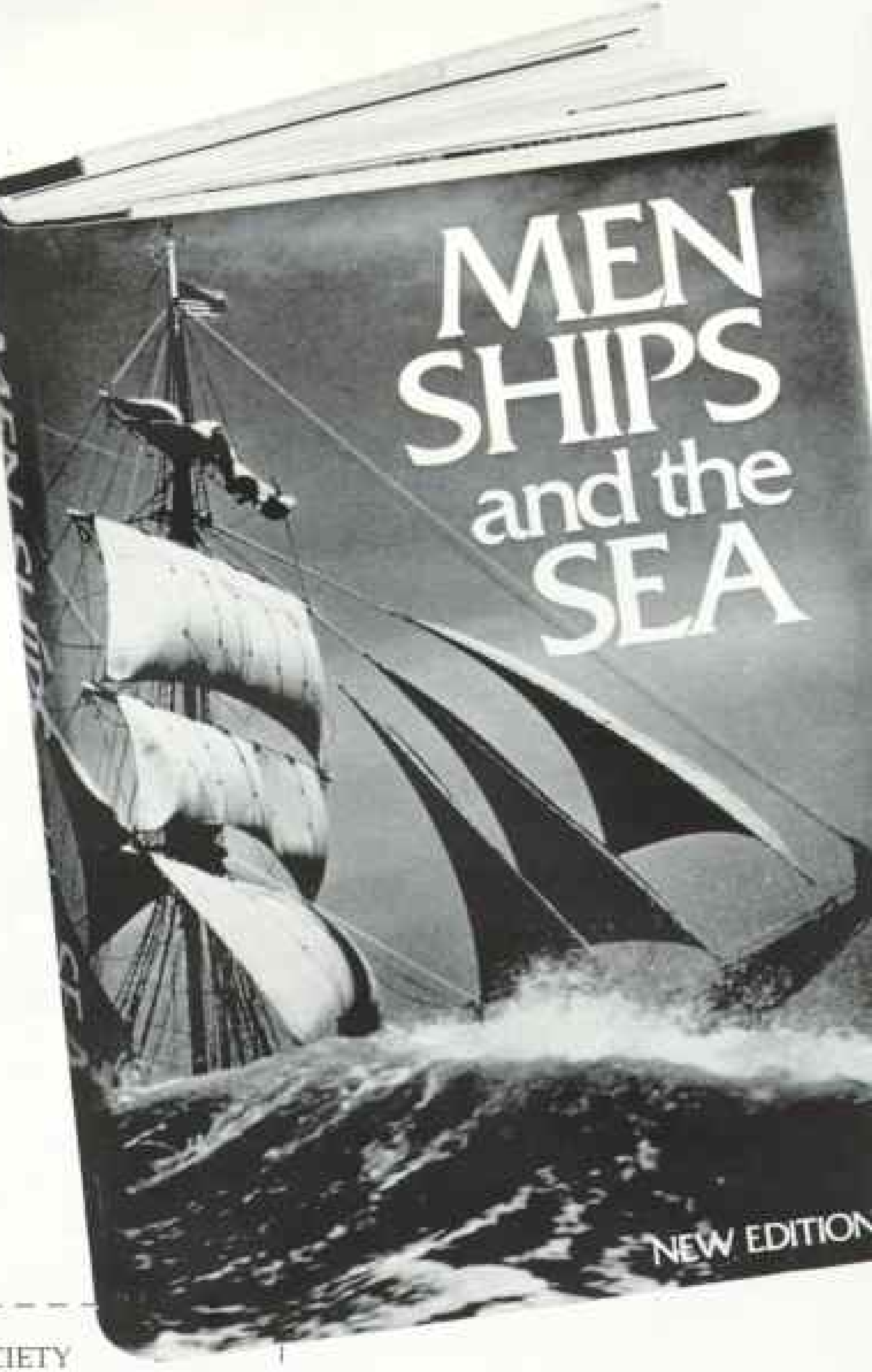
Dept. 10, Church Street, Jackson Center, Ohio 45334 • Dept. 10, 15939 Piuma Avenue, Cerritos, Calif. 90701

Canada. This Summer.

Summer in Canada never lasts long enough. There is always too much to do, to see, to remember. You'll find our cities filled with extraordinary places to visit — modern architectural triumphs like Montréal's Man and His World and Toronto's Ontario Place. Historic old forts — like Winnipeg's Fort Garry and Cape Breton's Fortress Louisbourg. Spectacular festivals — like Edmonton's Klondike Days and Vancouver's Pacific National Exhibition. Ottawa's splendid Changing-The-Guard-Ceremony and Regina's Mountie Drills. Come this summer and discover yourself in cities where life is still exciting, still beautiful, still gracious.

See your travel agent or write: Canadian Government Travel Bureau, Department C5, Ottawa, Canada K1A 0H6

Now . . . a superb new edition of this widely acclaimed National Geographic book . . .



"Outstanding." NAVY TIMES

"Finest book on the sea, yesterday and today, ever written."
VANCOUVER SUN

Relive with Capt. Alan Villiers the saga of man's longest continuous adventure—the exploration and conquest of his water planet. Meet Nile mariners and Greek oarsmen, Arab merchants and Viking raiders, Spanish seamen and treasure-hungry pirates. Sail with Columbus, Magellan, Drake, Cook, Nelson.

Here is seafaring history at its best—from dugouts to nuclear fleets, from decisive battles to boating for pleasure.

A book the entire family will enjoy. Or the ideal gift for a special friend.

NATIONAL GEOGRAPHIC SOCIETY
Dept. 885, Washington, D. C. 20036

Please send me the new edition of MEN, SHIPS, AND THE SEA. Bill me $7.95 at time of shipment, plus postage and handling. If I'm not completely satisfied, I may return the book without payment.

NAME (please print)

ADDRESS

CITY STATE ZIP CODE

This book is available only from the National Geographic Society

*436 pages, 7⅞" x 10¼"
423 magnificent illustrations, more than 300 in full color —breathtaking photographs and paintings, detailed drawings and charts, including 18 maps
Fully indexed • Only $7.95*

"In its class, Impala has the least mechanical problems and is the easiest to service."

GM

Impala Sport Sedan in the mountains of Southwest Texas.

In a recent survey of independent service stations and repair shops, conducted by *Motor Service* and *Service Station Management* magazines, Impala was voted "the car with the least mechanical problems and the easiest to service" in its class.

Which are two good reasons why Impala has been America's most popular car over the past 13 years, with more than 10 million purchased since its introduction.

Impala's front bumper system recoils hydraulically on minor impact to help cushion shocks.

And why Impalas have traditionally been worth more (up to hundreds of dollars more) when it comes time to trade them in.

Impala. The great American value. When you buy it. While you own it.

And, finally, when you sell it.

What more can you ask of a car?

1973 Chevrolet. Building a better way to see the U.S.A. Chevrolet

Highway safety begins at home. Buckle up before you leave.

Mailgram. New nationwide service from Western Union.

Here's a brand new way to send an important message. It's called Mailgram. It's a service that combines the delivery facilities of the mail with the speed of direct electronic transmission. It works this way: You phone your message to Western Union, toll-free, and our computer transmits it to a Post Office near your addressee.

There it is put in a distinctive envelope and delivered by regular letter carrier, normally the next business day.

Mailgram arrives in a blue and white envelope that's bound to get attention. So it's ideal for selling, buying, collecting, or congratulating.

Impact of a telegram at half the cost.

You can send a 100-word Mailgram to anyone, anywhere in the 48 states for only $1.60. If you have a Telex, TWX, or Info-Com in your office, it costs about one-third less. And high-volume users can send Mailgrams via magnetic tape at the lowest cost of all.

Send a Mailgram any hour of the day or night. When you phone in a Mailgram, your call will be answered within three rings or less by our new telephone answering service that's the largest in the world.

Call for a free booklet on the use of Mailgrams.

Find out what Mailgram can do for you. A toll-free call to Western Union will show how fast we answer the phone. Furthermore, we'll send you a booklet, "How to make friends, or money, (or both), with Mailgrams."

Mailgrams are just one way we're making progress.

Over the past seven years, we've invested one billion dollars to rebuild our century-old company. Try us now. You'll be surprised how fast and easy it is to send not only telegrams but our new Mailgrams as well.

western union

Quaint fishing outports take you back to another century.

Unique as Newfoundland itself — the traditional drink with the unbelievable name.

Listen to old world accents — with a twinkle and a sunny smile.

Stay in family-sized wilderness parks — big as all outdoors.

Set sail for a new found land. Drive your car and camper on board and head across the Gulf of St. Lawrence. Canada's earliest explorers visited here. And to this day the land remains very much unchanged. A rustic playground larger than all of New England, New York and Pennsylvania combined. Come stand on the easternmost tip of North America and discover this province of peace and family fulfillment.

Put Newfoundland in your holiday plans. Write today for our complete Information Kit: Newfoundland Vacation '73, P.O. Box 2016-N, St. John's, Nfld., Canada.

NEWFOUNDLAND

Another world next door.

NEW FROM GRAVELY!
Performance-Proved, All-Gear 8-SPEED TRANSMISSION

All-Gear 8-Speed Transmission Precisely Engineered for Service and Performance

NO FLUID POWER LOSSES Positive all-gear drive. No belts to slip or break, no transmission "surging," maximum power even at slow speeds.

PERFORMANCE PROVED on the 306-mile Great Gravely Durability Mow from Washington, D.C. to New York, this rugged 8-speed transmission took it all with only normal maintenance.

OTHER GRAVELYS For lighter jobs, see our 408 Lawn Tractor. Powers mower, snow thrower, and other attachments. Or for high mobility and flexibility, look over our walk-or-ride convertible models. Great for tight or rough areas, multi-job versatility.

JOB-MATCHED SPEED AND POWER!

Overpower lawn and garden jobs with the performance and versatility of Gravely's 10, 12, 14, and 16.5 HP riding tractors. Now on all 800 series tractors choose one of eight ground speeds from a gut-power ½ mph to a hurry-on-home 8½ mph. And with the constant-speed attachment drive, you get just the right combination to do any job best.

Mowing? When you hit high grass or weeds, shift on down and continue to get a smooth, even swath. Then shift back up to barrel down the straightaways. For close-up trimming, select the speed that gives you precise, comfortable control. Come winter, you can feed your snowblower at just the right pace for clean, one-pass snow removal. And for spring gardening, the wide speed selection means new rear tiller attachment can prepare soil without skipping or clodding.

With Gravely's low-center-of-gravity, rear-mounted engine for extra traction and stability, the instant forward-neutral-reverse lever for extra maneuverability, you're ready to take charge of any job. Speed, power, control . . . you get it all when you get a Gravely. For your nearest dealer, look in the Yellow Pages or write for our free catalog. Gravely, 5605 Gravely Lane, Clemmons, N.C. 27012

GRAVELY
Division of Clarke-Gravely Corporation

Bermuda. Where man and nature are kind to each other.

There's no doubt that Bermuda has been beautifully endowed by nature. So much so that we are not about to try and "improve" on it. We think you'll truly appreciate that.

We haven't built garish motels. Nor detracted from the clear vistas of sea and sky and lush green hills. Only mini-taxis and motor bikes are permitted and their speed limit is a leisurely twenty miles per hour. After all, when you're already where you want to be, what's the hurry?

Yet Bermuda is far from primitive. On the contrary, it is famed for golf, tennis, boating, fishing, swimming, dining, world-wide shopping.

Consider Bermuda. It's about the only place that still offers you the very best nature and man together have to offer.

See your travel agent or write Bermuda, 610 Fifth Avenue, New York, N.Y. 10020.

© WALT DISNEY PRODUCTIONS

For 20 minutes people had been gathering all along Main Street, waiting to see Mickey.

ONE OF THE BIGGEST events of the day was about to happen. A parade.

Leading the procession were Mickey and Minnie Mouse, followed by several marching bands and dozens of other famous Disney characters. Goofy came over to us and nuzzled the kids with his big nose.

"Our children sat in amazement as President Lincoln got out of his chair."

There before us was President Lincoln as big as life, speaking of the things that make countries great.

As he sat down again, the star-filled sky behind him began to turn red. White clouds gathered and stretched across in bands, leaving a patch of blue at the upper left portion of the sky.

Our youngest son Tommy, who was six, quickly pointed at the changing sky and said: "Mommy. Daddy. That's the American Flag."

His job took a lot of muscle and patience.

After the Hall of Presidents, the children wanted to see Fort Wilderness where we got another glimpse of our great heritage.

We met and talked with a man there whose name was Del Rosengrant. A real blacksmith.

He explained to Richard and Tommy (as well as Harriet and me) why it didn't hurt the horse to get shod—even when the shoe was put on while still red-hot.

He told us that his craft went back more than 400 years. But that as little as 50 years ago, the blacksmith was still quite important to the community. Because they not only shod the horses, but back then, they also were the toolmakers and machinists.

Hippos, elephants and headhunters.

We left civilization for a while after that and traveled on four famous rivers of the world.

The captain of our jungle boat safely guided us past hungry hippos, trumpeting elephants and spearclutching headhunters. The kids really got a kick out of it and laughed aloud as my wife and I ducked from one of the elephants who threatened to squirt water at us.

Everyone who worked at Walt Disney World always seemed to be having as much fun as the

visitors. And of course, the grown-ups were all having as much fun as the children.

Walt Disney World was the kind of vacation our family will never forget. There was so much to see and experience. Together.

How your children see the world depends on what you show them.

This summer you can afford to take your family someplace different. To Walt Disney World. Mexico. The Caribbean. Florida or the Bahamas.

Eastern offers family vacation packages to these places. Each with family accommodations and low family fares.

And chances are you can charge all or part of it on your Eastern or other major credit card.

If you plan to go...take this ad to your travel agent or call Eastern.

You can send for our free booklet on Family Vacations by writing to: Eastern Airlines, P.O. Box 849, Buena Vista Station, Miami, Fla. 33137.

Evening came to Walt Disney World with the lowering of the American flag and the singing of hymns.

KODACHROMES BY ROBERT FRESON

After the American flag was lowered, revolutionary soldiers marched off playing Yankee Doodle.

Eastern Airlines is the official airline of Walt Disney World.

"THE WINGS OF MAN" IS A REGISTERED SERVICE MARK OF EASTERN AIR LINES, INC.

New Brunswick is...

. . . the handsomely rugged, gloriously unspoiled Fundy Islands—Deer, Grand Manan, and Campobello (F.D.R. vacationed there). Regular daily ferry service. Comfortable hotel overlooking the sea—for about $13.50 double per person, American plan! Then explore—beachcombing, shopping in a real country store, bird-watching (Grand Manan is a natural sanctuary), put out to sea for a day on a Fundy fishing boat. Food? Most meals come fresh from the sea and garden. You might even enjoy dulse, a local specialty and an acquired taste. Plus all the fresh clean air you can breathe, and that special kind of island life and hospitality. There's a lot more you'll love about New Brunswick. You have to come and discover it yourself.

Canada's Picture Province

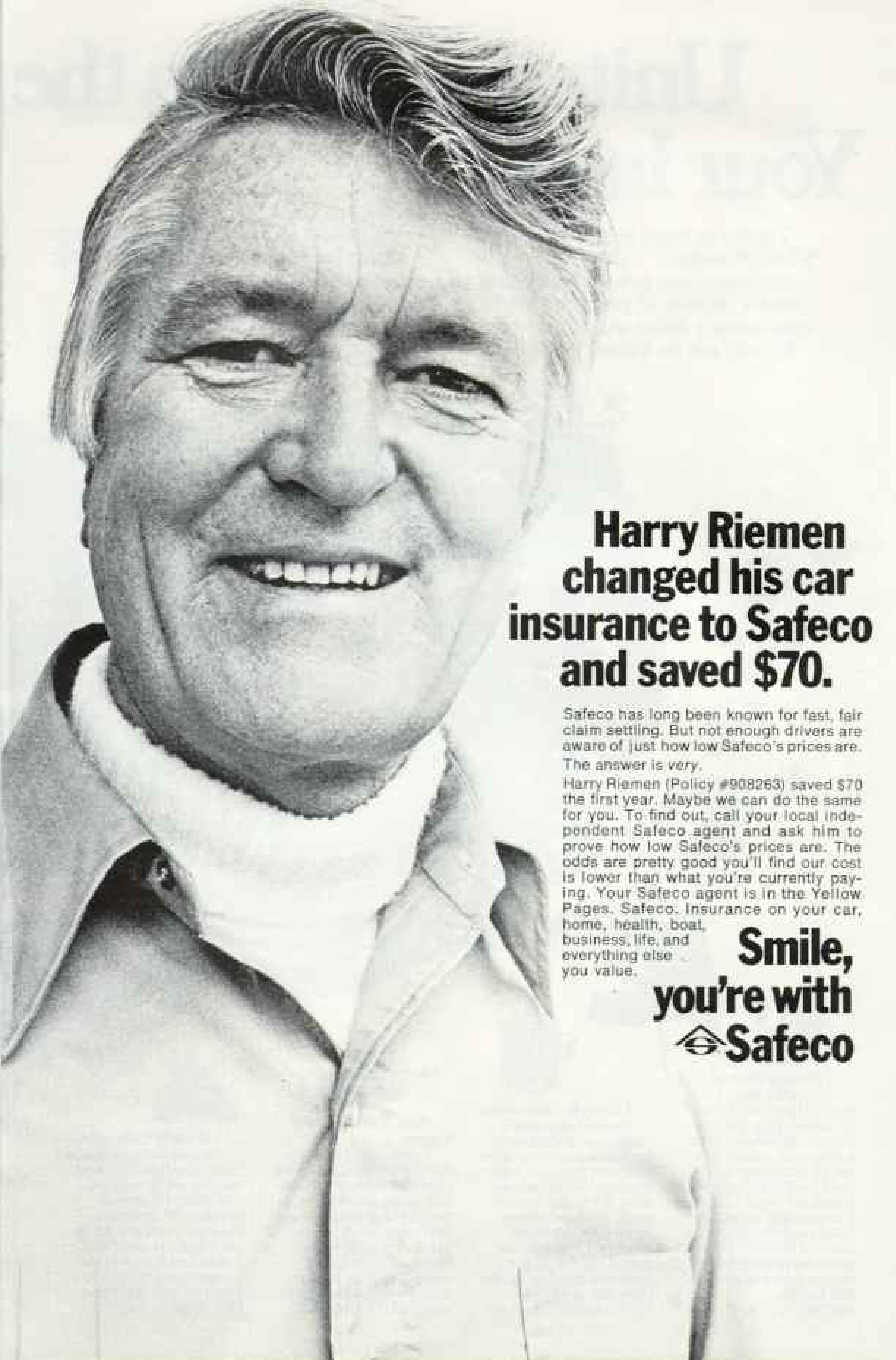
Tourism New Brunswick
Box 1030 Fredericton, N.B.

NAME ____________________

ADDRESS ____________________

CITY ____________________

STATE ____________ ZIP ________ NG


Harry Riemen changed his car insurance to Safeco and saved $70.
Safeco has long been known for fast, fair claim settling. But not enough drivers are aware of just how low Safeco's prices are.
The answer is very.
Harry Riemen (Policy #908263) saved $70 the first year. Maybe we can do the same for you. To find out, call your local independent Safeco agent and ask him to prove how low Safeco's prices are. The odds are pretty good you'll find our cost is lower than what you're currently paying. Your Safeco agent is in the Yellow Pages. Safeco. Insurance on your car, home, health, boat, business, life, and everything else you value.
Smile, you're with
Safeco

United presents the Your land.

There's so much to see in this land. So much to do.

And there was never a better time to spend a vacation in your land where you know what a dollar will buy.

So why not let United take you to it?

You see, no other airline flies to more of this land than United. And no other airline offers as many vacation values as we do.

Look over the sample vacations below, and you'll see what we mean by

Lifestyle Hawaii.
United's Lifestyle Hawaii brochure is sure to include your kind of Hawaii. Whether you're a sight-seer, golfer, or just the lie-in-the-sun type, your kind of fun can be found in United's Hawaii. For example, consider 7 days and 6 nights in the heart of Waikiki. The price per person/double occupancy ranges from **$41** to **$92.** IT-TWVA-73A.

Lifestyle California.
Spend 7 days and 6 nights seeing California. Stay at one or more of the 26 Royal Inns—all with spacious rooms, saunas, color TV's, and heated pools. You get a Hertz Pinto with unlimited mileage. (You buy the gas.) Cost per person/double occupancy ranges from **$89** to **$99.50.** IT-UA-RI-H-73A or B.

New York Theater Tours.
3 days and 2 nights at the Waldorf-Astoria. With orchestra seats at a Broadway musical one night, a comedy or drama the next. After-theater supper at Mama Leone's. And a choice of sight-seeing tours. The price per person/double occupancy is only **$80.** IT-UMAXI-2.

Lifestyle Colorado.
Choose a Royal Inn in Denver or Boulder. And venture out in your full-size Hertz Galaxie or Torino with unlimited mileage. (You pay for the gas.) And the cost for 7 days and 6 nights (per person/double occupancy) is only **$113.50.** IT-UA-RI-H-73B.

perfect summer place.

value. Air fare is not included because it varies from place to place . . . but your Travel Agent can fill you in on our discount fares that go along with most of our vacations. Then just ask him to book you on United.

To help you decide, drop the coupon in the mail. You'll receive our free, full-color brochures with all the details.

Come see your land this year. The perfect place for the perfect summer.

The friendly skies of your land.

United Air Lines

Tell me.

I want to know more about these vacation values. Please send me your free, full-color brochures. Right away.

Name____________________

Address____________________

City____________________

State________________ Zip________

My Travel Agent____________________

To: United Air Lines, 111 N. Canal St., 12th Floor Chicago, Ill. 60606, Dept. 10-DNG5

There are three ways of getting to South America.

By plane, by ship, and by Land-Rover.

Land-Rover was chosen for the Trans-Darien Expedition, organized to drive overland from North to South America. We remind you there are no roads going into the South American continent. Instead there's the Darien Gap. Over 200 miles of the most incredible and inhospitable jungle in the world.

It's the kind of terrain the Land-Rover can conquer. Indeed it's the reason Land-Rover was chosen for this adventure.

For the name of your nearest dealer call: 800-447-4700. In Illinois call: 800-332-4400.

Land-Rover

British Leyland Motors Inc.
Leonia, New Jersey 07605

BRITISH LEYLAND

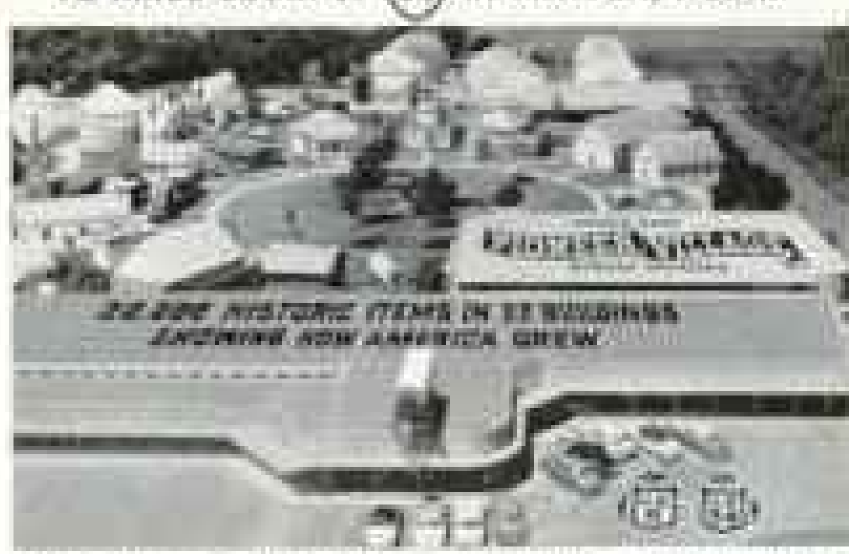
STANDARD EQUIPMENT: On the new Series III Land-Rover we offer an all synchromesh gearbox (4 forward speeds and reverse, plus a 2-speed transfer box, equals 8 forward, 2 reverse); alternator; larger capacity heater; improved power brakes plus new facia and other styling advances.

As always: Four wheel drive. Full length metal top. Body of corrosion resistant aluminum alloy with sliding side windows. Side-hinged rear door. Seats for seven. Windshield ventilators with built in fly screens. Dual braking system. Windshield washers. Back-up lights. Fresh air heater and defrosters.

See what made America Great

THE HAROLD WARP
PIONEER VILLAGE

12 Miles South of (80) at MINDEN, NEBR.



One of top 20 U.S. attractions ... more than 30,000 historic items in 22 buildings, arranged in order of development. Antique autos; farm implements; locomotives; airplanes; fine china; art; hobby collections; paintings; much, much more. Buildings include Indian Stockade; Pony Express Station; Sod House; People's Store; Pioneer Railroad Depot. Everything that made America great. Adults $1.50; minors 6 to 16, 50 cents; little tots free. Motel, restaurant, campgrounds.

See Our History In Its Making
Open 8 a.m. to sundown every day
Write for FREE color picture folder

PIONEER VILLAGE
Minden, Nebr. 68959

ON THE

How to turn blue sky thinking into a blue chip investment.

Find out for yourself how a major business expense can become a profitable investment.

Blue sky thinking is a major ingredient of leadership. If the executive mind never soars above the known and accepted, the historical and routine ways of doing things, the company will falter, fall behind and fade away.

But all blue sky ideas must eventually pass the rugged test of business economics. That's why Beech Aircraft Corporation has always talked to businessmen in terms of *investment* in business airplanes.

Take a good, hard look

Sit down with your accountant and the Beechcraft Capital Recovery Guide to see what your net capital investment in a Beechcraft would actually be. You will probably be surprised. Going all the way to the top of the line to illustrate, many companies can own the famous King Air A100, turboprop, pressurized corporate transport for a net capital investment of about $2000 a month. The new King Air A100 can serve as an airborne executive suite for 8, or a transport to carry up to 11 and a crew of 2 in quiet, comfortable, 285 mile-per-hour flight. The Beechcraft King Air is the most widely used turboprop business aircraft in the world. Over one million flight hours logged!

Some down-to-earth qualities

The King Air A100 is much more than a corporate transport. It is a sound investment. It is a vital piece of business equipment, so well built that downtime for maintenance simply isn't a problem. So expertly crafted and ahead of its times that depreciation is low. Resale high. A Beechcraft fact of life you can easily prove to yourself. Performance and flight characteristics put thousands of small town airports and remote strips on your company air routes. The business opportunities this opens are subject matter for your own blue sky thinking.

The first step is an easy one.

Read the un-coupon below and write on your letterhead. You'll receive the Beech business flying kit entitled, "How to Turn Blue Sky Thinking Into a Blue Chip Investment." The kit includes a Capital Recovery Guide and everything you need to make your initial judgment about the profitability of a Beechcraft in your business.

THIS IS NOT A COUPON!

It's sort of an un-coupon. If it isn't a crime to cut up a page in National Geographic, it ought to be!

The un-coupon is to urge you to write now for your kit entitled, "How to turn blue sky thinking into a blue chip investment." Please tell us which airplane you would be most interested in:

- 4- to 6-place single engine (up to 170 mph)
- 4- to 6-place single engine (up to 210 mph)
- 4- to 6-place twin engine (up to 230 mph)
- 6-place twin engine (pressurized, 280 mph)
- Twin engine turboprop corporate transport (pressurized, 250 mph)
- Corporate Jet

Write to Beech Aircraft Corporation, Department A, Wichita, Kansas 67201. Please write on your company letterhead, giving us your name and title. Are you a pilot? Aircraft owner? Thank you.

ARE YOU AT SEA WHEN IT COMES TO BUSINESS INSURANCE?

YOUR USF&G AGENT CAN HELP YOU CHART A COURSE.

You can look forward to smoother sailing with a program of protection developed by your USF&G agent. Coverages? From office buildings and factories to retail outlets and warehouses. From casualty and fire insurance to commercial multi-peril insurance. From business life and health plans to fidelity and surety bonding. Your USF&G agent is the true insurance professional . . . the independent businessman of highest caliber who can cover them all . . . along with other insurance plans for businesses and individuals. Consult him with confidence as you would your doctor or lawyer. Your USF&G agent . . . listed in your Yellow Pages.

THE
USF&G
COMPANIES

Baltimore, Maryland. Casualty/Fire/Marine/Multi-Line/Life/Health/Group Insurance/Fidelity/Surety Bonds.

Great-tasting nutrition.

With a sensible diet and a sensible amount of exercise, you're on your way to a younger look at life.

And it makes good sense to start with a nutritious breakfast. Like Kellogg's Product 19 cereal, milk, fruit, toast and juice.

That's a complete breakfast that's pretty hard to beat.

Delicious and nutritious.

The best to you each morning.

A great taste in the morning is such a fine beginning.

THE NUTRITIONAL FACTS OF KELLOGG'S PRODUCT 19

[illegible]

NUTRIENT	Product 19 1 oz.	Product 19 with ½ cup Whole Milk*
VITAMIN A	100%	104%
VITAMIN D	100%	112%**
VITAMIN C	100%	108%
NIACIN	100%	101%
THIAMINE (B_1)	100%	104%
RIBOFLAVIN (B_2)	100%	112%
IRON	100%	100%
CALCIUM	10%	29%
PHOSPHORUS	8%	23%
***VITAMIN B_6	1.0mg	1.08 mg
***VITAMIN B_{12}	2.5mcg	3.0 mcg
***MAGNESIUM	15.0mg	30.8 mg

TYPICAL NUTRITIONAL COMPOSITION

	Product 19 % of Total Weight	Product 19 Amount in 1 oz.	Product 19 with ½ cup Whole Milk*
Protein	8.5%	2.4 gm	6.7 gm
Fat	1.2%	0.3 gm	4.8 gm
Carbohydrates	81.0%	23.0 gm	29.0 gm
Calories		104	184

*Whole milk values derived from USDA Handbook No. 8 and USDA Report No. 36.

**Vitamin D fortified milk at 400 USP units/quart.

***Minimum daily adult requirements have not been established.

Kellogg's

PRODUCT 19

® Kellogg Company
© 1973 Kellogg Company

Something special you can get from your Pocket camera:

Pocket color slides.

Show them big and brilliant with a pocket Carousel projector.

Price subject to change without notice.

Did you know that the same little Pocket camera that gives you big, beautiful snapshots can also give you dazzling slides?

Next time, drop in a cartridge of 110-size Kodachrome-X or Kodak Ektachrome-X film and see what you get. Pocket slides that aren't much bigger than your thumbnail but project big and brilliant on your screen.

To show them at their best, there's the Kodak pocket Carousel projector. It's only a little over 8 inches square. Yet the slide tray holds 120 slides! (You can also show your Pocket slides on a 2x2 projector using special slide adapters and, preferably, a 2½- or 3-inch lens.)

See the Kodak pocket Carousel projector at your photo dealer's. There are three models and a choice of automatic features. From less than $100.

Kodak pocket Instamatic® cameras.
Kodak pocket Carousel projectors.

All central air conditioners can keep you coo

Model shown is High Efficiency Series Model No. 81643 or 81684. Available at most Sears, Roebuck and Co. stores and through the catal

---

Clarks® WALLABEES®

You'll feel the free spirit of the gull in every step you take in WALLABEES. The combination of moccasin construction and thick crepe soles make WALLABEES one of the most comfortable shoes in the world.

Hand made in Ireland of sand or oakwood suede and black, brown or white calf. Men's suede ankle boots about $32.00, low shoes about $29.95. Women's suede ankle boots about $28.95, low shoes about $27.95.

Clarks® SHOES

Manufactured World Wide — Worn Everywhere

Main Ave., Norwalk, Conn. 06851

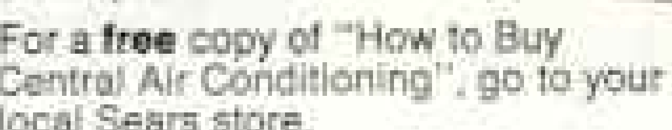
Call the toll free number for your nearest store. Dial 800-447-4700 (In Ill. 800-322-4400).

But Sears has 10,000 *Air Men* to keep you comfortable.

The Sears Air Men are made up of almost 10,000 trained central air conditioning experts who can plan a central air system that exactly meets your needs. So you get effective, efficient and economical cooling for your home. Then they make sure the system is installed with care. So it works right and as trouble-free as we can make it . . . the first time. And when you need service, the Sears Air Men are only a phone call away.

Of course, with every Sears central air system you get Air Assurance. Sears 5-year guarantee. The first year Sears will repair any part found defective. For the next four years, Sears will replace the compressor if found defective . . . at no charge to you for parts or labor.

Central air conditioning is more than just equipment, it's the people who stand behind it. And Sears has the Air Men. Call them today for a free home estimate. Ask about Sears convenient credit plans.



For a **free** copy of "How to Buy Central Air Conditioning", go to your local Sears store.

Find out how you can shoot creative, professional-looking photos.
Get the facts on the Honeywell Pentax Spotmatic II.

Pentax incorporates the world's best metering system, a unique flare-taming lens, classic design, and many other technological advancements into the world's best-selling 35mm SLR. You'll get crisp, clear, vibrantly colorful results even under the toughest shooting conditions. Write for FREE literature describing our better-than-ever 35mm SLR's. Honeywell Photographic, Dept. 101-159, P.O. Box 22083, Denver, Colorado 80222.

Honeywell Pentax

Camps

CAMP HUGO Co-ed summer camp on the Florida Keys. Certification in Scuba, Waterskiing & Deep Sea Fishing. Red Cross Certification Awards—Sailing & Motorboating. Accredited ACA. Write: **Capt. Hugo Vihlen, 1340 N. Krome, Homestead, Fla. 33030**

CARIBBEAN AQUATIC CAMP on Grand Cayman Island B.W.I. Specializing—Skin & Scuba Diving, Und. Photography, Tropical Fish Collecting, Water Skiing, Sailing, Native Crafts. Coed 7–14—Apply to **Parker's, P.O. 510, Grand Cayman B.W.I. (17¢ Airmail)**

FARRAGUT NAVAL CAMPS For boys 9–16. Trips on 63-foot flagship. 50-boat fleet incl. 25 sailboats. All sports. 2 gyms, athletic fields. Pool. Appr. summer school. Opens July 3. Catalog. **Farragut Naval Camps, Box LC, Toms River, N. J. 08753. (201) 349-1121**

HELLS CANYON EXCURSIONS Youth environmental workshop. Complete outdoor program for boys 12–18. Boating, Swimming, Fishing, Backpacking & Ecology Classes. **Hells Canyon Excursions, Inc., Box 368N, Lewiston, Idaho 83501**

Coed Schools

BERRY ACADEMY Coed College Prep. Distinctively academic, fully accredited. Spacious campus. Grades 6–12. Boarding: boys, gr. 9–12; girls, gr. 10–12. Scholarships, work opportunity. Sports. Founded 1902. Aff. Berry College. **Ed B. Laird, Dir. Adms., Berry Academy, Mt. Berry, Ga. 30149**

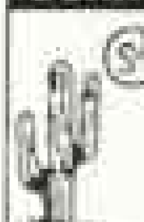
THE BOLLES SCHOOL of Florida. Grades 7–12. Fully Accred. 100% college prep. Coed day. Boys board. Advanced placement courses. College boards. Developmental reading. Study skills. Guidance. All varsity & intramural sports. **Dir. of Adm., 7404 San Jose Blvd., Jacksonville, Florida 32217**

FLORIDA CENTRAL ACADEMY Near Disney World. Coed. Grades 5–12. Fully Accred. College Prep. Small classes. Development of effective study habits. Athletics. Pool. Air-cond. dormitories. 20 mi. N. of Orlando. Catalog: **Dean, Box 38, Sorrento, Fla. 32776**

HOWEY ACADEMY Fully accredited co-ed college prep. Grades 7–12. Near Orlando, Florida. Individual instruction, horseback riding, supervised study, private beach, all sports. All air conditioned. Summer session. For catalog write: **Department 402, Howey-in-the-Hills, Fla. 32737**

INTERLOCHEN ARTS ACADEMY Acc. coed coll. prep. Grades 9–12. Emphasis on arts & academics. Music, Art, Ballet & Modern Dance, Drama. Small classes. Affl. with Nat'l. Music Camp. Catalog: **Dir. of Adm., Rm. 20, Interlochen Arts Acad., Interlochen, Mich. 49643**

JUDSON-ARIZONA
BOARDING - COLLEGE PREP. - COED



Fully accredited. Prep and General Courses. Healthful desert climate. Grades 3–12. Informal Western life. Small Classes. Remedial Reading. All sports. Riding. Art, music. **Henry N. Wick, Dir., Judson School, Box 1569, Scottsdale, Ariz. 85252. Tel. 602-948-7731**

MASSANUTTEN ACADEMY A coed school in beautiful Shenandoah Valley. Fully accred. College prep & general in gr. 9–12. Jr. Div. boys gr. 6–8. Young faculty. Tutoring. Sports. Social program. JROTC. Band scholarships. Write: **L. N. Graham, Supt., Woodstock, Va. 22664**

PINE CREST SCHOOL Academic excellence in Florida. Coed. Fully accred. prep. Boarding, grades 7–12. Honors, Adv. Placement. Grads enter leading colleges. Sports. Air-conditioned facil. Summer school, camp. Catalog. **Dir. of Adm., Box N, Pine Crest School, Ft. Lauderdale, Fla. 33308**

WASATCH ACADEMY H.S. yrs. in mtn. country! Accred. coll. prep. Sm. classes. Coed, boarding 9–12. Worldwide student body. Fine music, art facilities, sports. Summer school. Spanish course w/2 wks. in Mexico. Catalog: **Dept. G-43, Mt. Pleasant, Utah 84647**

WEST NOTTINGHAM Coed Gr. 9–12 & PG College Prep. Fully Accred. Adv. Placement. 4-day academic week; 5th day Contact Program. Career guidance. Sports. 80-acres bcsw. Phila.–Balto. Camp & Summer School. Est. 1744. Catalog: **H. E. Dietrich, Hdm., Box 31, Colora, Md. 21917**

Girls' Schools

BARTRAM IN FLORIDA Girls Grades 5–12 Fully accred. College prep. French, Latin, Math, Science. English lang. course for foreign students. Music. Art. Dramatics. Air-cond. facilities. Est. 1934. Booklet N. **Mrs. C. H. Voss, Director, 2264 Bartram Rd., Jacksonville, Florida 32207**

Boys' Schools

Army & Navy Academy

Fully accredited Military School on the Pacific Ocean, 80 miles south of Los Angeles. Strong academic emphasis, grades 7-12. Honor MI, ROTC. Box N, Carlsbad, CA 92008.

ASK ABOUT SUMMER CAMP PROGRAM

AUGUSTA MILITARY ACADEMY A faculty advisor for each student. Individualized instruction in the 'now' educational pattern. Prepares for top colleges & universities. Gr. 8–12 & P.G. Lower School, gr. 5–7. Summer School. **Write Col. N. Harris Livick, Box 100, Fort Defiance, Va.**

Brandon Hall

EXCLUSIVELY INDIVIDUAL CLASSES FOR THE UNDERACHIEVER

Sound preparation for all schools, colleges. Structured, challenging; ly flexible program and acceleration for the academically talented. Individual attention to dyslexic students.

ENROLLMENT THROUGHOUT THE YEAR

2503 Spalding Drive Grades 8-12
Dunwoody, Georgia 30338 (404) 458-7601

CARLISLE MILITARY SCHOOL "Develops Manly Men"—cultivates physical, mental, spiritual qualities. Gr. 7–12. Modern facilities. Band, swimming, golf, all sports. Honor ROTC. Rate $1790.00 plus uniforms. Write: **Col. Wm. N. Risher, Hdm., Bamberg, S.C. 29003**

CARSON LONG Military School. Educates the whole boy—physically, mentally, spiritually. How to learn, how to labor, how to live. Prepares for college and life. Grades 6–12. 137th year of character building. Overall charges $3100. **Box 71, New Bloomfield, Pa.**

CASTLE HEIGHTS

Quality Education in Excellent School Environment

For 71 years an outstanding private school. Its 10,000 alumni vouch for excellent academics, high standards and successful careers. Ideal environment for study, sports and student activities. Grades 4 thru 12. Junior School recognized as finest available. Summer Session: June 11–August 8.

Phone: 615/444-1254 or write Box 573N
CASTLE HEIGHTS, Lebanon, Tennessee 37087

COLUMBIA MILITARY ACADEMY Explore your son's future at CMA. College prep.—gr. 9–12. Sep. Jr. School, gr. 6–8. Excellent academic standing, fully accredited. All sports—indoor pool. ROTC. Complete music program. Write **CMA, Dept. N, Columbia, Tenn. 38401**

FARRAGUT ACADEMIES

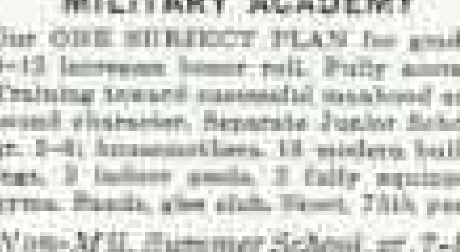
A complete high school education plus naval science and oceanography, sports and extra-curricular activities. Fully accredited program for boys 7–12. Separate Jr. School. Modern classrooms and equipment at two spacious water-front locations. Write or phone for catalog.

FARRAGUT NORTH: Box L, Toms River, N.J. 08753
Phone 201 • 349-1121
FARRAGUT SOUTH: Box L, St. Petersburg, Fla. 33710
Phone 813 • 341-1951

FISHBURNE MILITARY SCHOOL Grades 7–12 & Postgrad. Small school with balance of scholastic, athletic, and individual development. How-to-Study, reading programs. Select young faculty. Summer School. Fully Accredited. Catalog. **Adms. Officer, Box 588-N, Waynesboro, Virginia 22980**

WE TEACH A BOY AND HIS IMAGINATION HOW TO SOAR.

Creative learning skills and disciplined self-reliance are our goals. Grades 1 to 12 and P. G. on Florida's "Space Center" coast. College preparatory and general. Flight training. *Free color catalog.*
MELBOURNE 3, FLORIDA 32901
FLORIDA AIR ACADEMY



FORK UNION
MILITARY ACADEMY

Our ONE SUBJECT PLAN for grades 9–12 increases honor roll. Fully accred. Training toward successful manhood and sound character. Separate Junior School gr. 5–8; housemothers. 15 modern buildings. 2 indoor pools. 2 fully equipped gyms. Bands, glee club. Sem. 75th year.

Non-Mil. Summer School, gr. 7-12

Catalog: **Dr. R. T. Whitescarver, Box 301, Fork Union, Virginia 23055**

HARGRAVE MILITARY ACADEMY Gr. 7–12 & PG Est. 1909 Fully accredited College Prep. & Gen. How-to-Study, Reading & Special Help in college type schedules. Riding, golf, flying. Athletics for all. Christian emphasis. Open enrollment. Catalog. Write: **President, Box 401, Chatham, Va. 24531**

HOWE MILITARY SCHOOL Jr. & Sr. Schools, grades 5–8 & 9–12. Thorough acad. training. Accredited. College prep. Developmental Reading. Jr. ROTC. Sports. Own dorm. Est. 1884. Summer Camp. Catalog. **Col. R. R. Kelly, Supt., 353 Academy Pl., Howe, Ind. 46746**

KEMPER MILITARY SCHOOL AND COLLEGE Fully accred. Grades 7–12; 2-year college. Small classes. Fine faculty. Counseling. How-To-Study Program. Jr., Sr. ROTC. Sports. Social activities. FAA Flying. Education for leadership. Scholarships. Catalog: **799 Third St., Boonville, Mo. 65233**

MIAMI MILITARY ACADEMY Fully accred. ROTC Honor School. College Prep & General. Grades 6–12 & P.G. 48th Year. Guidance. How-to-Study. Honors Courses. Sports. Moderate all-inclusive fee. Summer Schl. & Camp. Catalog. **10607E Biscayne Blvd., Miami, Florida 33138**

MISSOURI MILITARY ACADEMY & Separate Jr. Schl. College Prep. Gr. 4–12. Sml. classes. All sports. 8 tennis courts. Golf. Riding. ROTC. New dorm, field house, library. Fine Arts. Driver's Ed. Catalog: **Col. Charles Stribling III, 953 Main, Mexico, Mo. 65265. 314/581-1776**

NORTHWESTERN MILITARY ACADEMY Personal attention key to our individ. college-prep curriculum. Gr. 7–12. Excellent faculty promotes achievement. Strong sports program. Many recreation activities. Sailing, flying, skiing. Write: **553 S. Lake Shore Dr., Lake Geneva, Wis. 53147**

RIVERSIDE MILITARY ACADEMY Accredited. College Prep & General. Grades 7–12 & PG. Honor ROTC 47 yrs. Winter in Fla., Fall & Spring in Ga. Year-round outdoor sports. Ga. Summer School. Economical. Catalog. Write **Supt. Riverside MA, Box R305, Gainesville, Ga. 30501**

THE SANFORD NAVAL ACADEMY

Outstanding Florida Private School

Selective enrollment. Small classes. Annapolis and university personnel. Remedial and advanced programs. Every midshipman taught to study and succeed. Accredited Honor School. Grades 8 thru 12.

Phone: 305/322-9132 or write Box 573N
THE SANFORD NAVAL ACADEMY, Sanford, Florida 32771

SEWANEE ACADEMY Formerly Sewanee Military Acad., the College Prep School of U. of the South. Boys bdg., Coed day. Grades 9–12. Fully accred. Independent study program. Sports. Est. 1868. Summer School-Camp. Write **Dir. Adm. Sewanee Academy, Rm. 10, Sewanee, Tenn. 37375**

EDUCATION WITH MEANING!

Meaning education academically, morally, athletically and militarily. Leadership. Integrity. Responsibility. Self-discipline. And, of course, academics. Building the "whole man."

Write: William I. West, Headmaster Box 114, Delafield, Wis. 53018

St. John's Military Academy

STAUNTON MILITARY ACADEMY

In Beautiful Shenandoah Valley. Thorough college preparation; fully accredited. Individual guidance. Band. All sports, 2 gyms. Pool. Jr. R.O.T.C. Program. Separate Junior School. Scholarships. Illustrated Catalog write Supt. S.M.A., Box D-6, Staunton, Va. 24401

LEADERSHIP, CITIZENSHIP & SELF DISCIPLINE STRESSED. Founded 1860

Bring out the man in your boy at Valley Forge Military Academy

Valley Forge has the know how... we've been helping boys grow into men since 1928. Grades 7-12. Sound academic preparation for college and for life. Jr. R.O.T.C. Catalog.

Valley Forge Military Academy

Box R33 Wayne, Pa. 19087 • Phone 215-688-3151

Home Study

CALVERT Kindergarten through 8th grade.

You can educate your child at home with approved home study courses, or use as enrichment. Home is the classroom, you are the teacher with the help of step-by-step instructions. Start anytime, transfer to other schools. Used by 125,000 students since 1906. Non-profit. Phone: 301-243-6030 or write for catalog.

Box NS-3, Tuscany Rd., Baltimore, Md. 21210

Parent's Name ______

Address ______

City ______ State ______ Zip ______

Child's Age ______ Grade ______

ST. JOHN'S MILITARY SCHOOL Gr. 8-12 Since 1887

Accredited. Friendly individual attention. College prep. ROTC. All sports. Driver's Ed. Admission thruout year. Episcopal—all faiths welcome. *Catalog:* **Col. Keith G. Duckers, Box NG-723, St. John's Military Schl., Salina, Ks. 67401**

WENTWORTH MILITARY ACADEMY PREPARATION for rigors of business or higher education. Accred. Grs. 7-8, 4-yr. H. S., sep. 2-yr. College. Sr. ROTC. New million-dollar field house. Golf. FAA flying. Summer Schl., younger boys' camp. 92nd Yr. *Catalog:* **Col. L. H. Ungles, 853 Wash. Place, Lexington, Mo. 64067**

The educational institutions listed in the Directory will be pleased to send catalogues and viewbooks to any National Geographic families expressing an interest in receiving additional information. By mentioning The Geographic, your inquiries will be assured the best possible attention.

CHANGE OF ADDRESS?

Please print your new address below:

NAME ______

ADDRESS ______

CITY, STATE, ZIP CODE ______

And attach the address label from your National Geographic Magazine wrapper here, so your records can be updated.

Paste Label Here

Clip this entire form and mail to:

NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D.C. 20036

RESIDENCE ELEVATOR

for new and existing homes

Beautifully designed and made by major manufacturer of commercial elevators. Install in closet space, stairwell or corner of existing home; takes as little as 37"x38" space. Larger models to accommodate wheelchair passenger and attendant. Also available: Escalift motorized chair for stairway installation. Write for literature.

DOVER CORPORATION / ELEVATOR DIV.

Dept. R121 P.O. Box 2177 Memphis, Tenn. 38102

Write ahead for a vacation into the past.

For information, color folder, or reservations for an unforgettable vacation in the world of eighteenth-century Virginia, write Box B, Williamsburg, Va. 23185, (703) 229-1700. Or call New York, 246-6800; Washington, FE 8-8828; ask Philadelphia operator for Enterprise 6805; Baltimore, Enterprise 9-8855.

Explorers Hall

Stand at the edge of space . . . journey to the ends of the earth . . . step back into history . . . peer into the future. Such adventure awaits you at your Society's museum of science and exploration in the Nation's Capital. When you visit Washington, see Explorers Hall. Open seven days a week. Free admission.
NATIONAL GEOGRAPHIC SOCIETY,
17th & M Streets N.W., Washington, D. C.

This year, in addition to many other thrilling attractions, the Canadian National Exposition features...

The Scottish World Festival Aug. 16-19

Here's exhilarating pageantry as the greatest Highland happening in North America gathers pipers, drummers, dancers and clan members from around the world for 4 exciting days! A giant parade ... the Inter-Continental Pipe Band, Highland Dancing and Drum Major Championships ... plus spine-tingling military tattoos featuring the Royal Canadian Mounted Police Musical Ride make this a spectacle you'll never forget.

The Soviet Red Army Song & Dance Festival Aug. 20-24

A cast of over 200 singers, dancers and instrumentalists under the direction of Colonel Boris Alexandrov performs at the CNE Grandstand. This brilliant ensemble has thrilled audiences all over the world with its precision and versatility.

CANADIAN NATIONAL EXPOSITION
TORONTO, ONTARIO, CANADA
AUG. 15-SEPT. 3

For more information, return this coupon to:
PUBLICITY DEPT.,
CANADIAN NATIONAL EXPOSITION,
EXHIBITION PARK,
TORONTO, ONTARIO, CANADA M6K 3C3

NAME ____________________
ADDRESS ____________________
____________ CITY ____________
STATE/PROV ____________ ZIP ____________
NG

ALL THESE LAWN AND GARDEN TRACTORS ARE GOOD ...AND LOUD.

EXCEPT ONE.

The new Bolens QT-16. It's good and quiet. Quiet enough to meet the growing tide of anti-noise ordinances. But don't let the quiet deceive you. This is a powerful twin cylinder 16 horsepower tractor. With the newest power components. Like hydrostatic drive. 4-position hydraulic lift. Electric attachment clutch. And a power locking collar that connects and releases the mower, snowthrower or tiller with fingertip pressure.

The QT-16 has the performance you want for your yard. And the quiet you'll appreciate from your neighbor's yard. So spread the word (quietly). The QT-16 is here. Now. Today. Years ahead of the competition. With the same Bolens quality you'll find in all our tractors, mulcher/baggers, walking mowers, riding mowers, garden tillers and snowthrowers. All engineered and built to keep you a good yard ahead.

BOLENS®
FMC CORPORATION®
A good yard ahead

CARRIER'S ROUND ONE PROTECTS ITSELF.

Checks 8 critical functions before every start.

Holds back after a power interruption till it's safer to come on again.

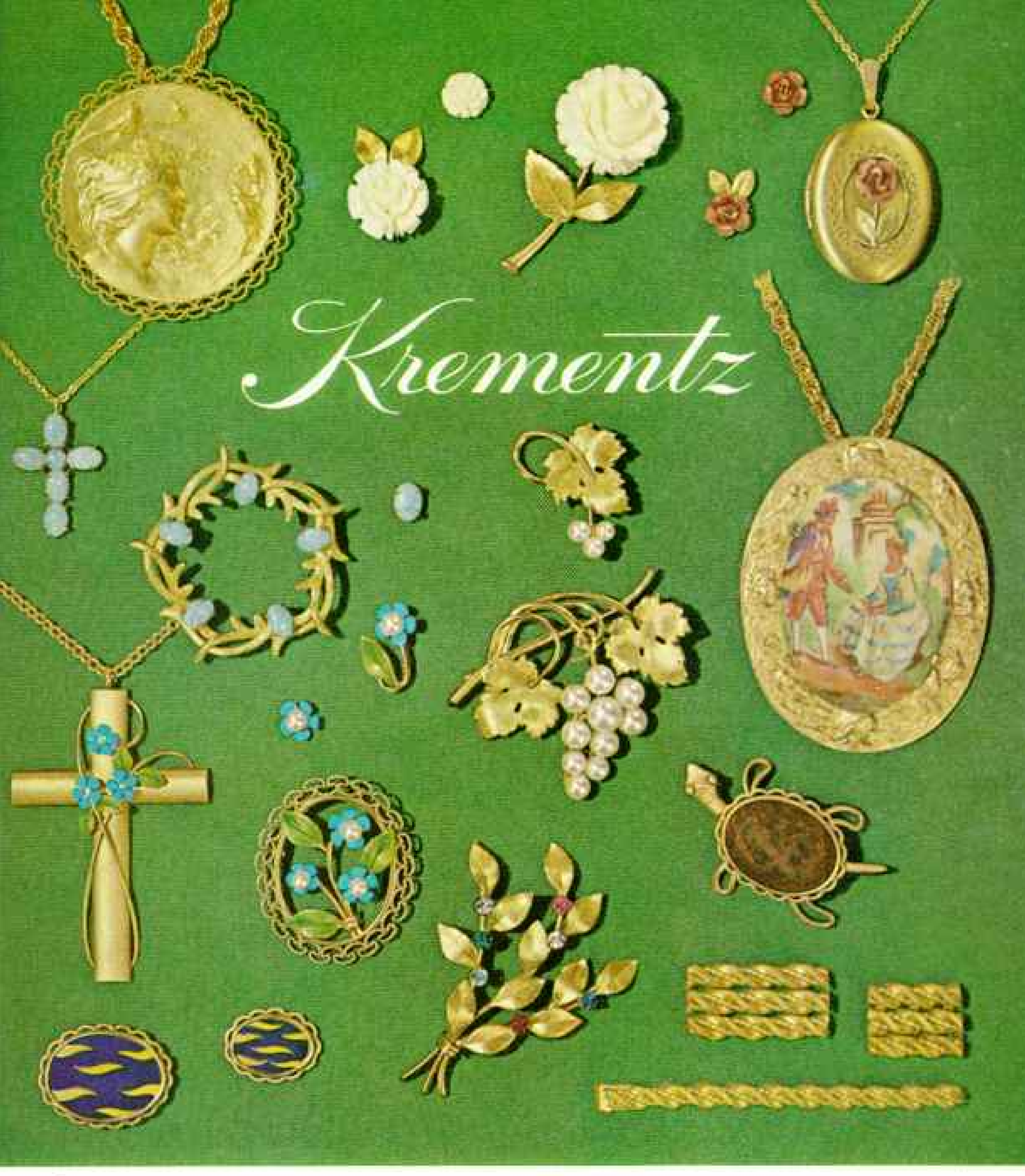
Keeps its vital parts warm for better lubrication, longer wear.

Knows when there's a brownout going on and paces itself accordingly.

Rests 4-6 minutes between every run, then starts in neutral to reduce strain.

Air conditioning that's dependable depends on itself for most of its protection. Carrier's Round One has on its door a solid state protective system—most advanced ever built into a central air conditioning unit. Yet the Round One costs little if any more than other units. Check that with your Carrier Dealer. He's in the Yellow Pages.

No.1 air conditioning maker



IMAGINATIVE DESIGN AND SUPERB CRAFTSMANSHIP together create the classic beauty of fine Krementz Jewelry. A heavy OVERLAY OF 14KT. GOLD gives these pieces much of the wearing quality and all of the rich beauty of solid Karat gold. You will always take special pride in giving this finer jewelry – for Mother's Day . . . Graduation . . . Weddings . . . for Father's Day – or to yourself.

Top, left to right: Medallion $37 Hand carved Ivory Earrings $20 and $12.50* Brooch $14.50 Pink Rose Earrings $14.50 and $14.50* Locket $20
Center: Opal Cross Pendant $40 Brooch $40 Earrings $27.50* Grape Motif Earrings $25 Brooch $40 Genuine French Limoges Pendant $37.50
Bottom: Forget-me-not Cross Pendant $30 Earrings $15* and $20 Brooch $25 Mother's Pin $25 Turtle Brooch (Genuine Epidote) $22.50
Cuff Links $22.50 Tie Tack $8.50 (left) Cuff Links $20 Tie Tack $9.50 Tie Slide $8.50

*14Kt. Gold for pierced ears

Each article in fine leatherette gift case.

Available wherever fine jewelry is sold

Write for free illustrated booklet to Krementz & Co.
47 Chestnut Street, Newark, New Jersey 07101

Krementz SINCE 1866 · MORE THAN A CENTURY OF FINE JEWELRY