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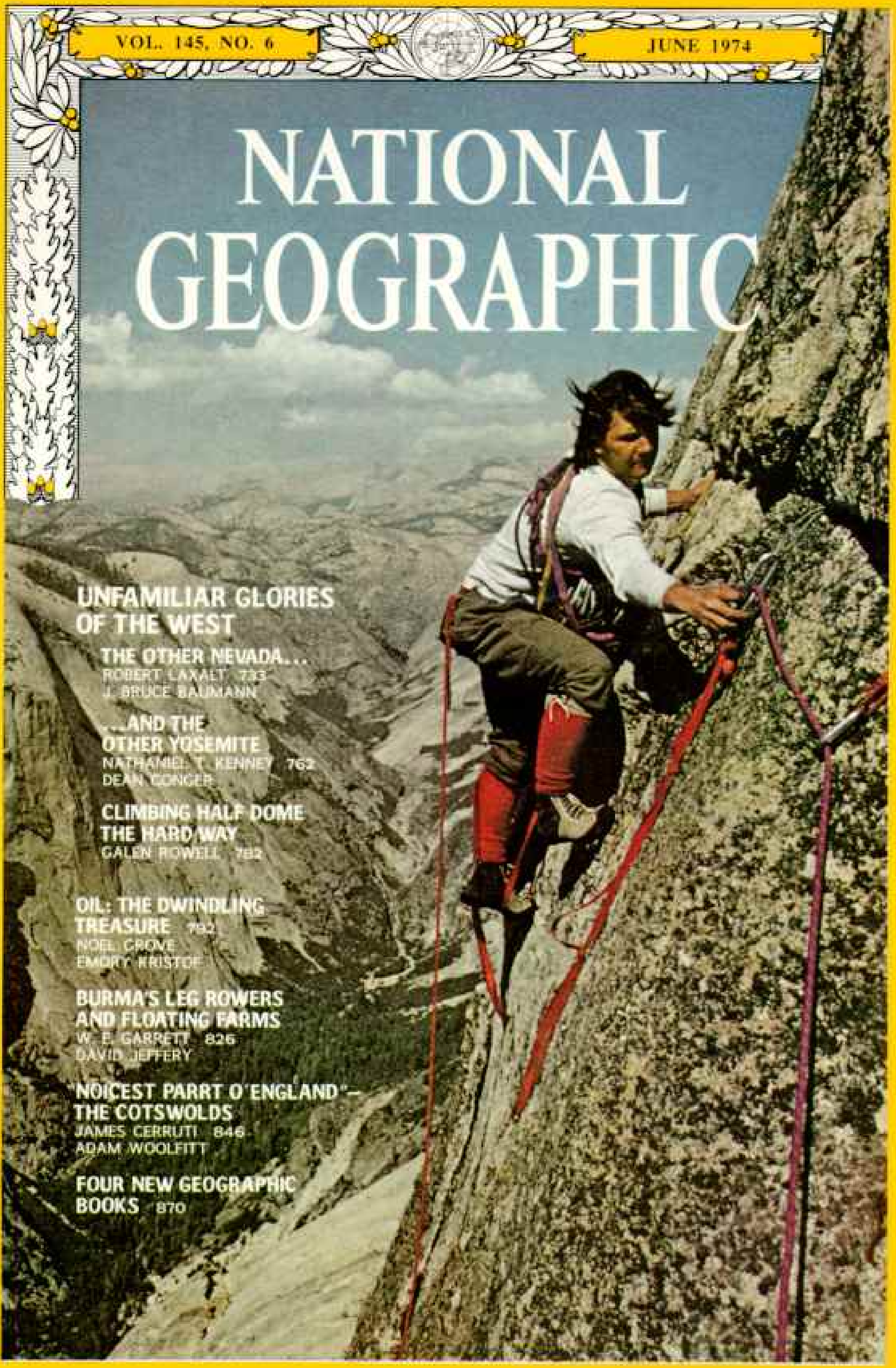

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NATIONAL GEOGRAPHIC

June 1974

The Other Nevada

By ROBERT LAXALT

Photographs by J. BRUCE BAUMANN

NATIONAL GEOGRAPHIC STAFF

WHENEVER I'm in Virginia City, I visit Gordon Lane, genial owner of the Union Brewery Saloon. It is a place I remember as a haven of warmth and good talk on cold winter nights. Few tourists notice its existence, because Gordon shuns notoriety and too much business. The tiny saloon with its worn wooden floor and peeling wallpaper is a museum of what he calls "authentic junk," heaped in corners and on old card tables.

Gordon and I must go through a ritual. He maintains that he can produce any potion I order. I come prepared to stump him, but I always lose. In my chagrin I ask him, "When are you going to clean up this place?" He points to a hand-painted cardboard sign that sums up an attitude typically Nevadan: *"This is my house. I do as I damn please."*

Gordon is a perfect representative of the other Nevada—the Nevada that has been eclipsed by the tinsel trimmings of Las Vegas, the round-the-clock hotel-casinos, the ski resorts of the Sierra. It is a Nevada that few people see, where personal freedom and the chance to be an individual thrive in an uncrowded landscape.

It is a Nevada of rugged mountains rising to 13,143 feet at Boundary Peak and of parched valleys dropping to only 490 feet above sea level near the Colorado River. There, on the fringes of Death Valley, temperatures can climb to 120° F.; in the north they can drop to 40° below zero.

The rivers of the state, like the Humboldt, Truckee, and Carson, would elsewhere be called streams, and its lakes, like Tahoe, Walker, and Pyramid, come few and far between. It is a Nevada of small communities, livestock towns like Elko and Winnemucca, mining towns like Ely and Yerington, isolated ranches and a few Indian reservations, and ghost towns surrounded by an overpowering vastness of land.

Despite its vaunted growth, Nevada's population of 527,000 adds up to only five persons

WROTE POET ROBERT FROST, "Two roads diverged in a wood, and I—I took the one less traveled by, and that has made all the difference." We follow similar paths in companion articles on Nevada and Yosemite (page 762), tarrying only briefly amid the familiar glitter of Las Vegas and Reno and the tourist-trampled meadows of Yosemite Valley. Instead we set our feet on the lonesome roads and rugged trails of Nevada's sagebrush hinterlands and of Yosemite's mountain-spired backcountry.—THE EDITOR

a square mile. It is the nation's seventh largest state and the 47th in population.

By jeep and horseback and on foot, I have traversed Nevada from the grasslands in the north to the parched deserts of the southland, from snowcapped Sierra to wrinkled old mountains of the east. With the blue Nevada sky wrapping me around, I have stood on peaks where it is still possible to look for a hundred miles without any signs of habitation, range on range of desert mountains in hues of rose, gray, and purple following one upon the other into the interminable distance.

Guided by onetime mustanger Wilbur Johnson, I recently went in search of wild horses in one of those uninhabited ranges.* Mounted on wiry mustangs that Wilbur had caught before the law protecting wild horses came into being, we worked our way up toward nearly impassable rock bluffs that have always offered the mustangs their best protection against man. Once we flushed a covey of chukar partridges that looped with drumming wings over the next ridge. Another time four deer broke out of a rare growth of green willows and fled in graceful leaps.

At first we had no luck at all. But in the afternoon, we came around a hill with the wind in our faces. Two miles below us a band of mustangs was resting in the shade of a juniper tree. Trying to get as close to them as we could, we dismounted and made a crawling, punishing descent down a rock-strewn hillside. When finally we inched our heads above the concealing ridge, we looked down upon a dozen mustangs.

*Naturalist Hope Ryden wrote of the West's wild horses in the January 1971 NATIONAL GEOGRAPHIC.

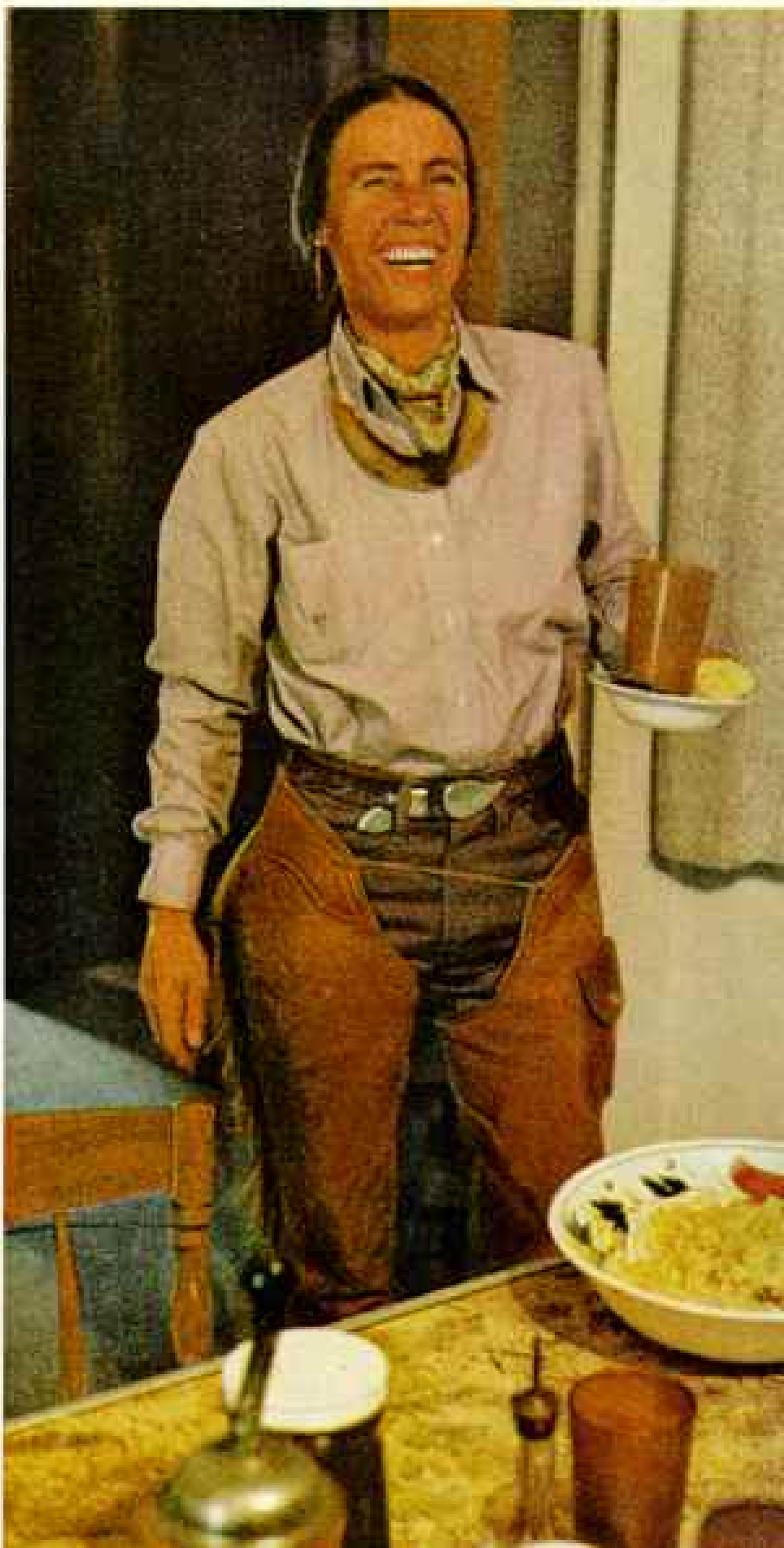
We watched as a mare nursed her colt. Then, suddenly, the stallion sensed our presence. He came out from under the juniper tree with powerful neck arched, and whistled a warning. One by one the mares followed, until they were lined up like a cavalry troop, all with ears cocked and nostrils flaring.

When they broke, trailing out first at a trot and then in a full gallop with shaggy manes and tails streaming (pages 738-9), the air was filled with the hard clatter of unshod hooves. In an instant they had vanished, leaving only a trail of dust in their wake. But in that instant, I knew the exultation of seeing horses that had never known the constriction of a rope or the restraint of a corral.

I saw freedom of another sort in the old ghost town of Belmont in central Nevada. Belmont is cradled in a mountain pocket that

Rugged silhouette of range life, Bill Gandolfo of Austin (**left**) disdains new mass cattle-branding methods for the old way—one calf at a time, hog-tied with the help of a well-trained cow pony. As the rancher applies the branding iron, hired hands inoculate and castrate the calf.

Former New York debutante Molly Knudtsen, owner of nearby Grass Valley Ranch, enjoys a hearty laugh at lunchtime (**below**). Respected for her buckarooing abilities, Molly overflows with energy, rancher's savvy, and a spirit of independence to match the vast Nevada landscape. She is the essence of the other Nevada, a heartland often ignored by visitors intent only on the 36th State's famed resorts.



Dusted with November's bleak snows, sagebrush-textured rangelands sprawl across northeastern Nevada, where cooling altitudes and plentiful

forage encourage an 80-million-dollar-a-year livestock industry. The ubiquitous sagebrush, most widespread plant in Nevada, adorns the state flag.

looks out upon great sweeps of pungent sagebrush desert and hills dotted with stunted juniper trees. It is one of a hundred mining camps that boomed and busted and have all but vanished from the Nevada landscape. In the 1860's and '70's, it was a flourishing community of 2,000 people with a magnificent showpiece of a courthouse.

The bust period for Belmont had already begun when, at the turn of the century, gold and silver were discovered at nearby Goldfield and Tonopah. Almost overnight Belmont became a ghost town. For half a century it remained so. But in the past few years a handful of people, for the most part elderly trailer dwellers, have trickled into Belmont.

Today its main street is lined with collapsed houses. Here and there a building clings to life with faded lettering on a wooden facade and rags of curtains flapping in smashed-out windows. The silence is broken only by the moan of the desert wind.

The self-appointed guardian of what is left of Belmont, 81-year-old Rose Walter, is a tall, erect woman with severe blue eyes, white hair caught up in a net, and a .44-caliber pistol (page 743). At first she took me for a scavenger of the ruins. "These old houses, such as they are, still belong to someone somewhere," she warned. After we had made peace, her stern demeanor melted and she invited me inside her house for coffee.

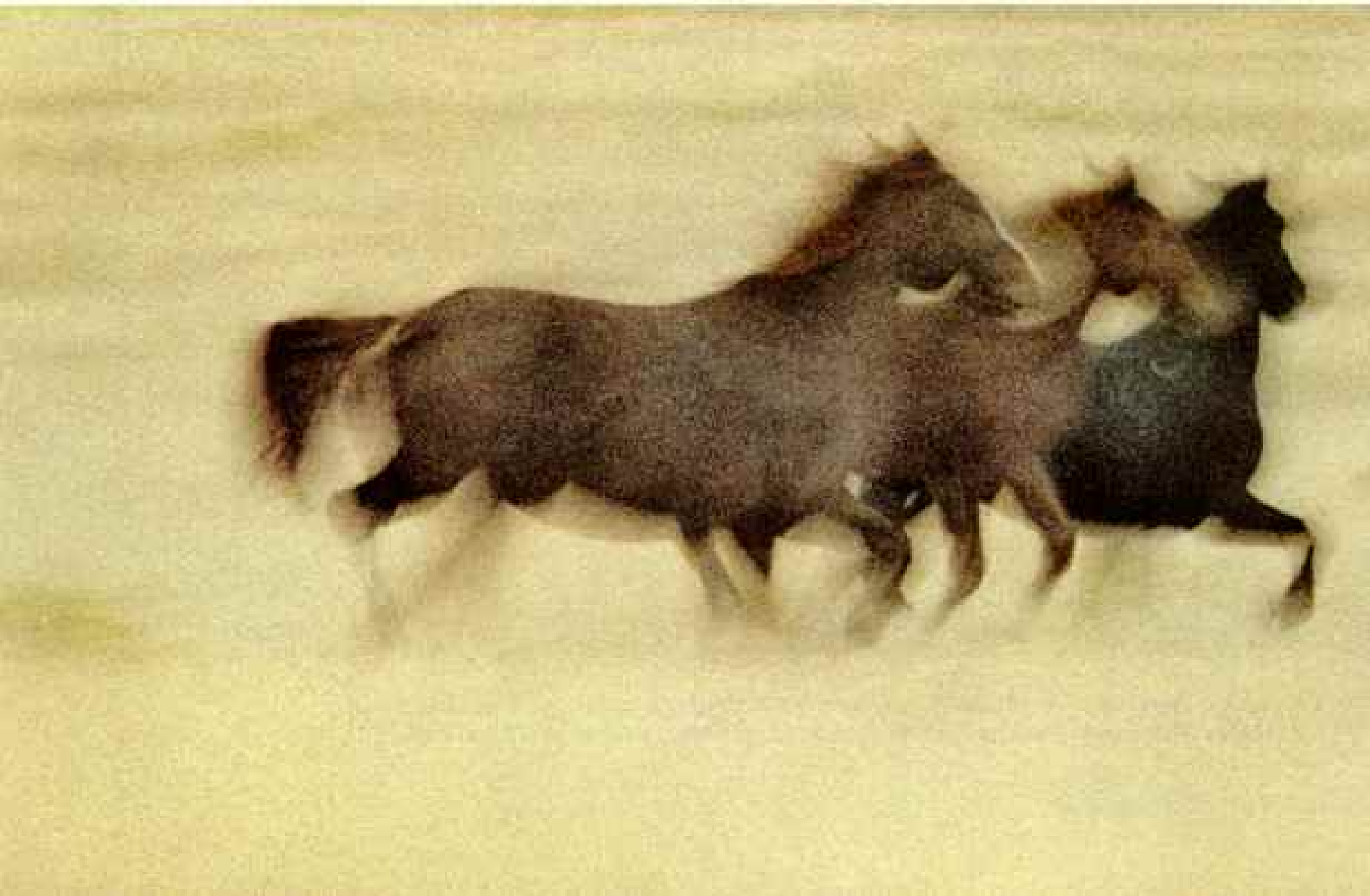
Like the courthouse, this structure does not seem destined for extinction soon. Built in 1865, it is a rock house with walls two feet thick. Flattened tin cans are nailed over holes in the floor. There is no telephone, and running water comes from a tank behind the house. She brewed coffee on an old wood stove, and I learned something of her existence in a ghost town.

Living Alone at 81—and Liking It

Belmont was Rose Walter's childhood home. When her miner husband died of silicosis, she chose to remain in the dying town. For most of her lifetime, she has been Belmont's only permanent resident.

"Summers are nice, except for the rattlesnakes," she told me. "The country's infested with them, coming to find shade under porches. Would you believe I've killed eight rattlers this summer? I aim for the head and never miss."

When I asked her about wintertime, she shrugged. "The snow and the cold don't bother me hardly at all. I got a strong house and that old wood stove keeps me warm as I need to be. Would you believe it got down to 20 below in that cold snap last winter? And ten feet of snow, though not all at the same time. Lonely? Heavens, no! I got my radio and my books to keep me company. And when the holidays come, the few of us here



get together and have a big dinner, dance a jig, and even get a little high."

Rose Walter is typical of Nevada's legendary backcountry women. They are, with rare exception, pioneers with roots deep in Nevada's beginnings. Molly Knudtsen is one of the exceptions (page 735). A slender, delicately featured woman who was a New York debutante, she handles the main buckarooing chores for her isolated Grass Valley Ranch in central Nevada. A twenty-mile ribbon of jarring dirt road is the ranch's connection to the nearest highway.

The ranch is not a gussied-up plaything, but a working spread with juniper-stockade corrals, weathered barns, and outlying buckaroos' cabins with sod roofs dating back to settlers' times. In its 50-mile length, it ranges 2,000 head of Hereford cattle.

In rain and snow and sun Molly rises at dawn to put on leather chaps, worn boots, and spurs to spend most of her day in the saddle. "She's the best woman buckaroo I ever saw," her wind-burned husband, Bill, drawled as we watched her spin her horse away from the short charge of an angry bull.

At day's end we sprawled wearily around an open fire in the living room of the little ranch house and listened to the wind and rain that signaled the first storm of winter.

"I came here as a bride in 1942," Molly told me, "and I have lived here ever since."

Freewheeling mustangs bolt at the sight of man, who once trapped wild herds for use as saddle and buggy horses. Until 1971, ranchers legally killed off mustangs for pet food and to ensure ample grazing for cattle. Now protected, the stocky breed can be "captured" only by artists such as sculptor Greg Melton of Sutro (**above**).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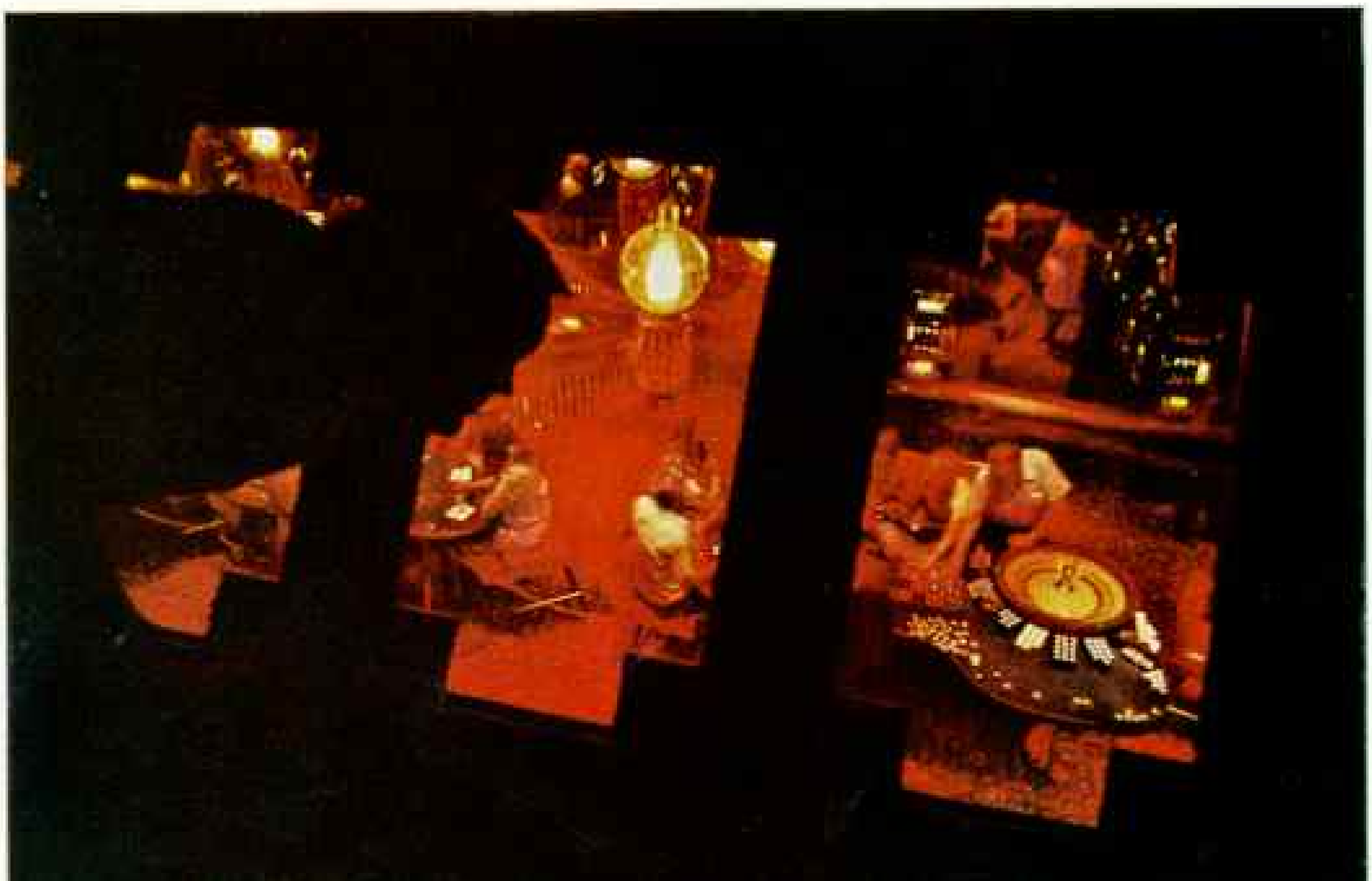


Glitter Gulch frames Las Vegas's most famous resident, odds-maker "Jimmy the Greek" Snyder (**above**). First settled in the mid-1800's by Mormons, the city bloomed into a world-renowned whirligig of chance after Nevada legalized gambling in 1931.

Today the energy crisis has dimmed the Gulch's glitter, but big-name entertainers and lavish floor shows like the Folies Bergère at the Tropicana Hotel (**upper, left**) still lure tourists to the state's largest city. Gambling remains the main attraction —and the state's major industry—grossing nearly a billion dollars last year. At every casino, security agents keep watch on dealers and players, often by overseeing the gaming tables through one-way windows (**left**).

Matrimony takes its chances in Reno, where billboard-glutted Fourth Street caters to thousands seeking instant marriages or easy divorces (**right**).

She paused and then added, "It's not an easy life but I like it, even when the temperature drops to 35 below zero, as it did last winter, and we have to chop through the ice in the creeks so the cattle can drink." The wind wailing down the valley underlined her words, and I shivered.

Unlike Molly, I did not choose Nevada. Nevada chose me. The son of a livestock family, I was raised in Carson City and helped my father on the range. So I had been aware forever of my state's hardness and loneliness as well as its beauty.

When I was growing up in Carson City, its most important claim seemed to be that of smallest capital in the United States—governing the destinies of a sprawling Nevada that had its dubious distinction too. As history books like to point out, there was one person for each of its 110,540 square miles.

Carson City was a town of not more than 1,600 souls, a paved main street and dirt back streets, white-frame houses, and a few stone mansions. On its main street stood the capitol, a U. S. Mint (now abandoned), and a famous hostelry known as Ormsby House.

In that hostelry a nearly forgotten man of history, Territorial Secretary Orion Clemens, had worked in a corner bedroom to shape Nevada's beginnings as a state. His occasional helper was his brother, an aspiring writer with the pen name of Mark Twain.

It All Began in Virginia City

Carson City presses against the evergreen-forested shoulder of the Sierra Nevada, and when I was a boy, most of the population of the state naturally lived in such surroundings, in the favored green valleys of western Nevada, where water was plentiful. Reno was the state's largest and most influential town, studded with the mansions of mining tycoons,

Asleep in the early morning, Virginia City awaits midday throngs of curio-seeking tourists. Boomtown storefronts reflect the era of the 400-million-dollar Comstock Lode, which yielded bullion that gave Nevada its nickname—the Silver State. But the ore ran out with the 19th century, as it did 160 miles away in Belmont (**right**), where octogenarian Rose Walter recalls long-gone bonanza days in what is now a ghost town.

Nevada's tortured landscapes lie within the arid Great Basin and sometimes drink in as little as three inches of rain a year. Scattered juniper and piñon trees, along with sagebrush, cover much of the state, penned in by the moisture-blocking Sierra Nevada on the west and the Wasatch Range to the east. When irrigated, Nevada's rich soil yields barley, wheat, oats, and corn. But water sources are few and often far away.

Near the old mining camp of Tonopah, a lone truck sputters down a dusty desert road, set amidst the repetitious outlines of the corrugated land (**left**).

Outdoorsman and sports fan, Governor Mike O'Callaghan takes his pet hawk, Red, for an early-morning workout in Carson City, the state capital. His windbreaker advertises a hockey team.

Ungainly and uncommon steed gallops in Virginia City's annual ostrich races; its jockey signals directions with a raised broom. In previous runnings of this tourist-oriented event, some entries bolted into the desert; one driver took three days to return. A fence now prevents such mishaps.

livestock barons, and bankers. It was, and still is, a stately town with a splashing river, the Truckee, winding through its tree-filled heart. Lake Tahoe in the Sierra above was a lonely mountain jewel with only a scattering of rustic cabins along its 76 miles of shoreline, and Virginia City was almost a ghost town, dying with the glorious memories of the Comstock Lode mining boom.

I remember that few people then knew much about a forlorn railroad stop named Las Vegas in the furnace deserts hundreds of miles to the south. Franciscan missionary Francisco Garcés was said to have passed near there in 1776, when Nevada was still Mexican territory. In the mid-19th century the Mormons had established a colony of sorts, and in my own youth what was to become Hoover Dam was being wedged into the mighty Colorado River dividing Nevada from Arizona. That was the extent of most Nevadans' knowledge of Las Vegas.

As far as Nevada is concerned, the place where it all began is Virginia City. When one of the richest silver-ore veins in United States history was struck there in 1859, it set off a movement of humanity that nearly equaled the California gold rush. Until then Nevada was simply a place to be gotten through by pioneers and forty-niners on their way to the promised land. They traveled 500 miles through Nevada's bleak landscape of mountains and deserts, following the California Trail.* With the strike, wagon routes from both east and west switched to converge in one wild rush on Virginia City. Thousands of disillusioned miners from the California goldfields joined with fortune seekers from all points of the compass to stake claims on the steep mountainsides that were to yield 400 million dollars in silver and gold.

This was the wealth that enriched the Union treasury in the Civil War, gave Nevada premature status as a territory in 1861 and as a state in 1864, built San Francisco's financial district, made a capital out of Carson City and a railroad center out of Reno, and sent thousands of prospectors spreading through an uncharted state in search of other strikes.

Nearly 20 Saloons for Every Church

At its zenith in the 1870's, Virginia City had a population of 25,000, roaring mills that pulverized raw ore and extracted silver and gold, dozens of mansions, four banks, and as a local paper, the *Territorial Enterprise*, liked to point out, six churches and 110 saloons. Then the Comstock Lode pinched out, mills fell silent, many of the great houses were moved to Reno and Carson City, and a score of newly made millionaires sought greener pastures.

Today Virginia City has recovered from the long decline that very nearly turned it into a ghost town. The American nostalgia for things historical has made it a regular stop for an unending caravan of tourists. Newcomers setting up curio shops and sidewalk displays of relics far outnumber the old-timers whose roots go back to Comstock times.

Still, the ghosts of Nevada's beginnings live on. In capacious Piper's Opera House, now undergoing a restoration, I could picture motley gatherings of rude-garbed miners and exquisitely dressed mining millionaires and their

*See "**Close-up: U.S.A.—California and Nevada,**" distributed as a supplement with this issue.

ladies in red-velvet boxes watching the stars of yesteryear—Lillian Russell, John Wilkes Booth's brother Junius, and Lotta Crabtree, the "Golden Girl."

As I strolled the boardwalks of Virginia City, it was not difficult to imagine an era when the mansions of the new rich had seen banquets of caviar, lobster, and French champagne, liveried horsemen guiding coaches through crowded streets, Mark Twain writing satirical pieces in the building that housed the *Territorial Enterprise*. I heard it said that Twain summed up his impression of the city in a sentence: "It was no place for a Presbyterian, and I did not remain one very long."

Some Las Vegans like to describe their town as the story of Virginia City all over again. They may be right, but I have never been able to accept the analogy. The aspect of sudden riches, opulent living, and the great names of the entertainment world may be the same, but I cannot forget that Virginia City was made by sweat and tears. I must think of the miners who worked at backbreaking labor in the steaming mine stopes of the Comstock Lode and remained in Nevada afterward to found families that were the core of the state.

Bandaged buckaroo recoups in Austin's Golden Club saloon (**above**) after an off-the-range traffic accident. Something of a civic center, the Golden Club—like most small-town Nevada bars—shuns plush Las Vegas trappings for simple hospitality. Its thirsty regulars include ranchers, sheepmen, miners, and others seeking a sympathetic ear or a friendly game of chance (**right**).

Casinos Use Big Names as Bait

It was Friday night in late summer when I drove down the glittering belt that is Las Vegas's famous Strip, passing luxury hotels, transplanted palm trees and instant greenery, and dazzling marquees. The weekend exodus from southern California was almost bumper to bumper—tourists come to tan themselves by day beside swimming pools and immerse themselves by night in an extravaganza of floor shows and bare-skinned cabaret acts. Afterward they would try their hands at roulette, craps, 21, and standing armies of slot machines in casinos nearly as long as football fields. It is a dizzying kaleidoscope of sights and a stunning barrage to the senses. It is Las Vegas.

With me was "Jimmy the Greek" Snyder (page 741), Las Vegas's best-known personage since Howard Hughes departed his ninth-floor sanctuary in the Desert Inn. Jimmy, whose last name has been Anglicized from its Greek original, made his reputation by setting odds and picking winners in sports events and political contests. His educated guesses are quoted in the country's sports pages and by columnists like Jack Anderson.

"The names on those hotel marquees are what really bring the tourists here," said Jimmy. "They're the dressing on the lure of legalized gambling. Where else do you get a lineup like that? If it isn't Sammy Davis, Jr., it's Elvis Presley or Tom Jones, Pearl Bailey or Mitzi Gaynor, the Folies Bergère or the Lido. Any one of those names would pack a hall anywhere. In Las Vegas the tourists get them back to back or all at the same time. You can't fight that kind of action."

There was no denying that. Las Vegas hotels and casinos spend 100 million dollars or more on big-name talent each year to ensure the city's claim to the title Entertainment Capital of the World. Each of its 30 major hotels also spends about a million dollars a


L. W. PERALDO CO., INC.
TABLE
1973

Clawing Lake Mead's broad face, 97 boats towing water-skiers vie during an annual 50-mile race. Mead, born in 1935 when Hoover Dam stoppered the Colorado and Virgin Rivers, created some 550 miles of shoreline with inviting coves,

sandy washes, and newly accessible canyons. A year-round arena for summer fun, it has become the most popular national recreational area. The lake also waters dry lands and drives hydroelectric turbines that power much of the Southwest.

year in advertising. As publisher Hank Greenspun of the *Las Vegas Sun* told me, "Las Vegas has had so much worldwide publicity that if its advertising spending were canceled out in one day, it would continue to draw tourists for another 100 years."

Perhaps. But that was before the energy crisis struck the nation's tourist centers like a bolt out of the blue. I saw Las Vegas again in November when hotel and casino owners "turned off the lights" to conserve energy. The Strip and Glitter Gulch seemed like graveyards when I remembered the solid banks of neon that had made night as bright as day.

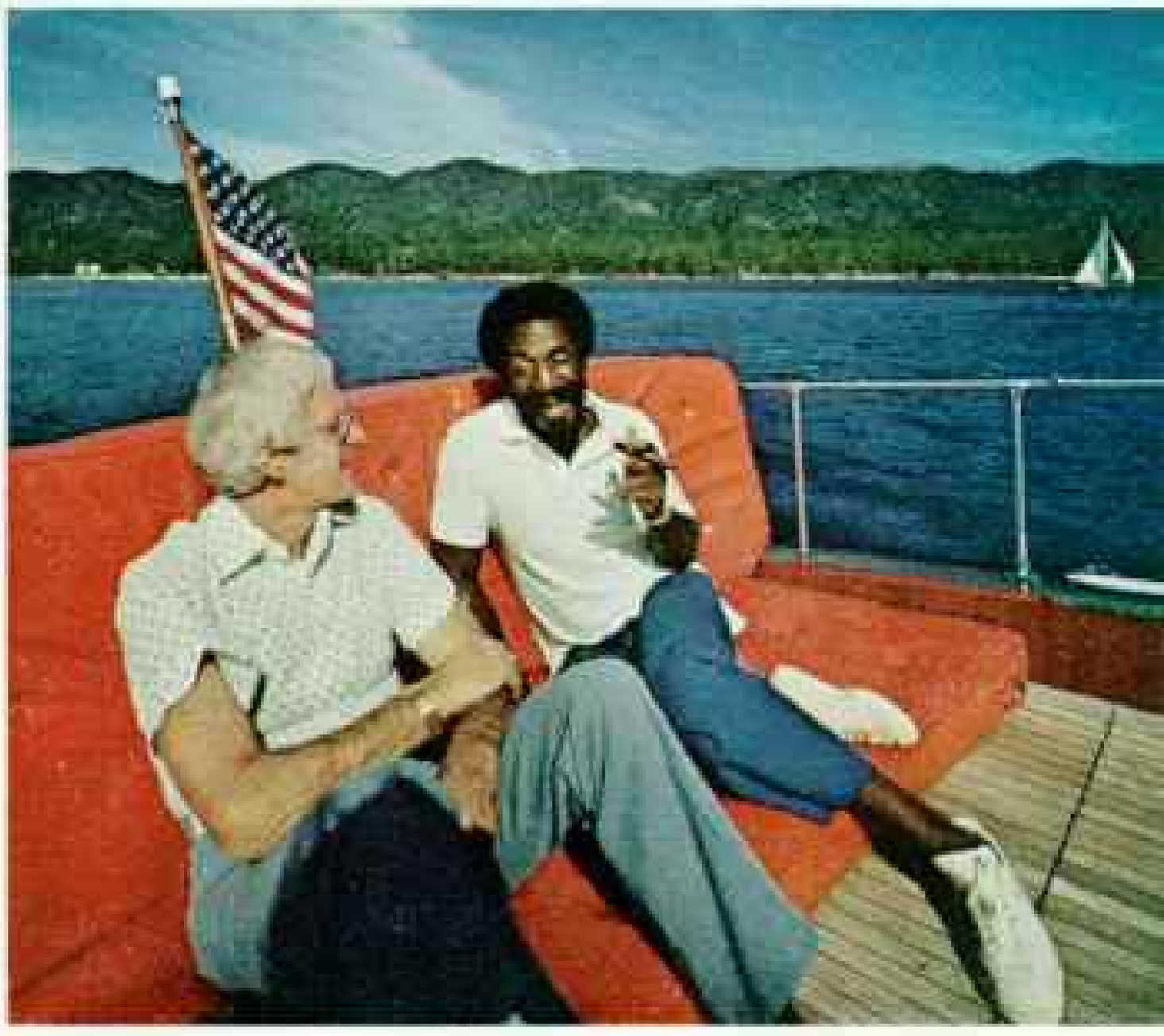
The brownout, however, is not Las Vegas's major worry. It is the uncertainty of gasoline for automobiles that transport nearly six million visitors a year to this tourist mecca. Hotels and casinos in Reno and Carson City and at Lake Tahoe are equally threatened.

"We'd better not kid ourselves that Nevada couldn't be in trouble," Governor Mike O'Callaghan told me in the Executive Chamber in Carson City. "Tourism, with its billion-dollar-a-year income, is the lifeline of our economy. It accounts for 50 percent of Nevada's tax revenues and nearly 75 percent of our employment. Mining, agriculture, and industry can't begin to touch these figures.

"Federal agencies now seem to be taking a

"**Fairest picture the whole earth affords,**" wrote Mark Twain of diamond-clear Tahoe (**left**), largest alpine lake in the United States. Cupped by mountains where California's elbow meets Nevada, Tahoe's 300-square-mile basin draws droves of summer tourists, campers, and pleasure-boaters that include casino owner Bill Harrah and comedian Bill Cosby (**below**).

Sewage and erosion brought by overdevelopment now threaten the lake's clarity. Even treated sewage—pure enough to drink—would generate water-clouding algae if dumped into Tahoe, so it is piped some twenty miles to a man-made, algae-tolerant lake in California.



positive approach in helping Nevada cope with the gasoline shortages. Without this support, things could get rough, particularly in Las Vegas."

But Las Vegas has a knack for surviving stormy times in one form or another. It has been both blessed by riches and plagued by trouble ever since three factors came together to transform the quiet town near Hoover Dam into Nevada's most populous city: the rush to desert living, air conditioning, and the building of a luxury hotel by one Benjamin (Bugsy) Siegel, an Eastern mobster. Provincial Nevada, which had legalized gambling in 1931 in a desperation move to shore up its impoverished economy, never dreamed what consequences the coming of Bugsy Siegel would have. Other hoodlum elements, quick to see the promise of golden profits in legalized gambling, came into Nevada by the dozens in the years following World War II.

In 1966, when my brother Paul was elected Governor of Nevada, Las Vegas was being assailed by the national press for hoodlum infiltration. Paul's first order of business was to meet with the FBI's J. Edgar Hoover and promise the director that he would set about "getting Nevada's house in order." It might well have proved an impossible task, except that recluse billionaire Howard

Hughes came to Nevada and began buying Las Vegas hotels. That spelled the end of hoodlum control over Las Vegas gambling.

Along with Hughes, Barron Hilton, and construction magnate Del E. Webb, William Harrah is one of the state's four biggest hotel-casino operators. His 24-story hotel in Reno is the city's tallest building, and he has just opened a new 27-million-dollar hotel overlooking Lake Tahoe. It contains one of the world's largest casinos.

Under Nevada's 1969 corporate licensing law, gaming establishments come under the scrutiny of the Securities and Exchange Commission. Harrah's corporation and 11 others with gambling operations are listed on various U. S. stock exchanges.

"The concept of public companies has done a lot for Nevada's image," Harrah told me. "Legalized gambling has become more palatable to the national conscience. But that was always a paradox, anyway. Gambling revenue in Nevada is still fifth down the line, behind pari-mutuel and lottery gambling in four other states—New York, California, Florida, and Illinois."

Mining Loses Its Glamour

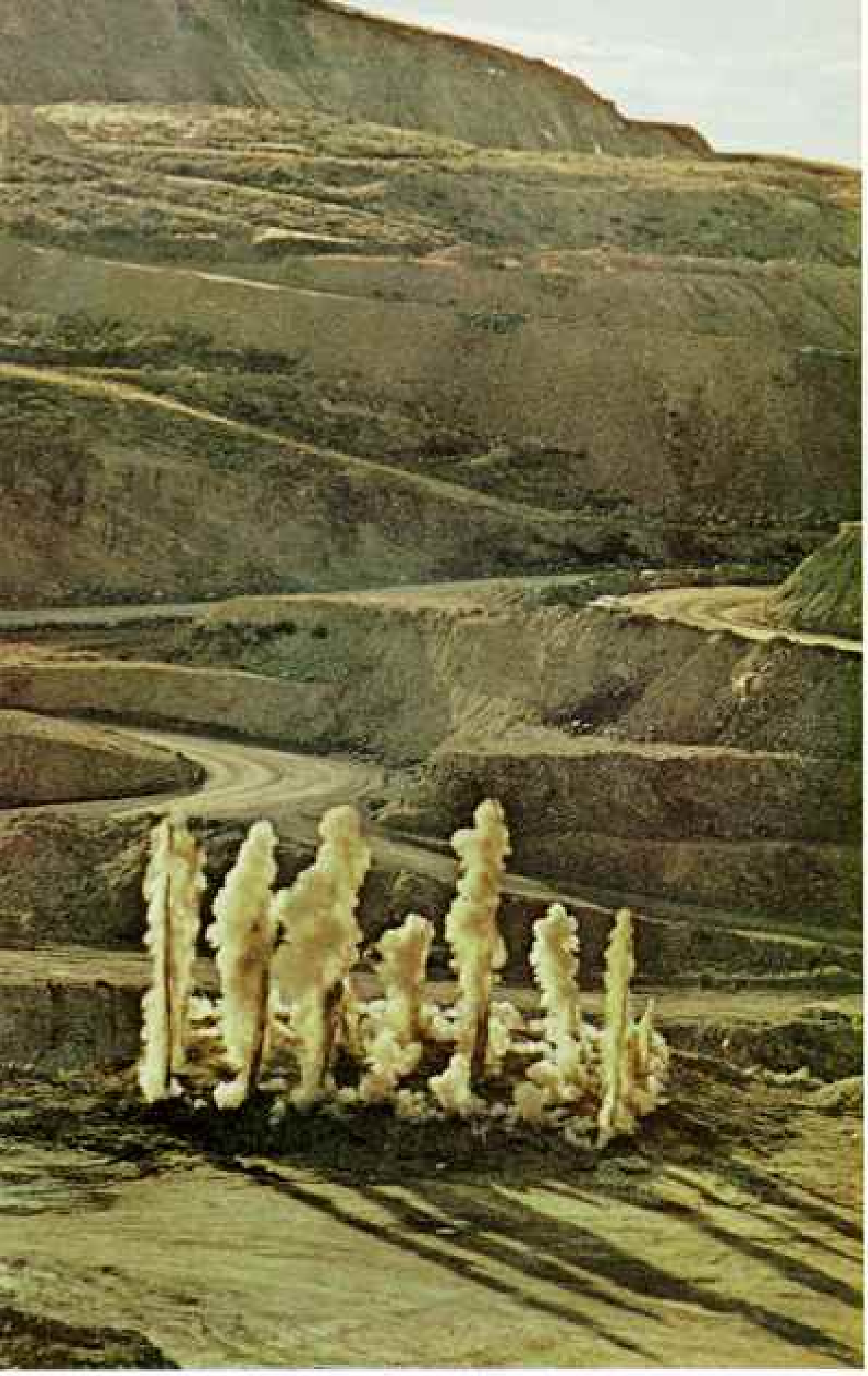
Tourism and gambling in the state's few population centers overwhelmingly dominate the Nevada economy today. Mining and agriculture combined realized earnings of only 307 million dollars last year, less than half that of tourism. And industry is still in its embryonic stage in Nevada.

Despite the rise in gold prices, the mining that was Nevada's reason for existence in the first place is almost a thing of the past. Only a few old prospectors still haunt the deserts in search of fabulous strikes. Except for the Carlin Gold Mining Company (following pages) and the Cortez Gold Mine in northern Nevada, the bulk of mining now is in unglamorous nonprecious metals—copper, lead, tungsten, iron—and nonmetallics—magnesite, gypsum, and barite.

Hush-hush government installations operated by the Atomic Energy Commission and the Air Force are tucked away in the more desolate desert sweeps. The AEC has blocked off nearly a million acres of barren land in southern Nevada. The open-air atomic blasts of post-World War II years have now given way largely to underground nuclear tests, including those for such peacetime uses of atomic energy as harnessed explosions to

Veteran music maker of Austin, Millie Acree pounded the ivories for sixty years of high-school graduations, dances, and parties before retiring last year.

Crosshatch of controversy quilts the land near Elko, where out-of-state dealers bought and marked off ten-acre tracts (**left**) for mail-order sale. Trusting buyers soon complained that their plots lay too far from water, sewer, and electric lines to be usable. Real-estate offers now must clear a state regulatory agency, and unethical land promoters face stiff fines.



Invisible gold hides in the hills near Carlin, scattered in flecks too small to be visible except under an electron microscope —and too small to mine until the advent of modern technology. Multiple explosions (**above, left**) rip loose chunks of gold-bearing rock. Crushed ore surrenders the metal to a cyanide solution; zinc is added to precipitate the gold, which is then smelted.

Working around the clock, Carlin processes 4,000 tons of ore to make a 50-pound button (**above**). Periodically, workers toss their gloves and coveralls into the furnace to recover any vestiges of absorbed metal. Carlin, second among North America's gold mines only to South Dakota's fabulously rich Homestake, was described in detail in the May 1968 GEOGRAPHIC.

High-quality gemstones glisten under the hose of Dowell Ward, Jr., owner of America's most productive turquoise mine (**left**). Ward paid $20,000 for his Crescent Valley holdings in 1956 and has since refused to sell out for three million dollars.

The bulk of the Silver State's underground wealth lies less in gold and turquoise, however, than in such commodities as lead, magnesite, and especially copper, which accounts for nearly 60 percent of Nevada's income from minerals.

expedite the extraction of natural gas.

Probably the most unusual project of Nevada's beginning industrial focus is located on a desert flat near Reno. Here I found inventor William Lear experimenting with an external-combustion system aimed at cutting automobile pollution. He explained his engine to me. It resembles a pressure cooker in which a small amount of liquid fuel is used to convert water to steam. The steam turns a turbine wheel at a maximum speed of 70,000 revolutions per minute. Result: a low-emission propulsion system with more miles per gallon for cars and buses.

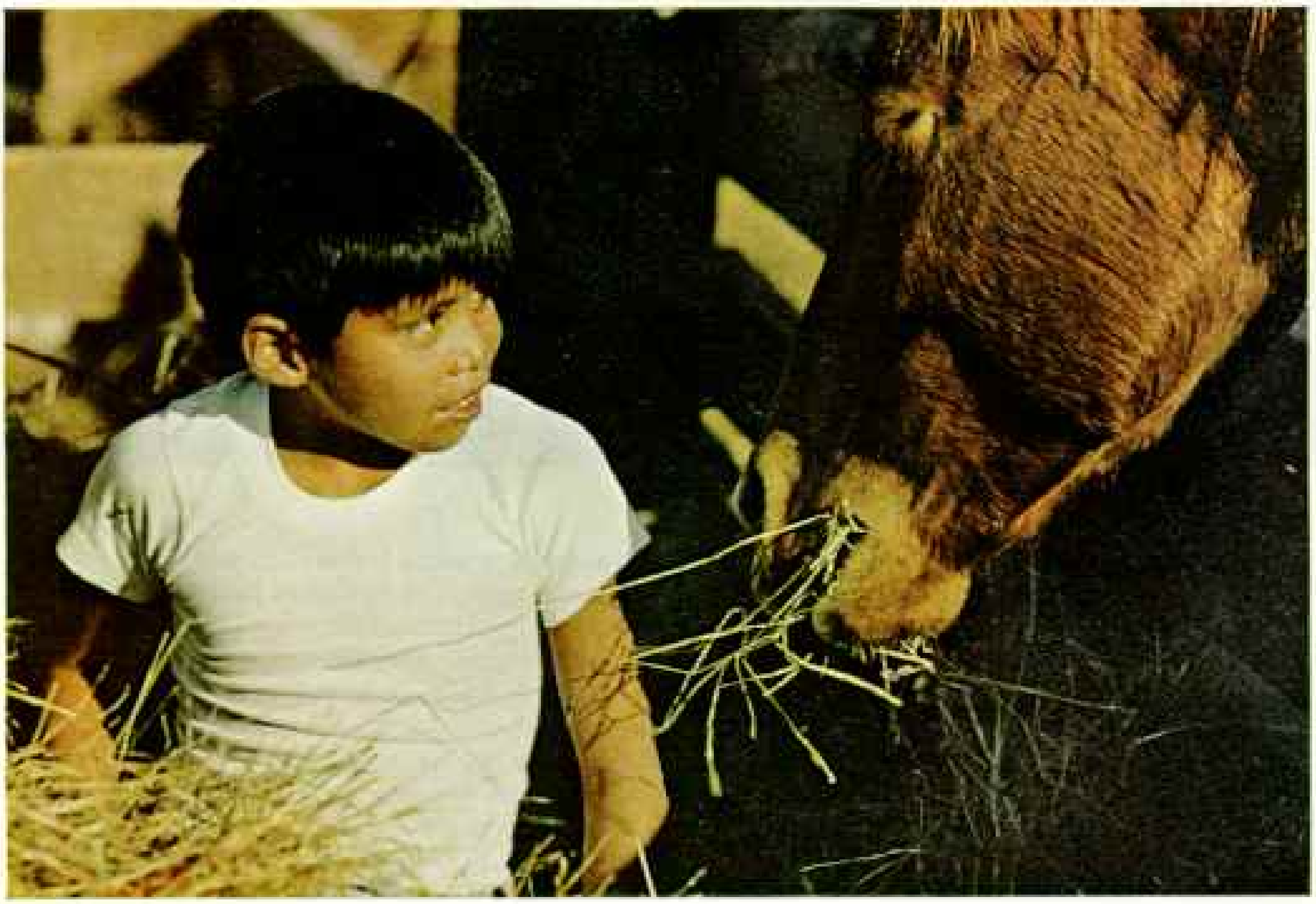
In his spectacular career as an inventor, Lear developed and marketed the first automobile radio, an automatic pilot for jet fighters, and an eight-track stereo tape cartridge. A good part of his fortune was made by developing a small jet plane for businessmen. I once took a flight in a Lear jet piloted by his son John. My recollection of that experience is that I finally knew how it must feel to be shot out of a cannon.

William Lear is a dynamic man who punctuates his speech with a profusion of softly spoken swear words. He has had rocky going trying to have his steam engine accepted by auto manufacturers.

"I'm fighting the colossal inertia of the major car companies," he told me. " 'Internal combustion is eternal' is their motto, or should be. They don't give a damn about pollution, but *I* do. I've put my money where my mouth is, 17 million dollars to be exact. Now, I don't have that many millions left. If I can't interest the auto industry very soon, I'm seriously thinking about going back to developing another small jet."

Ski Runs Top Sierra Peaks

Another Nevadan who is charting new frontiers is Hugh Killebrew. His Heavenly Valley—on the Nevada-California border above Lake Tahoe—is the nation's largest ski area. It contains 20 square miles of skiing country with runs that cross the tops of nine Sierra peaks. We looked down from one of those peaks on a sunset that turned Lake Tahoe's blue waters to warm gold. Some of the deserted shorelines that I remembered are lined now with resort hotels. "Before I'm



Young Paiute's best friend, a horse gets a handout on Fort McDermitt Reservation. Knee-patching economy (**right**) bolsters an Indian family's jeans for the wear and tear of reservation life. Nevada's 8,000 Indians—mainly Paiutes and Shoshonis—descend from proud and peaceable people who successfully foraged the arid, ungenerous land for

done," Killebrew said, "Heavenly Valley will be the biggest ski area in the world—50 square miles of Sierra, 1,000 miles of ski runs, and overnight villages along the way."

Even if all Hugh Killebrew's dreams come true, and the dreams of hundreds like him, there will still remain vast expanses of the other Nevada, not only unchanged but even, eerily, seeming to be displaced backward in time. I recall going with cowboy artist Craig Sheppard on a jeep trip into the extreme northeastern reaches of Nevada, a land so big and so lonely that I had the pervading illusion that we could be the only human beings left on earth.

Fifty miles off the paved highway night had caught us casting about among unmarked dirt roads for the one that led to the Elquists' ranch. Our only sure knowledge was that it lay somewhere east, and we followed the moon for direction. Finally, in the pale light that rimmed the mountains, we came to a stream, little more than a winding trickle with ice forming at its edges.

It led us to Pop and Bertha Elquist's Trout Creek Ranch, one of those old homesteads common to this lost corner of Nevada. The homesteads go back to the day when Nevada was a raw wilderness. And so do the ways of life and language.

Pop Elquist is a man with a leathered face and judging eyes. His wife, Bertha, is a strong-willed ranch woman as much at home in the saddle as she is in the kitchen, preparing huge meals for her husband, a buckaroo or two, and the rare neighbor "come a-visiting."

At the dinner table Pop was untypically talkative. It was a special effort to make us feel at home. He has never been to Las Vegas, and to Reno only a few times. He spun a story about a cattleman's convention there a while back when he got bored with the speeches and noticed a lariat hanging on the wall as a decoration.

"I thought to myself," he said, "you've roped cattle, horses, bear, coyotes, jackrabbits, and even a skunk. But you ain't never roped a Cadillac. So I took that there lariat, went outside, shook out a loop, and sure enough roped me a Cadillac pulling up to one of them stoplights. That city feller was the most surprised man I ever did see when that

centuries. Befriending early settlers, they rebelled when gold-hungry miners needing timber and fuel felled the piñon pines that had yielded the Indian's staple, pine nuts. Today, many of their descendants raise cattle. Plans are afoot for them to develop recreational facilities on Pyramid Lake Reservation in the hope of luring tourist dollars.

rope settled down over his windshield. At least, he was good-natured about it."

After dinner, the men sat in the parlor while Bertha and the other women visited in the kitchen. I listened in wonderment as these hardy men rocked in their chairs and engaged in talk so spare that half a minute, broken only by the ticktocking of a big clock, would elapse between exchanges.

"I'm a-wonderin' about them black cows, them Angus, that so many cowmen are goin' to now. In Ideeho and Nevada, too."

"I wouldn't have 'em. They don't take to range livin' like a Hereford. Give me a white-face every time."

"Well, some say them black ones make good eatin' beef."

And when the conversation changed:

"You gotta teach the young uns the valuation of a dollar."

"Yep. Everythin's too easy for them now."

And when the visiting was done:

"I've got sawdust in my eyes. Guess it's time to go to bed."

And so on in the measured tempo of men who have spent much time alone, who think before they talk, and to whom talk is not cheap. Since there were women within listening distance, their strongest expletives were *By Heaven! Lordy! Laws!*

Comforting Plunge Into the Past

Next morning we woke in the dark to huge platters of fried eggs and sausage, homemade bread and honey, and steaming coffee. Afterward we went out in the wintry dawn and helped Pop and his buckaroos run a kicking, biting stallion, skittish mares, and leggy colts into the corral. The buckaroos shook out long loops and roped down mares and colts by head and feet for the branding.

When the work was done at sunset, all the men went down to Pop's hot well, a spring of mineral water that he had dug out to make a pool. In the freezing darkness we stripped and jumped in. The water warmed our bodies, and the air formed icicles on our heads.

I lay back to watch the great clouds of steam rising into a night sky in which stars shimmered like elongated crystals. From a distant ridge a coyote yipped mournfully, and from the ranch a dog answered.

I might as well have been a thousand miles away from city lights and sounds, and a hundred years back in time, in the old, unspoiled land that is the other Nevada. □

Season's first snowfall

crusts a backcountry corral in Nevada's Ruby Mountains.

YOU'RE not going to believe me, but I was lonely in overcrowded, overvisited Yosemite National Park!

The day before we had ridden over Burro Pass, where dawn now brightened a decaying snowfield. Somewhere up there, packer Sam Livermore was hunting the mules and the horse that had strayed back along the trail in the night.

So I was alone in our meadow camp below the pass, but I didn't mind, for a host of creatures made friendly company. Marmots whistled. Birds sang. Alpine chipmunks scampered over boulders. In wildflower gardens beside a stream, Belding ground squirrels stood bolt upright, watching; the habit has earned them the name "picket pins."

But the day passed. The animals went to their nests, and my friend didn't return. Heralding the coming of night, a cold wind moaned down from the mountaintops. And suddenly I realized that I was lonely.

Lonely? Here in Yosemite, where the National Park Service has wrestled for years with one of its most complex problems of overcrowding? Even I found it hard to believe.

Your Choice: Throngs or Solitude

The picture that many people have of this lovely 1,189-square-mile park in California's Sierra Nevada as jammed from end to end with people and cars just isn't true. I know Yosemite well. I've been visiting it for years, and last summer I roamed all over it. There is congestion, but only in places.

If a man finds joy in crowds and wants

The Other Yosemite

By NATHANIEL T. KENNEY

Photographs by
DEAN CONGER
NATIONAL GEOGRAPHIC STAFF

Beyond the overpeopled valley of Yosemite National Park, lonely splendors beckon; adventurous visitors find mountain vistas and tucked-away spots as private as their inmost thoughts. Here an early-rising trout lover casts for rainbows on the Merced River, Yosemite's main stream.

comforts, he goes to Yosemite Valley, or to Tuolumne Meadows along Tioga Road. But if he wants to be alone, he need only step off the beaten path. A whopping 90 percent of Yosemite is roadless wilderness in which he might not see another soul for days.

Variety is Yosemite's strong suit. This park lets a man hike, fish, swim, square dance, ride a horse, camp in a tent or in a motor home with chrome trim. He can watch 220 kinds of birds, hobnob with bears (careful!), drive a pack burro, ride a bike, slide down a glacier, live in a deluxe hotel, study 1,400 kinds of wild flowers.

So you like to scale terrifying cliffs? Rock-climbers say Yosemite has the best granite faces in the world; you will find the story of one team's dizzying ascent on pages 782 to 791. Hundreds climb the park's mountains every year. Many of the inexperienced are hurt—and nine were killed in a recent two-year period—but still they come.

One especially brave or foolhardy thrill-seeker went to Yosemite one winter (the park never closes) and ski-jumped off El Capitan, a solid chunk of gray rock rising a sheer 3,000 feet out of the valley. He wore a parachute as well as skis, and landed safely. Rangers do not recommend this stunt.

For something different in a national park, there's a cross-country snowmobile tour out of Badger Pass, a popular ski area and one of California's oldest ski resorts. And at Wawona, which has a stately old resort hotel and the Mariposa Grove of giant sequoias, you'll find another park rarity, a golf course.

But I like the backcountry best—Burro Pass, lonely Jack Main Canyon, or maybe Pate Valley, where normally you'll meet almost as many rattlesnakes as people.

You can trust John Muir for good advice:

"Climb the mountains and get their good tidings," wrote the sage of the High Sierra. "Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves." *

By Packtrain to the High Country

So I set a date with Sam Livermore and his animals. Sam, son of Norman B. (Ike) Livermore, Jr., California's Secretary for Natural Resources, is a Dartmouth graduate who spends his winters in England studying international relations, but in summer he listens to Muir and leads pack trips into the wilds.

We saddled in early morning as smoke from a hundred breakfast fires cloaked the ponderosa pines of the stable area in blue haze, then we jingled out of the valley on the trail to Merced Lake (map, page 768).

There the Yosemite Park and Curry Company has set up one of its permanent High Sierra camps for hikers who don't want to carry grub and sleeping gear. With us rode Mary Jo Hinton, then an employee of the Curry Company, and GEOGRAPHIC photographer Dean Conger and his son, Eric.

It is a Yosemite axiom that the farther you go from the valley, the fewer humans you encounter. Yet more and more people, especially young people, are backpacking the Sierra loop trails. Until we left the Little Yosemite Valley, we were not often alone.

"Doing it the easy way, eh?" a young hiker chided us. But then we met one who said, "I wish that mule had a back seat."

We had a good night's sleep by Merced Lake. The stock didn't. As we mounted in the morning, bound for Vogelsang High Sierra Camp beneath a peak towering 11,516 feet into the blue, Sam told us to hold the reins tightly, for a sow bear and two cubs had ambled through the meadow in the night and our animals could be nervous.

The first people we met were not nervous at all; they were skinny-dipping in a stream. I thought they would flee for cover when we rode upon them, but they only greeted us in friendly fashion and we did the fleeing.

We came to a glorious meadow. We stopped for lunch. Disaster struck. As Mary Jo started to dismount, her mule inexplicably spooked, throwing her heavily upon a jagged rock.

Fearing major injuries, we did not dare move her, but built her a shelter against the cold wind, and gave her a sedative.

Sam and Eric galloped off for Vogelsang. They had a stroke of luck, coming upon a crew repairing one of the few phone lines outside the valley.

The workmen tapped a wire, Sam phoned Helitack, the park's helicopter rescue unit at Crane Flat, and a chopper was soon descending upon the meadow.

Carefully wrapping Mary Jo in a sleeping bag, we put her into a basket stretcher slung beneath the helicopter, and it buzzed upward and away like a huge dragonfly. She was in the valley hospital within minutes. We went on, subdued and tired, to Vogelsang camp.

As for Mary Jo, the hospital found several vertebrae fractured, but she was up and limping about in a week.

Wilderness a Balm to Bruised Lives

A wilderness purist no longer calls the Sierra Loop, with its much-used trails and comfortable camps, the backcountry. To look at what is still backcountry in anybody's lexicon, we had taken that rough trail that leads over Burro Pass.

It wasn't all loneliness, I should say here. We met a few outdoorsmen who return to the solitude of the mountains year after year.

There were Chuck Sipes and Norm Smith, who lead wilderness treks of people whose problems with the law got them into California penal custody. The idea is that nature will help rehabilitate them, so they're offered this opportunity. We met Chuck and Norm on an evening when ice was making on mountain ponds, but they were in shorts.

*Harvey Arden revisited "John Muir's Wild America" in the April 1973 NATIONAL GEOGRAPHIC.

Living cameo in Yosemite's showcase, a yearling deer nestles in shade not far from a teeming valley road. Sharp eyes and a quiet footstep can bring such rewarding sights to nearly all of Yosemite's 2,300,000 yearly visitors, especially if they will venture even a mile or two beyond the superpopulated confines of the valley itself.

"**The mountains are calling** and I must go," proclaimed naturalist John Muir. He strode California's glacier-carved Sierra Nevada a century ago in search of scientific knowledge and soul-staggering panoramas like this twilight view of the Yosemite region (**above**). Mighty Half Dome shoulders above Yosemite Valley at left; silver-tasseled Nevada Fall catches the day's last light at right center.

Cocooned in goose down, hikers (**right**) wake to the blinding slap of a High Sierra sunrise after an exhilarating night atop Yosemite's Matterhorn Peak.

Testing ground of wilderness, Yosemite's cliff-bracketed central valley became the nucleus of the nation's first state park in 1864. In 1890 Congress designated the land around the valley a national park, incorporating the state preserve 16 years later. Today's 1,189-square-mile domain is ruled, some say, not by man or bear, but by the raucous, ubiquitous, and impertinent Steller's jay (**right**), Yosemite's feathered mascot.

On the shore of Rodgers Lake we met Bill Bohannan of California and Oregonian Randall Kaufmann. They have cast flies into virtually every Yosemite lake and stream and were going over the waters again last summer for a guidebook they planned to write.

Randall makes his living tying flies. He gave me a hatbandful of his best. With these I actually caught fish, a thing I rarely manage. I threw them back in, which pleased Bill and Randall.

"We do the same," Bill told me. "Like Thoreau, we wonder: 'Who hears the fishes when they cry?' "

Folk Songs and Firelight Knit a Family

In our camp where Piute Creek twinkles in susurrant clarity into cold Benson Lake, we finished early supper. We heard cries. On the Benson beach we found Dixie Carpenter struggling to crank up a self-stalled burro.

Dixie invited us to meet the rest of her family. We found them in a lakeside meadow around a leaping campfire: Ted K. Matthes, University of Oregon statistician. Ted's wife, Anne. Their four children. And their mothers, of whom Dixie was one and Florence Matthes was the other. Both were over 65—and young as springtime. They all urged us to stay and join in a songfest.

How they could sing! Folk songs I didn't recognize, sung with a subdued intensity that reminded me of Gregorian chants—fitting music for the cathedral-like hush of the wilderness evening. Somewhere far away a great songster of the coyote tribe joined in with an intricate quavering descant of his own.

The fire diminished to embers. Dixie loosed the burros to graze. Aaron Matthes, 5, fell out of the same small tree several times, on each occasion earning a bit of sticking plaster and a grandmother's kiss.

The children snuggled into their sleeping bags one by one. We went back to our camp. Sam said: "After meeting this family, I think the nation will be all right for another generation anyway."

Southward from Benson Lake the trail twists for the dry, dusty Pate Valley, dropping vertically half a mile as it meanders through stately forests of ponderosa and sugar pine, of the sequoialike incense cedar, and the two kinds of oak that dwell in this land.

Once, long ago, a tribe of unknown Indians lived here. It was mainly to commune with their ghosts that we rode into the valley. We wanted to see the things they left behind when they walked into the sunset for the last time—things like vivid rock paintings and middens of translucent chips flaked from the obsidian chunks out of which they fashioned their projectile points and tools.

As I noted earlier, the Pate Valley is rattlesnake country. We saw several, sunning themselves in the trail that led back to Tuolumne Meadows. But when Dean approached to take their pictures, they fled into the manzanita thickets, and we were unable to rout them out.

You climb out of Pate Valley by some of the roughest trail in the park—a temporary thing, rangers told me, which they would later smooth out. Your mule slips and slides and puffs and blows up dizzy grades; if you fear heights, as I do, you close your eyes and make deep fingerprints in the saddle horn and do not look below into the canyons, like raging Muir Gorge, that stud this part of Yosemite with some of earth's most magnificent primitive scenery.

Eric Conger bounces in his saddle. He has looked down upon dark shapes flickering in crystal pools.

"See those trout!" he cries. "Stop! Let me catch some for our supper."

But we did not stop, for we were bound, perforce, to civilization, and more and more people, slogging along in the dust, reminded us that we were nearing the paved roads.

"Nightingales" Sing Fearsome Songs

We camped above Waterwheel Falls, mecca of hikers, tossed to the very clouds by a granite chute, somersaulting in a glittering rainbow. I was left alone; Dean and the others took the horse on a photo mission, leaving me with four lugubrious mules who wailed their loneliness—as they did whenever the horse they loved left them.

As darkness descended, flashlights joggled along the trail, stopping at my campfire.

"We've been hearing horrible noises," said wide-eyed Marilyn Haff and Susan Holt, schoolteachers from Gorham, New Hampshire. "Are they bears? Is it safe for us to go on tonight?"

"No bears," I assured them, and showed them our four flop-ears. "Just harmless Sierra Nevada nightingales."

In the morning we rode to Tuolumne Meadows, past Le Conte and California Falls and the especially fine cascade at Glen Aulin camp.

In the Yosemite everyone knows, a free shuttle (**right**) lures motorists out of their cars for tours of the visitor-clogged valley. Ooh's and ah's mingle with the thunder of Yosemite Falls, which hurtles from a granite ledge 2,500 feet above.

Freewheeling ranger guides a posse of pedalers on a nonpolluting trail ride. The same glacial forces that hewed the mile-wide valley also laid down a flat fill of silt, 2,000 feet deep in places—thus creating Yosemite's broad meadows and making possible horizontal cycling through a largely vertical landscape.

Tumult on wheels, a tricycle for grownups snarls along a one-way road loop designed to keep heavy traffic flowing smoothly. On busy summer weekends as many as 40,000 people jam into the valley. Park officials ponder schemes for banning personal motor vehicles and enticing visitors to use public transit.


Free Valley Shuttle

Now there were so many hikers that the trail took on the aspect of a city park on a summer Sunday afternoon.

These hikers, all fresh and clean, belonged to that overwhelming majority of Yosemite's 2,300,000 annual visitors who never leave the park's amenities. They looked askance at our ten-day-old beards and filthy Levi's.

I suppose we swaggered a bit, if that is possible in a saddle, and thought ourselves superior. But that night, I'll have to admit, the hot showers and clean clothes and candlelit dinner at the Ahwahnee Hotel weren't at all hard to take!

Melodious Name for a Tough Tribe

If you've never seen Yosemite, plan to enter on State Route 41 from Fresno. You emerge from the Wawona Tunnel's blackness upon Discovery View and the classic picture of the valley, the one captured on a million postcards. I doubt it has changed much since Maj. James D. Savage's Mariposa Battalion looked down from somewhere nearby in 1851. To the right the wind-tossed ribbons of Bridalveil Fall leap from a cliff. Beyond loom El Capitan (page 774) and Half Dome (page 766), two of the most photographed granite massifs in the world. Then, narrowing, the valley twists northward and is lost behind mighty cliffs.

Below the lookout point's retaining wall, scores of ground squirrels and electric-blue Steller's jays, begging for handouts, have delighted visitors for years (page 768).

Savage and his men were looking not for beauty, but for Indians, a tough tribe they had been sent to round up and put on a reservation. The Indians were Ahwahneechees, reinforced by stragglers from other tribes, who came to be known as "Yosemites," from their name for the grizzly bear, *uzumati*.

While Savage didn't catch them all in 1851, the Indians finally were driven from the valley. It then became, first, farmland and pasture, next a California state park. In 1906 it was incorporated into the surrounding national park, the third oldest, established in 1890.

I saw one memento of the Indians, but I don't imagine anybody will ever see it again. It was a perfect obsidian arrowhead, a tiny one used for hunting birds. A sensitive friend with whom I was fishing picked it off the bottom of the clear-flowing Merced River but then buried it deep in the bordering meadow, saying that he felt it belonged there.

The Yosemites and their modern successors

IN A REALM OF UNCERTAIN SUMMER,
9,000-foot-high Rodgers Lake
awaits an August day that may bring
warm sun or chilling snow flurries.
Scores of mirror-bright alpine lakes
dapple Yosemite's upper canyons, cupped
in granite debris left by retreating glaciers.

Early-autumn snowfall lays a hush on Yosemite Valley. Monolithic El Capitan, at left,

shared the same tastes in dwelling places. The Indians built their *u-ma-chas* in the seven-square-mile glacier-carved gorge. Here 20th-century man also has put up most of his houses—the hospital, Curry Village, Yosemite Lodge, and Ahwahnee Hotel.

Some 1,200 people live in this small city year round. Understandably, the congestion and traffic jams are at their worst in this area. Thanks to intense effort by the Park Service, however, I found less crowding than I'd seen a few years earlier.

"We've cut out almost half the spaces in the campgrounds," Superintendent Lynn Thompson told me. "That has reduced the number of valley visitors. We've banned parking in front of the Visitor Center, and taken all but bicycle and bus traffic off the Mirror Lake and Mariposa Grove roads. But the best moves we made were the establishment of free bus systems and making the valley road pattern into a one-way loop."

The transport of the future will be strikingly modern. The Park Service has experts

wears a girdle of clouds. Three-spired Cathedral Rocks, at right, overlook the valley's nave.

looking into a monorail system and aerial tramways.

Yosemite serves as a testing ground for all manner of things. One study that intrigued me had to do with the comings and goings of mice, voles, and shrews in Ahwahnee Meadow, under the shadow of Half Dome. College students catch the little animals in live traps, then mark and release them to see how far they wander.

Another survey has to do with the wary bighorn sheep.

"Yosemite had bighorns in Indian times," park research biologist Dr. Jan van Wagtendonk told me. He showed me a skull with huge curving horns.

"This probably belonged to one of a band that survived until fairly recently in the wild country on our northeast boundary. Are they still there? We don't know for sure.

"If they're not, should we reintroduce the species? That probably depends upon whether their winter range, which is outside the park, is still available for their use."

Yosemite, however, isn't a game paradise.

It never had buffalo, elk, or mountain goats, or many beaver. Its grizzly bears, creatures that don't get along well with humans, were shot out long ago, and so were its wolves. There may be a few mountain lions living in the wild southern sections.

If you last saw Yosemite ten years ago, you'll remember there were many black bears in the valley. As a matter of fact, there were probably four times as many as in Indian times, the reason being the lure of campground garbage cans and tidbits from visitors, forbidden by park rules.

Last summer I saw only one bear in the valley, in Lower River Campground. He was ringed by a huge crowd, and a ranger was trying to clear an escape route for him lest he become frightened and hurt someone.

The ranger said he thought there were no more than twenty bears in the valley now.

"We trap surplus animals and turn them loose in the backcountry," he explained.

Once at White Wolf Lodge, Curry Company executive John Crofut and I saw steam coming from a large metal garbage bin. These bins are designed to be picked up and emptied into a truck equipped with a lifting mechanism.

We stopped the car.

"There's a bear in there," said John, but I didn't believe him, and hammered on the bin with a rock. Out came a tremendous bear,

Wheeling stars, a jet's winking light, and snaking cars write their signatures on Yosemite's night in this time exposure. A lone lantern's gleam on El Capitan's face marks a climber's dizzy berth, one day up from the valley. Rock-climber Galen Rowell (**below**) seeks a night's rest in a hammock during an ascent of Half Dome (pages 782-91). He later abandoned it for the greater comfort of a ledge.

DOUG ROBINSON (ABOVE)

rain-wet and steaming. It fled into the forest while I dove for the car.

"One time a garbage collector picked up a bin with a bear in it," said John. "I'm told it was quite a lively scene."

Tourist Handouts Cause Grief for Deer

Like the bear population, the valley deer herd is smaller than it was in the recent past. The rangers deliberately culled it.

Dr. van Wagtendonk described the reduction of the herd as "a paradoxical resort to manipulation" to keep the valley in a natural condition. Lured into the valley, like the bears, by illegal tourist handouts, the deer had gradually increased to unhealthy numbers. Rangers merely took the place of long-vanished predators to restore a natural situation.

Despite the culling, you'll see deer when you visit Yosemite, in the high country or in the valley (page 765). There are three kinds of mule deer: Columbian blacktail, Rocky Mountain, and California.

I not only saw many deer last summer but, unbelievably, I also caught one with my bare hands. It was only a tiny, wobbly fawn, and normally I should not have touched it, for often a mother deer will abandon a baby marked with human scent.

In this case it was necessary. Slipping and falling on the hard pavement, the fawn was trapped on Tioga Road with a cliff on one

side and a canyon on the other. Tires squealed as the fast traffic braked and swerved to avoid the tiny animal. It was only a matter of time before it would have been killed.

I caught the fawn and carried it up the road until I found sheltering forest. I squeezed it occasionally as I went, hard enough to make it bawl and let its mother know where it was.

Yosemite's third conspicuous large animal is an old friend of mine, the coyote. His is one of the great voices of the wilderness, a song that, like the bugling of an elk or the honk of a wild goose, tears at the heart.

And yet, in Yosemite, many people see the coyote and never know he isn't a pet. That's because here, where people spoil him with their garbage, he has almost become Fido.

One day I was sunning on Cathedral Beach beside the Merced with John Crofut's wife, Kris, and the two small Crofut children, whom I know as Peter the Wolf and Benjy the Bear. The boys had walked away to watch the steady procession of vacationists riding inner tubes and rubber rafts down the swift current.

Looking up to make sure they didn't go too far, I was horrified to see a full-grown coyote trotting along beside them. After all, a coyote is a wild animal, and I set out toward the boys on the run.

But then I realized the coyote was paying the children no attention. With wagging tail, it was following a man emptying trash cans, hoping an occasional tasty scrap would fall.

Backpackers of all ages can reach the high country under their own power by choosing trails that zigzag up easy inclines.

Wailing Coyote May Voice Joy

This coyote probably had forgotten how to sing, but another hadn't. It was pouring out its soul in a moonlit meadow one night when a score of us, strangers all, gathered to follow Jon Kinney on a "night prowl."

With or without a coyote aria, a nighttime nature walk with a ranger as sensitive as Jon is an experience no visitor to Yosemite should miss. I said we were strangers when we assembled. Two hours later, when we parted, we would be a band of friends, although we had not seen each other in full light and most likely never would.

"Why is the coyote sad?" a little girl asked as we set off through sighing pines.

"Maybe he isn't," Jon said. "Maybe he is singing a happy song. It sounds sad to us because we hear it with human ears."

But the burble of Yosemite Creek in its stony bed could only be a cry of joy, and the thunder of Yosemite Falls soaring above us was the sound of brute nature.

"John Muir loved this water music, as he loved the singing and the bobbing dance of the ouzel, the little bird of the icy waters you may have seen walking along the bottoms of Yosemite streams in search of its dinner," said Jon.

Standing where Muir once lived in a rustic cabin of sugar-pine boards, watching the moonlight flicker on the rushing creek as Muir must often have done, I felt inexplicably close to this sage of another generation. I could fully understand something the great Scottish-born naturalist had written, a line of prose-poetry:

"But the darkest scriptures of the mountains are illumined with bright passages of

love that never fail to make themselves felt when one is alone."

Now, from the hushed dark under stately pines and incense cedars, Jon Kinney led us into Clark's Meadow. The moon hung low over the granite profiles of Three Brothers; drowsy-happy, the little girl who had asked about the coyote now rode on her dad's shoulders.

Mint blessed us with its fragrance as we brushed it in passing. Swaying in a gentle wind, blooms of cow parsnip and pale-yellow evening primrose glowed like ghosts.

In the past the valley meadows have been plowed, fenced, and overgrazed. Thousands of people have trampled them. Nearly a quarter of their grasses, flowers, and trees are human imports, not natives.

But let no one believe the meadows are not still fresh and beautiful.

"In fact," as famed photographer Ansel Adams has said, "they are lovelier and in better condition than when I first saw them more than fifty years ago."

Jon Kinney stopped us in a clearing encircled by tall pines. "Once a giant tree grew at the center of the ring," he speculated. "The encircling trees came from the seed it cast.

"And now," he continued, "join hands, close your eyes, and form a circle around me." Then: "Sit down softly on the grass, lie back, open your eyes, and look up at the sky."

Optical illusion made the pines seem to lean to the circle's center so that their tops all but came together, leaving only a dab of sky to be seen. The moon had dropped below Three Brothers; stars twinkled in the bit of sky.

We were silent. I remembered a time, years before, when I lay just so beneath a northern California redwood and looked up. Sharing the view with me was Conrad L. Wirth, then the National Park Service Director.

Connie said, "You'll never feel closer to God than you do now."

Lessons Flow From a Bad Day's Events

In another meadow, in July 1970, occurred an incident I have heard facetiously described as the first cavalry charge in the valley since the Mariposa Battalion fought the Indians more than a century before. I hate to mention it, for it was the sort of unpleasant thing that should not happen in a place of natural beauty.

Yet it brought about some changes in Park Service policies that affect not only today's Yosemite visitors, but also those of other national parks. There have been no recurrences of the "battle."

Briefly, mounted rangers and deputized assistants charged a crowd of young people who had congregated in Stoneman Meadow, became unruly, and refused requests to move. People were hurt, people were arrested.

Greatly disturbed, the Park Service faced up to what it realized was not merely a disciplinary problem, but a sociological change.

To improve the ranger image in the eyes of the young people, Superintendent Lynn Thompson authorized modern hair styles (you'll see young rangers with long hair under their Smokey Bear hats), and he insisted that reason would henceforth supplant force, even to extremes.

"When that extreme arrives," he added, "we will of course be extremely tough. For

Test for brawn and breath, Half Dome's 45-degree back-side trail evokes the vim of youth and the caution of increasing years.

Yosemite's many mansions range from 2,000 feet to more than 13,000 feet high on a Rhode Island-size wedge of the Sierra Nevada's west slope. Here, against a backdrop of the High Sierra, packer Sam Livermore enters cool-shadowed Matterhorn Canyon, a two-day ride from the nearest road.

that reason we have created a highly trained force of rangers whose major duties would be law enforcement. Believe me, the violator who happens to tangle with these men is in real trouble."

He gave the youngsters their own campground, Yellow Pine, where you walk in with your backpack and pay only twenty-five cents a night. I visited it frequently, liked the young people I met there—many of them good outdoorspeople and skilled rock-climbers—and never found it disorderly.

No one, least of all Lynn Thompson, claims that the millennium has arrived, but I can assure you that you can visit the valley any time without risk of getting involved in a battle between cavalry and youth.

Snow Brings Relief From Clamor

Winter lays a hush upon the valley that would astonish those who know it only in the green time. The snow blankets the meadows; the trees at their verges, burdened with white icing, create scenes like paintings on Christmas cards.

Under the drifts the littlest of the "mountain people"—as John Muir called the animals—live unseen and snug. No one pries into their small lives, painting their toenails so as to recognize them a second time.

But the coyotes stay topside, and one of them follows Benjy the Bear and Peter the Wolf Crofut and their friends to school, hoping for a spill from somebody's lunch pail.

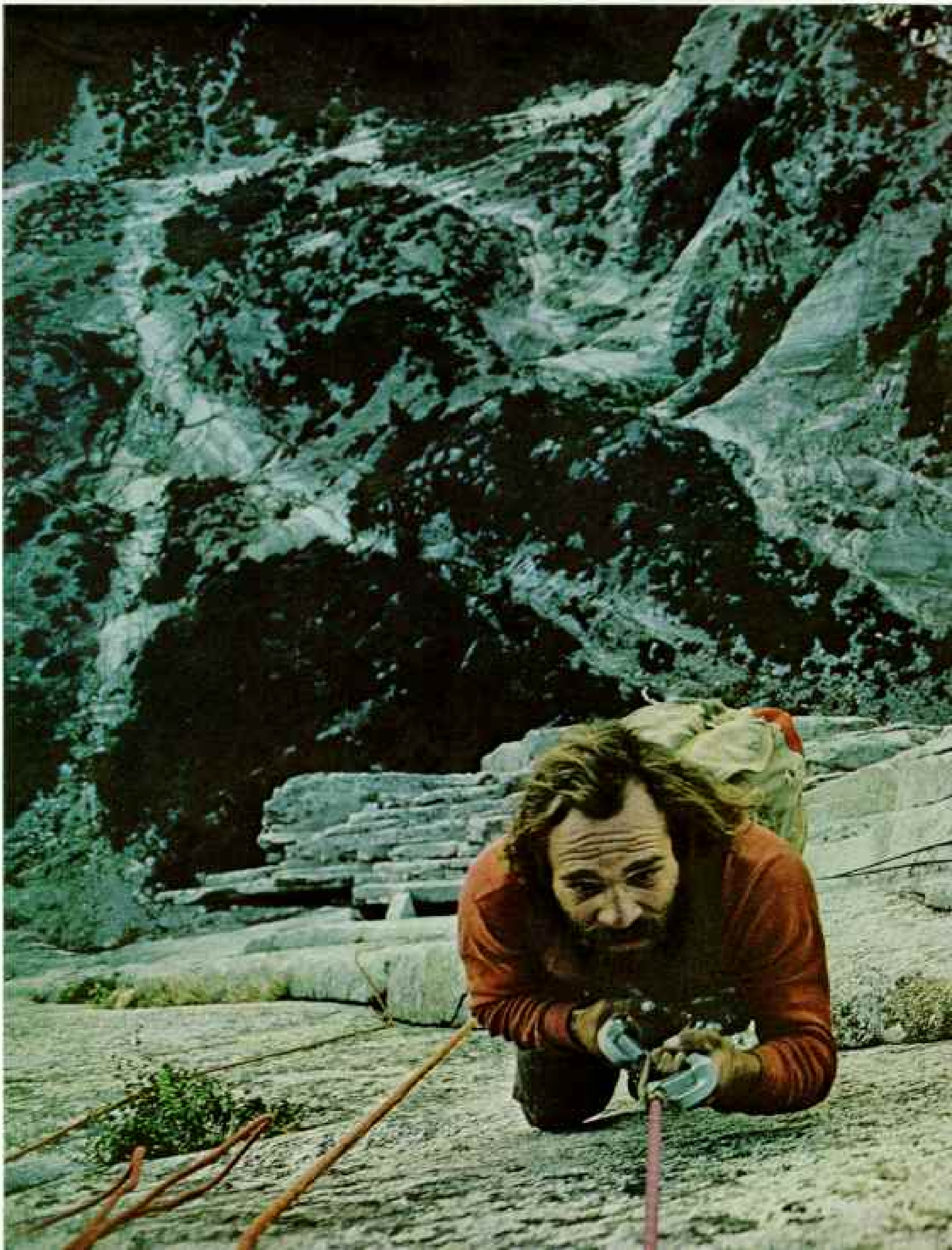
A few winters ago I visited a permanent valley resident. We were sitting in front of his fireplace, watching the flames dance and listening to the crackle of the blazing logs, when a great commotion began outside in the night.

An automobile horn blew insistently, lights flashed, a man shouted.

"What in the world?" I asked.

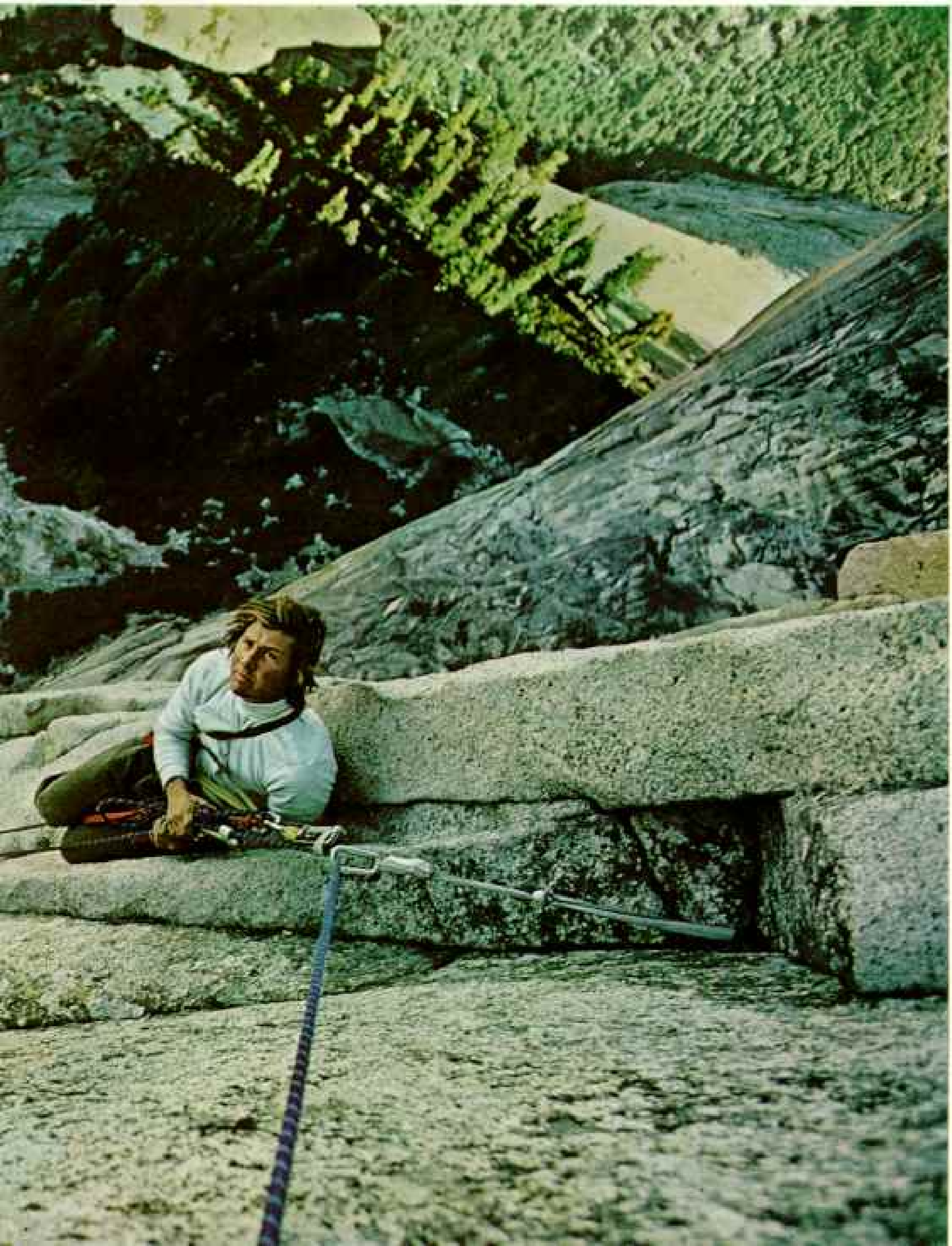
"That's a neighbor reminding us of our blessings," my friend replied with a grin. "Maybe our water pipes are frozen, but he's telling us that just as soon as he's done with that racket, we'll have peace and quiet until next summer." □

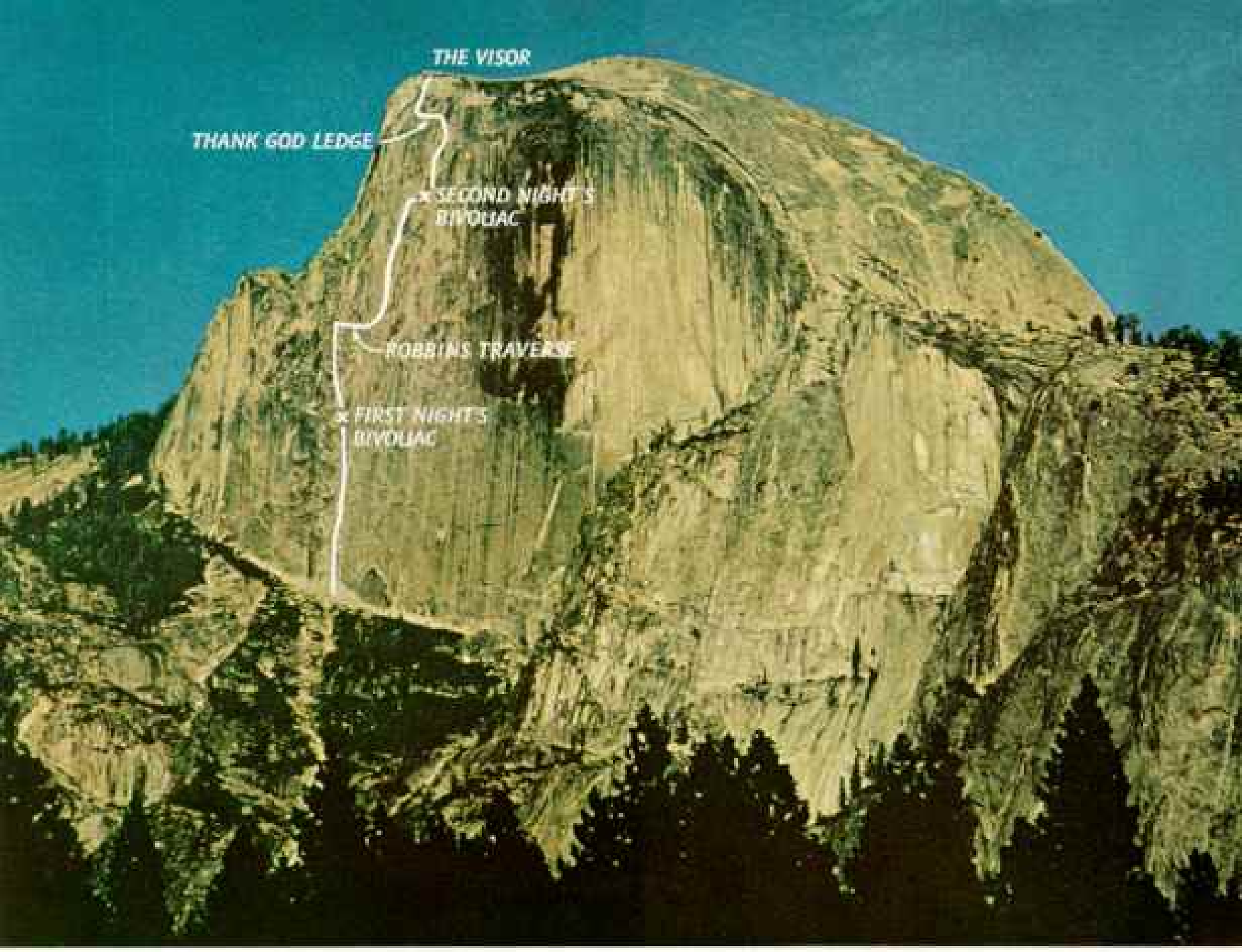
Climbing Half Dome the Hard Way



ARTICLE AND PHOTOGRAPHS BY GALEN ROWELL

Straight below us—1,600 feet of empty air. Above us—400 feet of perpendicular granite. This is our third day on Yosemite's famed Half Dome, whose sheer northwest face has never before been "climbed clean"—that is, without driving steel pitons into the rock. For anchors and fall-stoppers we use only aluminum wedges and nuts, also called chocks. These can be popped into and out of cracks with our fingers and do not scar the rock permanently, as pitons do. On such anchors, some no larger than a child's thumbnail, we stake our climb, our hopes, and our lives.





I HATED TO LEAVE the security of a good foothold. A rope ran slack from my waist diagonally down the cliff, ending in the hands of Dennis Hennek, who stood securely anchored on a two-foot-wide ledge.

Between us a series of carabiners gleamed like oversize safety pins, attaching the rope to various anchors in the rock. The nearest was ten feet below me. From there it was another fifty feet to Dennis, and then a thousand feet straight down to the bottom of the northwest face of Half Dome, the massive rock wall in Yosemite that John Muir called "sublime."

Viewed from its base, this sheer cliff hangs from clouds to earth, like a vast granite tapestry spread over 160 vertical acres. No one can fail to marvel at the colossal forces that carved it through the ages—massive uplift, stream cutting, and glacial bulldozing along a fracture zone. To everyone the soaring, 2,000-foot wall is beautiful. To a rock-climber it is irresistible. We were into the second day of our ascent.

The northwest face of Half Dome was first climbed in 1957 and had often been scaled since, but never as we were doing it now.

I looked in front of me at a crack in the rock: an eighth of an inch wide and deeper than I could see. From the equipment hanging from my shoulder I picked out a tiny aluminum wedge, smaller than a thumbnail, barely an eighth of an inch thick. From it hung a steel loop thinner than a shoelace.

Gently I threaded the wedge into a narrow spot in the crack and tugged hard on that cable loop. It would have to hold my full weight, even if I should fall.

Where a Walk Becomes an Act of Faith

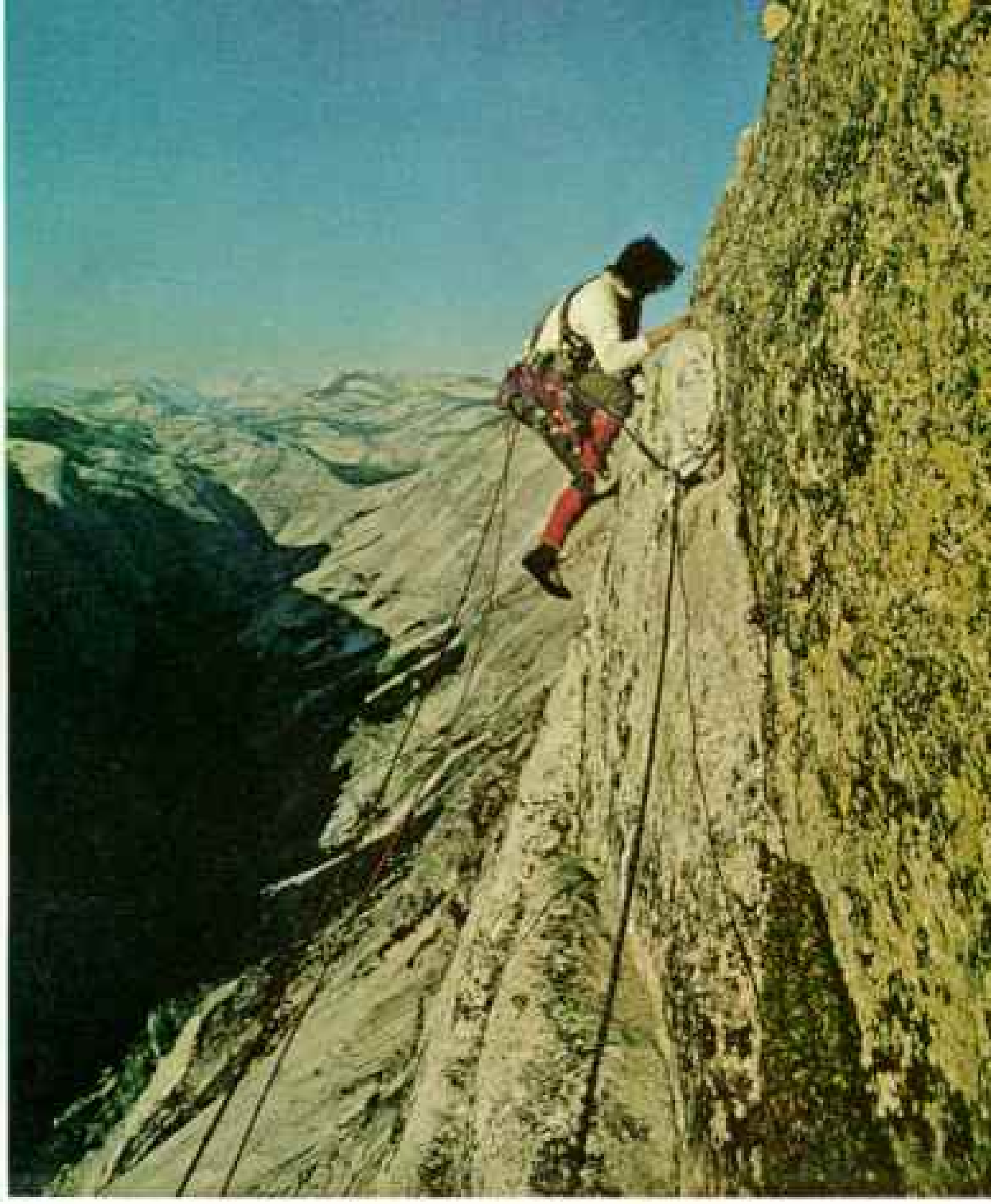
I clipped my rope into the cable loop and yelled to Dennis, "Lower me!"

The rope tightened. I left my foothold and walked diagonally down the wall to a tiny ledge, higher than Dennis but far to his right. I breathed a sigh of relief. The first part of the Robbins Traverse, midway up the sheer face of Half Dome, was over.

The traverse name honors Royal Robbins, leader of a three-man party that made the first ascent of the face 16 years before our

Considered unclimbable for years, Half Dome's northwest face was first scaled in 1957 by Royal Robbins and two companions. Many have followed —so many, in fact, that Half Dome's cracks bear the unsightly white scars of countless pitons. We hope others will follow our example of using only rock-saving chocks.

Here Dennis Hennek (**right**) has the lead. Doug Robinson and I follow, removing chocks placed by Dennis as we go and leaving the wall unmarred—as if nothing more than another cloud shadow had passed across its ancient face.



attempt. At that time it was the longest, most difficult rock climb ever accomplished in North America. Of the five days and four nights on the wall, Robbins said, "We were really scared because we hadn't done anything like it before."

I knew how he felt. Fear is normal for anyone attempting the unknown, and we too were trying something never attempted before: a climb of such length and duration, carrying no pitons.

A piton is a steel support to be hammered into a crack until it rings like a railroad spike. Big climbs had been considered impossible without such aids as pitons and expansion bolts. At the least, a climber would take them along just in case; an Austrian mountaineer has described a climber who takes that sort of precaution: "He carries his courage in his rucksack."

Instead, we relied for protection on little pieces of aluminum alloy that can be inserted into narrow places in cracks and lifted out again with one's fingers.

Called chocks or nuts, these remarkable little aluminum devices come in the form of narrow wedges (page 786) and in multifaceted shapes. The use of nuts developed more than a decade ago in the English Lake District and in Wales. Some of the first nuts were picked up along the Snowdon railway by climbers on their way to scale Welsh crags. With a small rope looped through its hole, a regular machine nut could be jammed into a crack to serve as a safety anchor.

Today nuts are manufactured specifically for climbers, in various sizes to fit cracks up to six inches wide. In an ideal spot a nut may have even more holding power than a piton. But pitons fit into far more places than nuts.

Minor Shock Increases the Suspense

I was unaware of our total dependence on nuts until the first afternoon of our climb, when Dennis yelled up to me: "We've looked in all the bags and can't seem to find the pitons. They must have been left behind."

Dennis Hennek was not a convincing fibber. A veteran of dozens of multiday climbs, from the Arctic to the Andes, he was far too

Wall-walkers' tools include such indispensable kinds of chocks as stoppers (**left**), aluminum wedges made to stop you if you fall. These and similar devices are dropped or pushed into cracks and secured with downward jerks of their steel or nylon cables. Upward yanks usually suffice to remove them. One such nut-and-sling has been set into a crack (**center**) a few inches from a rusty piton left by earlier climbers. A safety-pin-like carabiner (**right**) clips the anchor to the climber's rope. Doug (**opposite**) makes a traverse with his armory of carefully racked hardware dangling and clanging.

experienced and careful to have left pitons behind—unless he did it purposely. He and our other companion, Doug Robinson, had sorted the climbing equipment together.

I realized what Dennis meant: This time we were not carrying our courage in our rucksacks. We were committed to an adventure.

Now, well into our second day, it was Doug's turn to lead. From my ledge in the middle of Robbins Traverse I watched him struggle. He tried vainly to place a nut ten feet above me in a narrow crack with flaring sides. Was this as far as we could go?

Doug's right leg began to shake like an old-fashioned sewing machine. He came down and rested. This section is usually climbed by pounding in pitons and using direct aid—attaching a nylon ladder to a piton and moving upward to place another.

Doug could find no nut that the flaring crack would accept, so he tried a different way. As Dennis fed out rope, he traversed downward to a crack only a few inches wide.

Our spirits lifted as we watched Doug "free climb"—using footholds and fingerholds only, without direct support from rope or anchors. Soon he reached a perfect slot where at last he placed a nut that not even the weight of a car could have budged.

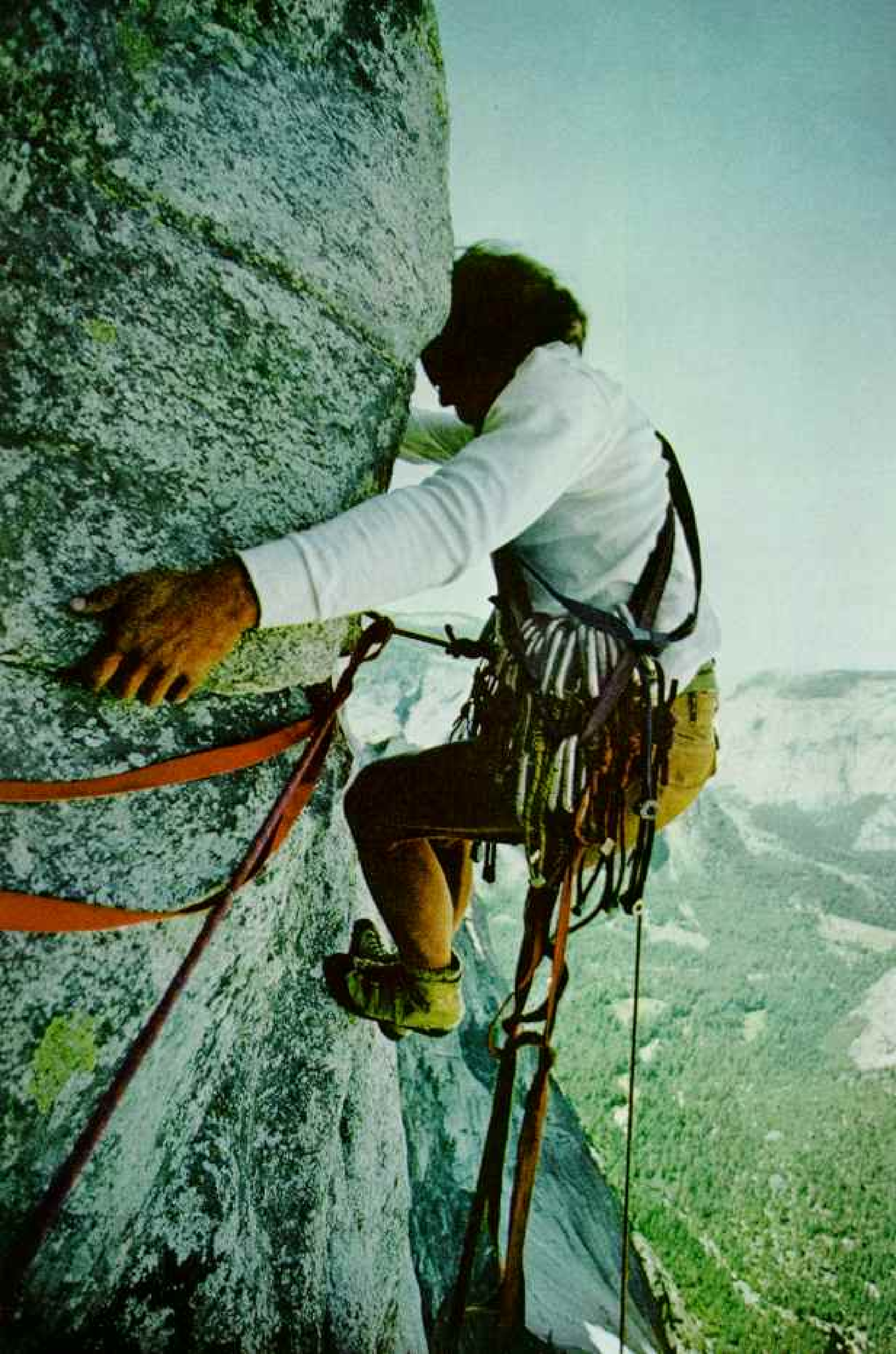
This nut gave Doug the confidence to continue free climbing. Soon he had his hands on a ledge a hundred feet long and half as wide as a city sidewalk. The difficulties of the Robbins Traverse were behind us.

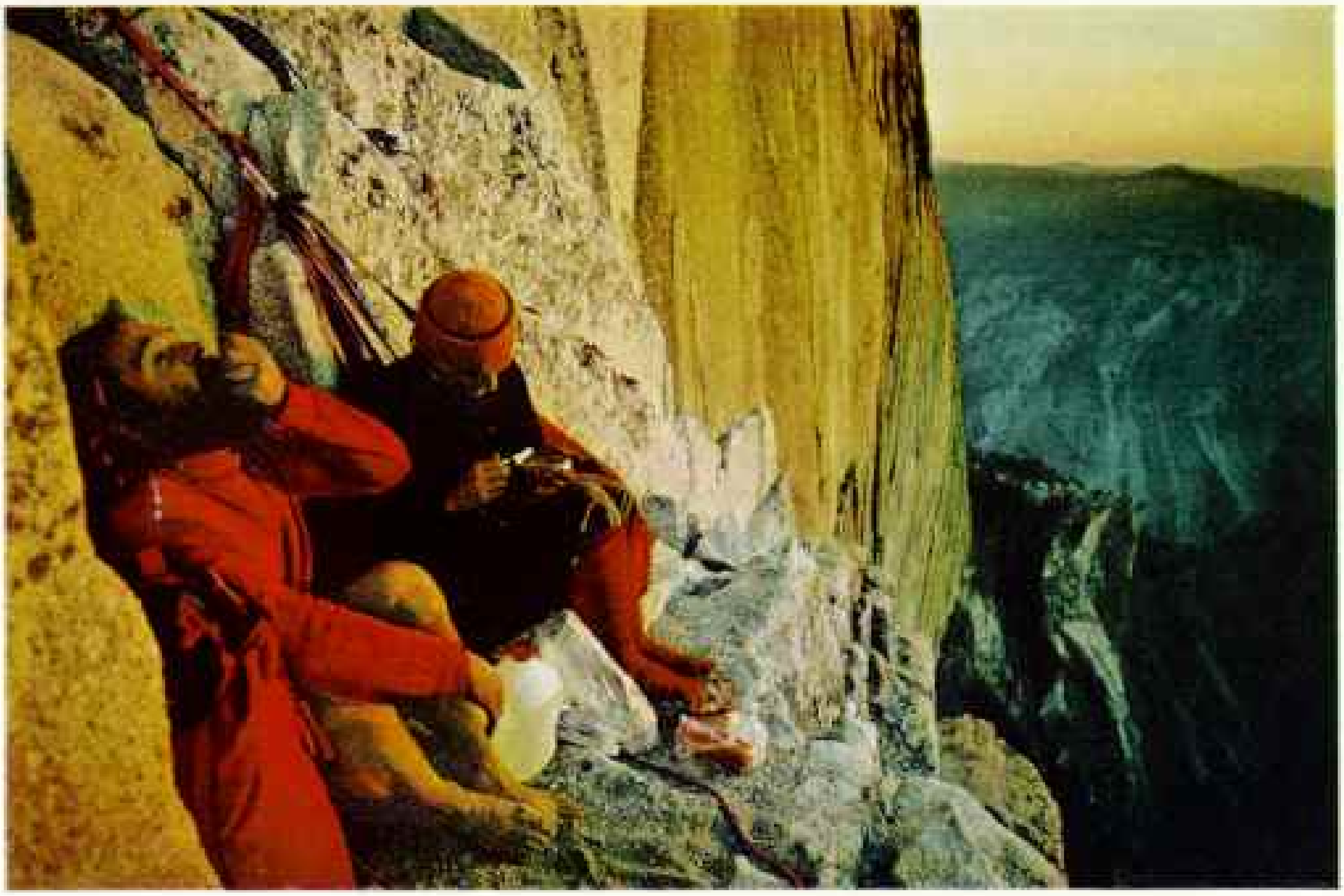
Doug's Ideal: the Mountain Goat

Doug fixed several nuts for anchors, and on an extra rope he hauled up our two sacks holding sleeping gear, food, and four gallons of water in plastic bottles. Dennis and I joined him, lifting out the nuts Doug had placed for protection on his lead.

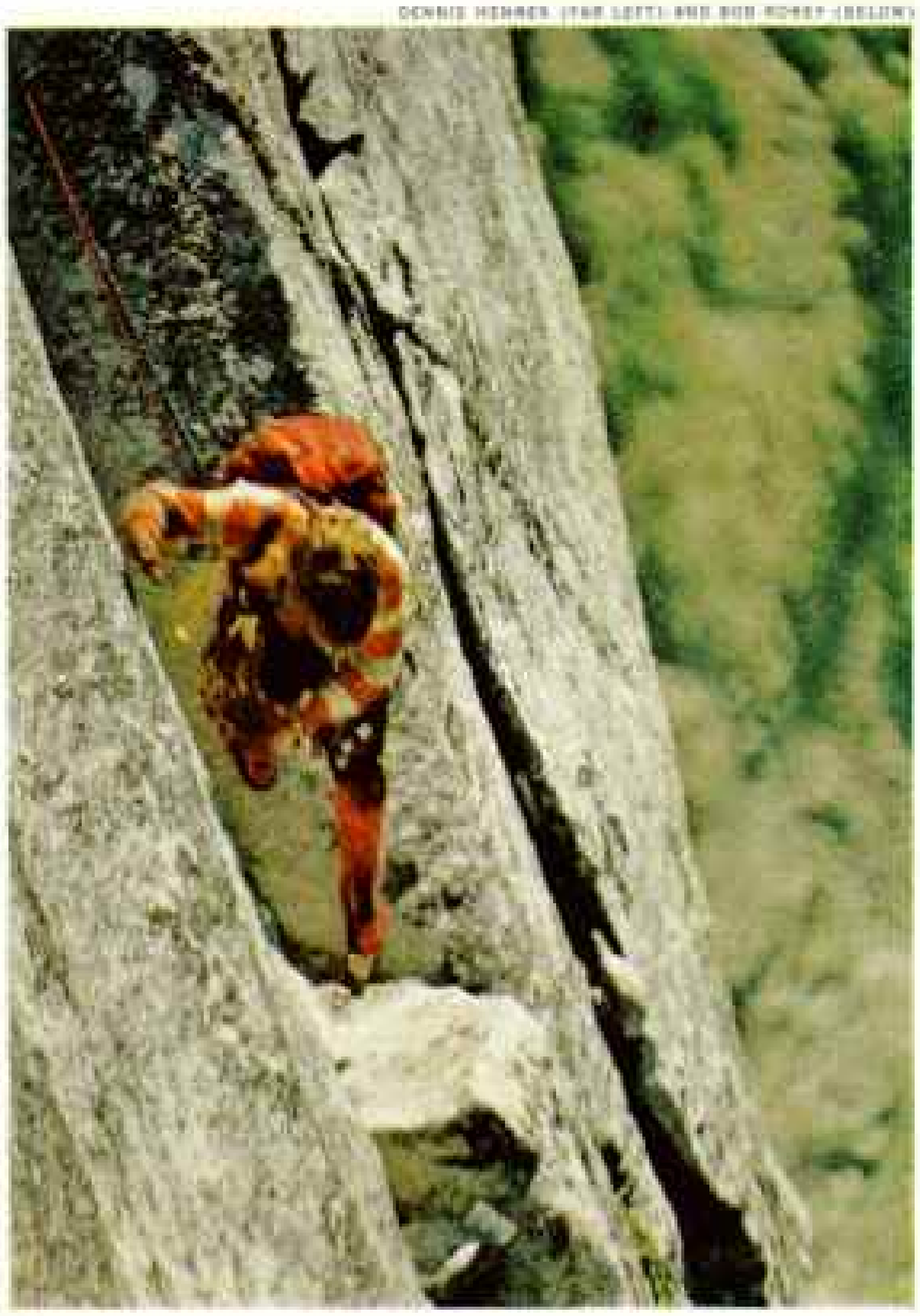
Happy about that morning's progress, we lunched on sausage, cheese, and hard candies. I thought back to the day I'd asked Doug if he would be interested in climbing Half Dome.

He had politely refused, because of his feelings about pitons and "direct-aid climbing." Instead of standing in a nylon ladder while driving a row of pitons ever higher, he





DENNIS HENNEK (FAR LEFT) AND BOB KIRBY (BELOW)



There are always strings attached—climbing ropes, haul lines, slings. If you use such lifelines to support your weight, it's called "direct-aid climbing." If you use them only to catch you in case you fall—as an acrobat uses his net—it's called "free climbing."

That's me (**far left**) using direct aid on a sheer granite face. What's holding me up? Not the climbing rope, but an *étrier*—a nylon loop supported by a nut I've just anchored, into which my right foot fits stirrup-fashion.

Free climbing up a crack system, Dennis (**middle left**) jams fists and feet into the fissure in a technique called "jamming."

After a day's muscle-numbing labor, we "tie in" to a high-rise ledge (**above**) and enjoy some food, rest, and the luxury of taking off our shoes.

In this vertical world you have to be prepared for sudden *oops* and downs. Trying a too-risky shortcut near the summit, I "peel," or fall, but only about ten feet (**near left**). The rope, anchored from above, pulls taut and stops me just above a little ledge. *Amen!*

preferred to climb like a mountain goat, on skill alone, using the rope only as a backup.

Doug moved to the mountains after college to make his living by guiding and writing. Simplicity keynotes his life. He and a friend once set out on skis from the south end of the John Muir Trail, near Mount Whitney, and arrived in Yosemite Valley more than a month later. They went in winter, without stove, thermometer, watch, or compass, to experience the mountains on their own terms, not just on man's way of measuring them.

I knew that Doug was in superb condition and had the skill to climb Half Dome. I told him that some recent ascents had been more than 80 percent free climbing; by using nuts, we would not need many pitons.

After much thought, Doug replied, "I'll go if we climb it clean." Meaning no pitons at all.

I said, "Let's try it clean, but we'll carry some pitons just in case." Doug agreed, we shook hands, and met a week later in Yosemite.

The idea of using nuts instead of pitons implies much more than a wish for simplicity. The last man in a climbing party usually removes the pitons, so they can be used again.

By the late 1960's, thousands of climbers had placed and removed tens of thousands of pitons in Yosemite alone, wearing natural cracks into ugly white scars. Wild and once-remote cliffs were fast becoming worn pegboards in an open-air gymnasium.

One could, of course, avoid crack damage by leaving the pitons in place. But that would rob a climb of much of its adventure. Climbing is essentially a wilderness activity, and a row of pitons snaking up a rock wall detracts greatly from the experience of being part of a natural scene untouched by man.

Clinging to Cracks and Chimneys

With lunch finished, we turned our attention back to cracks and climbing.

Crack systems are like rivers in the rock, guiding traffic over vertical terrain, making climbing possible on otherwise blank cliffs.

Above Robbins Traverse we followed a large crack system for 600 feet, mostly in chimneys—cracks wide enough to crawl inside and ascend by pressing against the sides with shoulders, back, arms, or legs. By the second evening we reached a series of ledges only 400 feet below the summit.

In the setting sun we found simple joy in walking back and forth, dragging our bare toes through the sand deposited on the lofty, two-foot-wide ledges by centuries of erosion.

Much of a climb is quiet and reflective. So it was now, 1,600 feet above the base of the cliff and 4,500 feet above the dim, hazy valley floor. We spoke little during a supper of sardines, raisins, and water. As we had done the previous evening on a narrow ledge a thousand feet below, we bedded down for the night, roping ourselves to the wall so as not to roll off in our sleep (page 789).

When All Else Fails, Try a "Skyhook"

In the clear air of the third morning we looked down into the valley almost a mile below, watching antlike people, seeing them clearly, feeling close to them, and yet so far.

I began the first lead toward the Visor, an overhang of the summit that juts 50 feet into space (diagram, page 784). The steep rock soon became so difficult that I could no longer free climb. Working my way upward with nylon ladders attached to nuts, I came to a spot I couldn't pass. None of the nuts would hold in the slightly overhanging crack.

Dennis yelled up, "Can you get a hook in?"

I spotted a nubbin of rock not much larger than my thumb. It had a flat top on which I managed to hang a "skyhook"—a steel hook you use when you'd like to use your fingernails but know they aren't strong enough. On a nylon ladder attached to the hook, I moved up to where I could place another nut.

Dennis and Doug each led for a section until we reached the beginning of Thank God Ledge, so named by the Robbins party because it enabled them to avoid the Visor. Several climbers have taken the name to mean a shelf big enough for bivouac. The tiny ledge was a severe disappointment to them. It is only 15 inches at its widest.

Doug led across the ledge, crawling past the narrowest part. From its end, he placed a nut for safety as high as he could reach, before free climbing a very difficult crack.

We were now only 150 feet below the summit. Friends who had walked up the cable-secured pathway on the back of the dome (page 779) waved from the top. But our climb was not over. The cracks were narrow and parallel-sided: archenemies of nut placing.

Dennis led off delicately, placing tiny wired wedges. Fortunately the rock face was rough, allowing a combination of free and aid climbing. He supported part of his weight on the rock, the rest on the meager wedges.

Soon he came to a place that would prove

to be the key to the success or failure of the climb. Instead of pursuing one crack at a time, he now had to deal with discontinuous cracks —climbing a foot or two up one crack, and then reaching to a completely different one, two or three feet to the side. His goal was a ledge that looked deceptively close but was in fact 30 feet above him.

Time seemed to stand still as Dennis placed a skybook. Then a very special nut—the smallest of all, made of chrome-molybdenum steel and only a sixteenth of an inch thick.

Finally another tiny wedge, his most secure anchor in 20 feet. All three of us were so engrossed that to us those moments expanded to contain all reality. The crux of the climb was in Dennis's hands.

Finally he yelled down, "Off belay!"

He had tied his rope to solid anchors on the shelf above. Now only two moderate leads separated us from our waiting friends. I led one, Dennis the next, and soon we were hauling the last bag onto the flat summit.

At dusk we walked down along the cables on the back of the dome and set up camp in the forest near a spring. We had not had hot food or drink for three days, and the tea with its flavor of the aluminum pot seemed the finest liquid we could have tasted. Our beds of pine needles were more comfortable than any mattresses we could imagine.

In the morning we watched the sunrise under brewing storm clouds as we hiked the remaining seven miles to the valley floor. At the end of the trail we boarded the public shuttle bus with our heavy packs, dust, and odors. We felt satisfied and yet strangely depressed—because our adventure was finished.

That feeling will disappear only when the next adventure begins. □

EDGAR BUTLER

"There is no upness comparable to the mountains," wrote Sierra-loving John Muir. His words mirror our feelings as we stand—Doug, Dennis, and I—on Half Dome's summit. We are proud right down to the marrow of our aching bones that we not only achieved this upness on our own, but that we did it without marring the way of those who follow.

Oil, the

By NOEL GROVE

NOT SINCE THE DEPRESSION of the 1930's had the economies of nations around the world suffered such peacetime disruption and strain. Factories shut down, workers were laid off, lights dimmed, buildings chilled, gasoline stations closed, Sunday driving was banned, fuel prices soared, stock markets fell, and shortages threatened in a host of products, from perfume to fertilizer.

Oil. For more than half a century it had been an inexpensive resource, a black milk of the earth on which nations fed and grew strong. The supply seemed infinite, and by 1973 this amazingly versatile substance had pervaded almost every phase of our lives.

Then the Arabs constricted the flow, with convulsive results. Saudi Arabia, largest oil producer in the Middle East, has a population less than 4 percent that of the United States and a gross national product scarcely one percent as large. Yet oil had become a resource so vital that the most powerful industrial nations faced recession or, as in the case of Japan, outright collapse if Arab cutbacks persisted.

Moreover, the United States awoke to the realization that the oil industry itself had grown so huge and so complex that few people could comprehend its operation. The combined assets of this nation's oil companies total more than 70 billion dollars. A number of these corporate giants operate with budgets exceeding those of many nations.

I recently traveled nearly 50,000 miles in a globe-girdling journey that took me to 11 nations. Producers, consumers, businessmen, government officials, oil-field roughnecks, geologists—I talked to a host of people until the picture of a troubled industry took form.

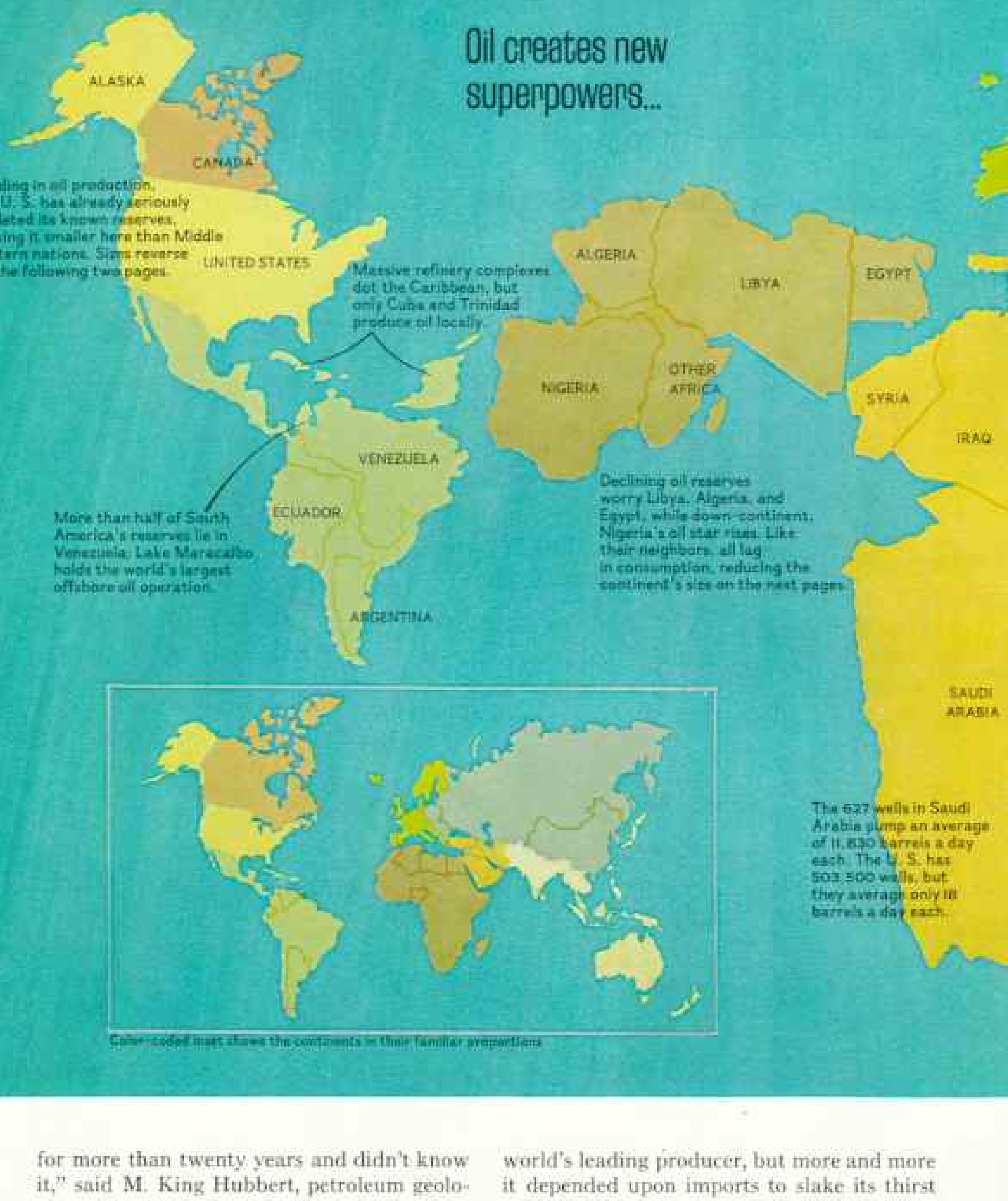
The shortage plaguing the United States, I discovered, was long in the making.

"We've had an oil shortage in this country

Pitcher of Kuwait crude and a smiling Arab symbolize the dilemma of the 70's: the economic duel between nations that produce oil and those that must import it to survive. The world's sudden awareness of its dependence on oil prompts a new look at this diminishing resource—how we get it, how long it may last, what may happen when it runs out.

Dwindling Treasure

Photographs by EMORY KRISTOF BOTH NATIONAL GEOGRAPHIC STAFF



for more than twenty years and didn't know it," said M. King Hubbert, petroleum geologist with the U. S. Geological Survey. "In 1947 our domestic production slipped below our consumption, and we became a net importer of oil. In 1956 I wrote a paper predicting that U. S. production would peak in 10 to 15 years. It happened in 14."

In 1970 the collective output of the 31 U. S. states that produce oil reached a volume that perhaps never will be reached again. The United States retained its position as the world's leading producer, but more and more it depended upon imports to slake its thirst for oil. When political events cut back the Middle East supply in 1973, King Hubbert's 26-year oil shortage came alive.

Shallow Well Opened the Oil Age

Modern techniques of tapping the earth's black gold with drills originated in the United States. In 1859 at Titusville, Pennsylvania, a retired railroad conductor, Edwin L. Drake, punched downward with a steam-driven bit

and struck oil at 69½ feet. Large reservoirs could be found, he proved, by pricking the earth's skin! An industry was born, and life on this planet began changing in quantum jumps unparalleled in history.

Crude oil welled up easily from the shallow holes of Pennsylvania and California. On a hill called Spindletop in east Texas, a gas-propelled geyser of oil blew drill pipe high in the air in 1901, signaling a well that spurted out 100,000 barrels a day before it was capped.

A worker turned to a newspaper reporter at the scene and drawled, "Mister, that's some gusher, ain't it?" An old word took on a new meaning of instant wealth.

Gushers, dramatic but wasteful, are now usually prevented by pressure valves, but the search for oil retains an excitement and challenge uniquely its own. I felt it myself when in Wyoming I worked five days as a roughneck, the name justly earned and proudly worn by the men who operate oil rigs.

"Bit's stuck," growled Jess Cox one day, the words fighting their way past the knot

of tobacco in his cheek. Nearly a thousand feet beneath us, conical teeth had gnawed into this Wyoming mountain until the earth flinched, spilling rock into the hole and binding the steel probe.

The derrick shuddered. Four giant diesel engines fought to lift the drill pipe. Driller Gary Stull flipped a lever that squirted ocher-colored mud down the pipe, and the pipe finally broke free. Grunting and sliding on a derrick floor slick with mud and Jess's tobacco juice, we screwed on another 30-foot length of drill pipe to send the bit deeper.

I paused to squint against the September morning on the plains and let my mind leap back millions of years. Once this expanse of grass with its islands of aspen was a vast shallow sea in mid-continent. The death of tiny marine plants and animals sent a slow but steady rain of organic matter onto the basin floor. Heat, pressure, and decomposition transformed it into liquid hydrocarbons.

Now man had come to search for the treasure. Already $3,000,000 had gone into 11 dry

holes in this 36-square-mile township in western Wyoming. This was another such wildcat well, meaning that men were looking for oil where oil was not known to be.

Oil Detectives Sift Many Clues

Elmer Parson hoped it was there. The chief geologist for True Oil Company makes his living sniffing out oil. He may pore over aerial photographs, looking for the undulations and faults of past movement in the earth's crust that form traps for petroleum. Where no outcrops lend clues, he may study the readings of a gravimeter, which dips sharply on a fragile set of springs when a subterranean rock massif exerts an exceptionally strong gravitational pull. Being heavy, the rock is likely to be impermeable. Being impermeable, it may trap oil.

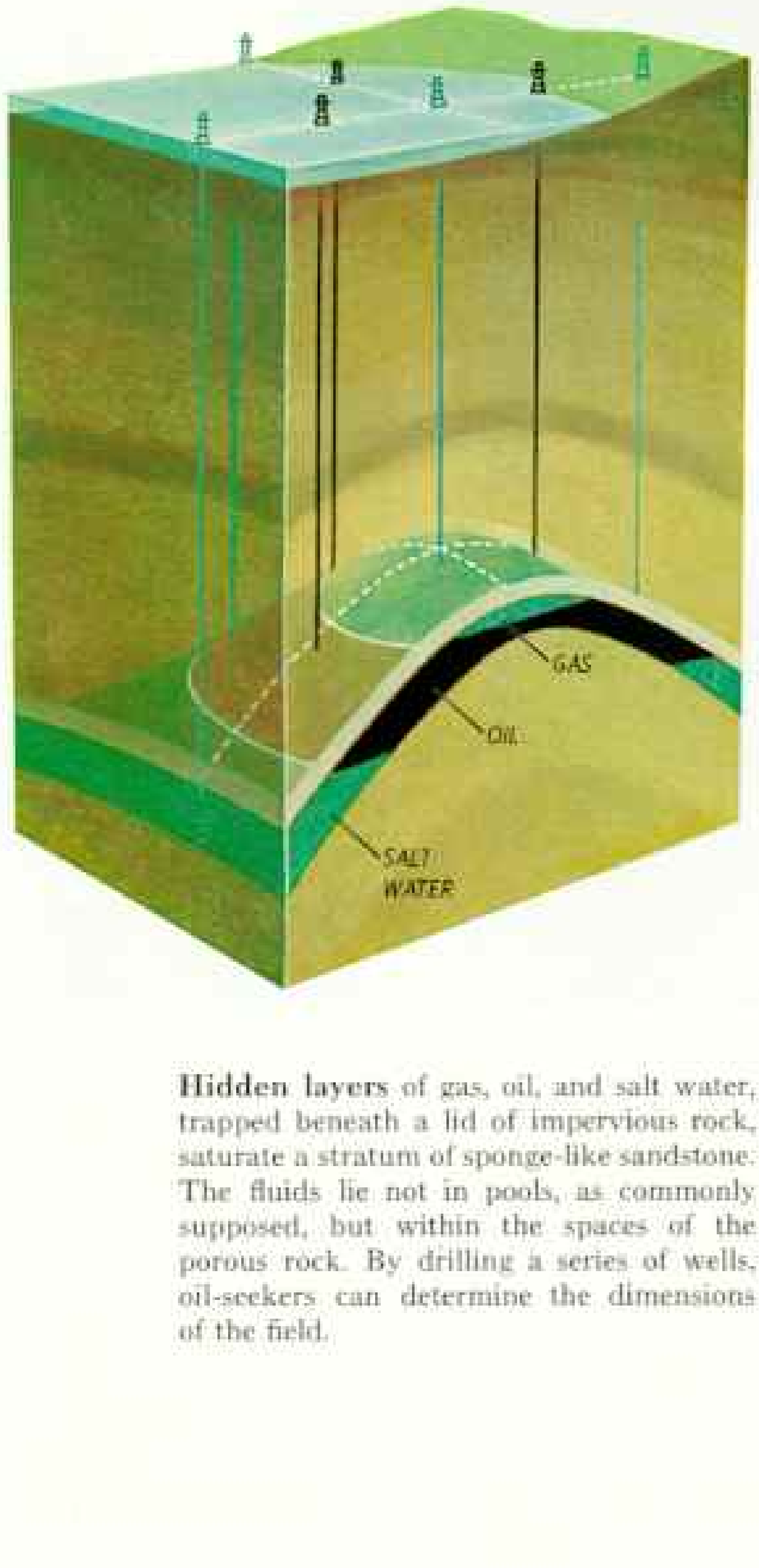
The geologist may also depend on seismic surveys, in which explosions set off earth tremors. Delicate instruments then print a squiggly-lined picture as the shock waves reflect off rock formations deep underground.

"Most of the information that led to drilling at this site came from the 11 unsuccessful holes," Elmer told me. "There's an underground sheet of rock that was pushed east about 20 miles into what is now Wyoming. We're drilling in front of that sheet."

He drew a rough subsurface map of the site. "We should be right on top of a big wrinkle caused by that pressure," he said. Trapped in a sponge of sandstone beneath a layer of shale, he hoped, was oil.

"Only one wildcat well in fifty is successful," said Dave True, a partner in True Oil and a former roughneck who bought a beat-up secondhand drill rig in 1948 and parlayed it into a multimillion-dollar business.

In 1973 nearly 9,900 wells were brought into production in the United States. Our well in Wyoming was not among them. "It showed salt water, not oil," said Elmer Parson when I called months later. "Apparently we missed the top of the wrinkle, or anticline. After we evaluate the data, we may try again."



Hidden layers of gas, oil, and salt water, trapped beneath a lid of impervious rock, saturate a stratum of sponge-like sandstone. The fluids lie not in pools, as commonly supposed, but within the spaces of the porous rock. By drilling a series of wells, oil-seekers can determine the dimensions of the field.

Tapping Desert, Arctic, and Sea Floor

Unlike True's venture, many oil fields lie far from areas of oil consumption, in climates and terrain not known for their hospitality. Ever present are the dangers of working with heavy equipment. The scars, lost limbs, and mended bones of oil workers testify to encounters of fragile flesh with falling pipe, twisting chains, and straining steel.

The roughneck's uniform may range from plaid shirt to no shirt, from rain slicker to cocoonlike parka. A man picking up a wrench without gloves would scorch his hands in Kuwait in summertime or freeze them in winter on the North Slope of Alaska.

My October visit to the oil-rich Slope featured cloudless sunshine, no wind, and a tingling but comfortable 8° F. Five-year veteran Otto Byars described for me the dark deep freeze of midwinter, when daytime is only a pink glow on the horizon.

"In 1970 we moved camp one day when the wind chill figured 120° below zero. I was working on the roof of a bunkhouse when another guy looked at me and told me to get inside. My face was freezing."

Offshore drilling can be even more hazardous. "We had a man knocked off the platform by a mudding hose that whipped loose in February of 1973," said tool pusher Sterling Smith in Norway's productive Ekofisk field in the North Sea. "Only seven minutes in that cold water killed him."

Men are often transferred from one North Sea platform to another by boat, in swells that put the rope ladder at hand one moment and 50 feet out of reach the next.

Sixteen-passenger helicopters daily ferry personnel 200 miles from operational headquarters at Dusavik, Norway. "You are in the safest type of aircraft in the world," said a brochure in the one that wop-wopped me over the open sea. "In case of main-engine failure, the large rotor's continuing spin will let the aircraft down safely." Less than a

month after my round trip to the Ekofisk field, the tail rotor malfunctioned and that same helicopter pinwheeled into the frigid sea, killing four passengers.

The investments in capital are mind-boggling. Cost of the pipeline to carry oil from Alaska's North Slope to the seaport at Valdez will exceed four billion dollars. Rental fee for the floating crane *Champion* in the North Sea comes to $27,000 a day.

"Seven Sisters" Rule the World of Oil

Who picks up the tab for exploration at the world's ends, for multibillion-dollar pipelines, for man-made sea islands with $800-an-hour helicopter commuting service?

The answer is that we all do, as customers of some of the largest corporations in the world. Seven giants—Exxon, Texaco, Mobil, Standard of California, Gulf, Royal Dutch Shell, and British Petroleum—own producing rights covering two-thirds of the world's proven reserves. Although the first five are U.S. companies, all "Seven Sisters" are truly international. They pay taxes to host countries for extracting oil, and sell much of it outside the United States.

In corporate jargon, each of the giants is "vertically integrated," which means they operate in every phase of the business—exploration, extraction, transportation, refining, and distribution of oil.

Separately owned, they nevertheless cooperate. When the riches of the Middle East became apparent early in this century, companies from the United States, Britain, France, and Holland solved territorial squabbles by drawing a large red circle that encompassed several nations. They agreed to cooperate in oil production in that area.

Today consortiums of companies extract oil in the major producing areas of the world. Production in Saudi Arabia has been carried out, not by Texaco in one field and Exxon in another, but by Aramco, the Arabian American Oil Company, owned by four major firms and the Saudi Government. Each company claims its respective share of oil, and Arabia takes most of its share in cash.

British Petroleum and Atlantic Richfield Company are in charge of development and production on the North Slope and are reimbursed by nine other companies. All 11 will claim their shares of the oil. Seven companies, pooling funds, plan to build the pipeline for moving the oil to Valdez.

Exploration, production, transportation, and marketing by the large companies cross provincial and national boundaries, requiring the high-level diplomacy of international politics. "The global interests and jurisdictions of these corporations . . . are part of a system of arrangements and understandings that may be called the first world government," wrote Robert Engler in his book *The Politics of Oil.*

"Wildcatting in the United States is carried on largely by small independent companies," I was told by an oil investor in Wyoming.

Kindling the oil age, Polish pharmacist Ignacy Łukasiewicz lights a kerosene lamp he developed in 1852. Local farmers around Krosno had asked him to try to distill vodka from the oil that seeped from the ground. The result: not liquor but kerosene, a clean, low-smoke lamp fuel. A museum in Krosno now commemorates the event.

"The big companies have found it more profitable to look for oil overseas."

A barrel of oil in Texas, the largest producer of our states, may cost $1.25 or more to extract from the ground, including expenses of finding the reservoir. In Saudi Arabia, easier drilling, faster underground flow, and a higher percentage of oil strikes lower the cost of a barrel of crude to less than 12 cents.

Taking the Empty Quarter's Pulse

On the edge of the Rub al-Khali, the vast, aptly-named Empty Quarter of Arabia, I bounced over the desert in a pickup truck with Briton John Jones of the oil-exploration firm Geophysical Services, Inc. Even in November, heat waves danced off the horizon until the sand seemed to melt into the sky.

"We're running tests to compare the seismic results of explosives and a Vibroseis," John said. A Vibroseis is a six-ton trucklike vehicle with a vibrating plate that lowers to the ground and massages the earth, while recording instruments monitor the pattern of tremors underground.

Trucks and men gradually materialized in the shimmering emptiness, and our pitching, rolling vehicle came to a merciful halt about 30 yards from where three men stood. As we got out, a THUMP jarred our feet, and the ground erupted in a dun-colored plume that rained rocks and dirt on the cowering men.

Bob Hyman brushed debris out of his hair, and his dust-grimed face grinned sheepishly. "The holes backfire every once in a while, but usually not this badly," he said. "We had ten pounds of explosive in each of 15 holes in that blast. The force is supposed to go down, not up, but sometimes if you don't pack a hole tight enough. . . ."

No oil had been found at this site at the usual levels around 6,000 feet, he explained, so they were measuring deeper structures.

A different kind of liquid wealth had been found earlier near the tiny rail stop of Haradh, some twenty miles away. At the Wadi as-Sahba, a broad, long-dry riverbed, oil exploration had found plentiful underground water, and a 25-mile stretch of desert barely a mile wide bloomed green with life.

In Dhahran, on the Persian Gulf, I heard some of Saudi Arabia's hopes and plans for other such transformations. My host was Dr. Abdulrahman Zamil, an economics professor at the College of Petroleum, an oil-funded oasis of technology for some 1,230 students.

Three weeks earlier Saudi Arabia had announced it would halt all shipments of oil to the United States, in protest against U. S. military and economic assistance to Israel. Puzzled, I asked several times about the lack of hostility toward photographer Emory Kristof and me, in streets, schools, factories, and government offices. The answers were always the same. Saudis, said the Saudis, really like Americans, though they disagree with U. S. foreign policy in the Middle East.

"You are probably in the safest place on earth for an American," Dr. Zamil said. "Also, we have a strong tradition of desert

Bleak outposts challenge oilmen. Rimed by his own breath, oil geologist "Smitty" Smith (**above**) gnaws a frozen cigar on Alaska's North Slope. Here America's largest single liquid reservoir awaits a pipeline that could, by 1980, carry two million barrels of oil daily—10 percent of estimated U. S. needs. Canadians drilling farther north have yet to strike oil, although they have found gas. A low sun silhouettes a wildcat well (**right**) on Ellef Ringnes Island, only 800 miles from the Pole.

Seagoing supertank is jockeyed into position by five tugs before settling a few feet to the bottom. The million-barrel container provides temporary storage for crude oil pumped from Norway's Ekofisk field, where in 1970 the North Sea's newfound riches were first tapped in commercial volume.

Sixty-foot waves of 35° F. water will pound the structure in winter. Holes in the concrete outer wall are designed to break the sea's force. Near the surface a diver inspects pipe being lowered to the sea floor (**left**) by a barge. "Saturation divers" work the murky depths in 30-day shifts, relaxing topside during off-hours in a pressurized diving tank (**right**).

hospitality. You are a guest in our country."

Traditions give way slowly in Saudi Arabia. Faced with so much oil income that it becomes virtually unspendable, the nation nevertheless edges into change cautiously.

Droves of Cadillacs appeared in early days of Saudi prosperity, but personal displays of wealth are more subtle under the austere King Faisal ibn Abdul-Aziz. The miniskirts spawned by sudden wealth in Kuwait are never seen on Saudi streets, where the veil still reigns.

"The Kuwaitis," sniffed a Saudi friend, "want to put all civilization in a glass and drink it at a gulp."

Saudi Arabia sits atop a fortune that could create a desert utopia. The first five-year national-development plan was undertaken in 1970 at a cost of 40 billion riyals. A new plan beginning in 1975 is priced at 200 billion riyals—almost 60 billion dollars.

Arabian oil begins its long journey to the rest of the world by pipelines from the wells (pages 806-807), most of which lead to a tanker-loading terminal at Ras Tanura, on a peninsula in the Persian Gulf north of Dhahran. With two Arab officials of Aramco, I drove along tangles of pipe leading to the terminal, where some two dozen tankers lay offshore like hungry whales.

"It takes as little as eight hours to load a 200,000-ton tanker," explained Mr. A. Mohsin. "Altogether we load about seven million barrels a day."

Only relatively small tankers, carrying up to 100,000 tons each, can enter U. S. ports. Larger ships, drawing 90 to 100 feet, find them too shallow. Oil spills of the past decade have bred a storm of environmental protest, helping stall construction of deepwater terminals on U. S. shores. Oilmen argue that larger tankers would reduce the number of ships in

Oil fuels a controversy, prompting talks in Riyadh between U. S. Secretary of State Henry A. Kissinger and Saudi Arabia's King Faisal ibn Abdul-Aziz. In protest against support to Israel, Saudi Arabia and neighboring Arab countries in October 1973 declared a total embargo on oil sent to the U. S. and the Netherlands, and cutbacks on deliveries to other nations. Frantic negotiations between producing and consuming countries underscored the new political power wielded by the petroleum-rich nations.

the water, thus reducing the chances of accidents. Environmentalists counter that a single spill from a supertanker could produce an ecological nightmare.

"It's impossible to guarantee there will be no accidents or spills," admitted Capt. Alec Thompson, a former tanker pilot. "You can take as many precautions as you want, but you still have to account for human error."

Human navigational errors caused the S.S. *Torrey Canyon* to steam at full speed onto Pollard Rock off Land's End, England, in 1967. It carried 119,000 tons of Kuwait crude.

Japan Builds Ocean Behemoths

Today's seagoing giants carry four times that much, and bigger ones are coming. Their construction has thrust Japan into a commanding lead in shipbuilding. The Mitsubishi plant at Nagasaki assembles the biggest movable objects ever built by man. Their very existence illustrates the global cross-webbing of the oil industry, as explained by my Mitsubishi host, Mr. Haruo Hirose.

"Ships built here may be financed by American money, fly the Liberian flag, carry Saudi Arabian oil, and sail into a Welsh port with an Italian crew," he said as we strolled past hulls that lay on the ways like supine skyscrapers. "Very international operation.

"Six years ago we were told it was not economically or technologically feasible to build larger than 250,000 tonners," said Mr. Hirose with a wry smile. "Already half-million-tonners are being built, and the feasibility of million-tonners is being studied."

Improved welding techniques and stronger high-tensile steel, together with improved economics, spurred the growth of the behemoths. A supertanker hauling the same load as six smaller tankers may save its shipper more than half a million dollars in one trip. Even so, economic and geographic considerations stall construction of the larger craft.

Risks on such a huge ship and its cargo, together worth close to 200 million dollars, might skyrocket insurance rates. Port facilities at present would limit their use. A million-ton tanker would be a quarter of a mile long and a hundred yards wide and draw more than 115 feet of water.

Louisiana hopes to unload the first supertanker at a United States terminal, but by present plans the proposed port 21 miles out into the Gulf of Mexico could handle only ships up to half a million tons.

"They would hook up to a single-point mooring," said E. C. Hunt, Jr., president of a Louisiana commission studying the possibility of building the port, as we flew over the Gulf to view prospective sites. Ships would never touch shore, he said, but would off-load to a buoy that would revolve so the ship could turn with the wind. Underwater pipes would then carry the oil to onshore tanks.

"Oil is already the lifeblood of Louisiana," said Mr. Hunt. "A superport would create 35,000 new jobs and pump more than five hundred million dollars into the state's economy by 1980."

Two other superport sites in the Gulf, one off Freeport, Texas, the other off Mobile, Alabama, are also being considered. Special legislation is required, since the terminals would be beyond the 12-mile limit of federal and state jurisdiction. Some environmentalists question whether they will be needed.

"If you accept the premise that we are going to increase imports, yes, we'll need a superport," said J. Ross Vincent, president of the Ecology Center of Louisiana in New Orleans. "We are not as concerned about the port itself as we are about the onshore facilities—refineries, tank farms, and pipelines pumping millions of gallons a day—that could damage our estuaries.

"But the real problem," he continued, "is that we should *decrease* imports. We've become too dependent on oil."

If Oil Stops, the World Stops

Dependent on oil. That fact was driven home to Americans when the shortages of the past year began to illustrate that oil touches their lives in more than a thousand ways.

As I boarded a plane in New Orleans, I placed my polyester jacket in the overhead compartment that was part of the plastic interior paneling, and settled into a seat cushion of polyurethane. As jet fuel thrust the aircraft high above the city, I rubbed an oil-based ointment on lips chapped by Gulf Coast breezes and began drinking coffee from a cup of polyethelene. I was wearing, riding in, sitting on, drinking from, soothed with, and propelled by oil.

But our primary dependence upon oil has long been for the motor vehicles that now dominate our life. Short supplies of gasoline became a common theme in 1973 and 1974. Bewildered Americans groped for explanations of sharp price increases, gasless days,

Desert's new horizon: Massive pipelines carrying tons of crude oil propel Saudi Arabia out of the camel age. These conduits near Dhahran, on the east coast, deliver oil from the Ghawar field—perhaps the world's largest reservoir—to tankers at Ras Tanura.

Conducting a technical symphony, a director (**left**) signals for a blend of music and narration at a government TV station in Riyadh. Subject: modernization of a small town—new schools, electrification, irrigation. Television programs beamed throughout the country familiarize Saudis with their nation and the development spurred by income from oil.

Petroleum returns to the earth: Sacks of fertilizer destined for a U.S. aid project in Afghanistan pile up for shipment. Natural gas, separated from crude oil during the refining process and often burned as waste, is converted into soil-enriching urea at this petrochemical plant near Ras Tanura.

limits on purchases, and long waiting lines.

At a Chicago coffee shop I eavesdropped on a conversation between Messrs. Don Swansey and Jack Hollinger, who deal in linoleum. Their talk soon turned to oil.

Mr. Swansey: "I don't believe there's an oil shortage. My boys and I do a lot of hunting, and those rural areas have plenty of gas."

Mr. Hollinger: "To me, this is just an excuse to raise prices while cutting back on fuel supplies. I just wish I could get some consistent answers. First you hear there's not enough oil, then you hear we're going to have enough after all."

Crisis Was Real to Energy Chief

Mr. Hollinger, Mr. Swansey, forgive me. I took your complaints to the highest government source on energy in the land. In shirt sleeves, and striding briskly from behind his desk, William E. Simon, who had just been named head of the new Federal Energy Office, had every appearance of being a busy man.

"I'm down here at 6:30 in the morning and home at 10 o'clock in the evening, seven days a week," he said. It was a schedule he obviously did not relish, and one, he assured me, he did not undertake because of any "false" shortage of oil.

Loss of crude from the Middle East, he explained, meant a 7½ percent shortfall. "Beyond that, we know numbers that are hard and numbers that are soft. The hard numbers, as to the extent of the current shortage of oil, are accurate," said Mr. Simon.

"But the soft numbers come in with the variables—warm weather, reduction of demand through conservation and higher price, leakage in the embargo," he added. "So we erred in the amount of shortage, but at least we erred on the high side."

When improved figures were announced, and surpluses appeared in certain areas, he explained, it caused many people to disbelieve the shortage.

One of the biggest variables, and the most hopeful in the move toward self-sufficiency, said Mr. Simon, is conservation. "As part of what I call the 'new energy ethic,' we are going to report, by industry, the energy used and how it is used. Building codes for offices and homes will be rewritten to assure energy conservation. We must change our life-style in dealing with energy."

Some people disbelieve figures for underground oil reserves in this country, he

Bulbous-nosed sea brute, the Japanese-built supertanker *J. R. Grey* (**facing page**) receives a coat of paint in dry dock at Nagasaki. Numbers indicate draft in feet. Nearly four football fields long and half a field wide, the craft hauls 2,000,000 barrels of crude oil —enough to supply a tankful of gasoline for three million cars.

Gulping oceans of oil, tankers crowd piers at Iran's Kharg Island in the Persian Gulf, one of the world's largest loading terminals. This pier, plus two deepwater berths for larger tankers, can load six million barrels in 24 hours, more than the combined daily needs of France, Italy, and Spain. Environmental concern has helped prevent construction of supertanker ports in the U. S.

admitted, but a bigger concern is oil-company inventories. "The vast network of terminal operators, refiners, marketers, and jobbers makes it difficult to develop a system of reporting inventories," said Mr. Simon.

"We've never needed a reporting system before, because we seemingly had an endless supply of oil. Well, we are putting in such a system now, whereby all inventories from the major oil companies will be reported to the energy office."

Squeeze That Slowly Tightened

Nettlesome shortages predated the Arab embargo. Lack of fuel shut down the largest industry in Denver, Gates Rubber Company, and closed many Denver schools for several days in the first quarter of 1973. The State Capitol building of Iowa ran out of heating oil. Factories stopped work in West Virginia, Illinois, and elsewhere. Last summer, gasoline stations in the Midwest closed when their tanks ran dry, and farmers worried about having enough propane to dry their corn.

How did it happen in the nation that leads the world in oil production?

The search for villains in the oil shortage has run rampant, with the oil companies the most popular target. Their vastly increased profits in the midst of fuel famine did little to quiet suspicions. The Senate Permanent Investigations Subcommittee held hearings. Presidents of oil firms denied they had created the shortage to increase profits, and insisted that large profits are necessary for continued research and development.

Charging that major firms have monopolized refining on the East and Gulf Coasts, the Federal Trade Commission filed suit against the top eight U. S. oil companies. Litigation will take years. And so, perhaps, will a final understanding of the oil shortage. That awaits the clear vision of retrospect.

But in the meantime imagine, if you will, four people gathered to discuss the reasons for the shortage—an oilman, a government spokesman, an environmentalist, and a taxicab driver. Their comments represent condensed versions of viewpoints I heard.

The oilman, armed with facts and figures, speaks first. He argues that the total costs of finding oil are awesome. He then points to declining United States production, citing as reasons a reduced depletion allowance (a tax break for oil producers, aimed at stimulating exploration) and higher drilling costs.

Like Atlantis emerging, wellheads, walkways, and drilling rigs sprout in Louisiana's sun-spangled Terrebonne Bay. Here some 400 wells pump 50,000

barrels of oil daily, but the yield slowly declines. To beef it up, rigs rework 30-year-old wells that have corroded or become plugged with sand. The fuel pinch and increased prices for crude oil have brought a surge of new drilling and reworking of old wells all across the United States.

"As a result, many oil companies turned to cheaper foreign sources for crude going to refineries," he says. "But uncertainty over imports due to government controls caused another problem, at the refinery. Crude oil from different countries has different sulphur content. You can't design a refinery until you know your source of crude."

A major government mistake, he adds, was regulating the price of natural gas, holding it so low that reserves were drained. Now that gas stocks are low, consumers are switching back to oil, with disastrous results.

"Gasoline demand," he points out, "has steadily gone up. In 1964 it accounted for 4.4 million barrels of oil daily. By 1972 it had increased to 6.4 million."

Most of his accusations are aimed at the environmentalist, although he says, "I'm an environmentalist myself."

"We have billions of barrels of oil on the North Slope of Alaska, but environmentalists have delayed construction of the pipeline to get it.* More oil awaits us on the outer continental shelf, but there has been a virtual moratorium on lease sales.

"Industry and government anticipated that nuclear power might produce 20 percent of our electricity by the 1970's, but it still accounts for only one percent. We have vast reserves of coal, but public outcry against strip mining and air pollution replaced coal with oil at many power plants."

Nature, the Public, the Pocketbook

The environmentalist interrupts: "We have been unjustly blamed for causing the oil shortage. Most of us never opposed production of Alaskan oil, only the poor planning of a pipeline route that crosses active fault zones and requires ocean tanker travel.

"We are blamed for the refining shortage, but since 1957 only three of 13 refinery proposals blocked on the East Coast were stopped for environmental reasons.

"We're not against outer continental shelf development altogether. We merely ask for careful studies into how much that oil will alleviate our energy problems, as opposed to wiser utilization of what we already have. We ask that decisions be made with caution, instead of with the haste that accompanies the profit motive."

The government man begins by accusing the major oil companies of turning from United States exploration to cheaper foreign production. "You were producing oil overseas and selling overseas," he says to the oilman, "while enjoying tax benefits from the U. S.

"The whole structure of the oil industry has become so immense," he continues, "that it is difficult to get exact figures and determine exactly where shortfalls lie. And the government has been hamstrung by a lack of trained people to deal with the shortages, after a decade of plenty."

"Seems Everybody's to Blame"

The cabdriver is a confused and angry man. He cares little about refinery capacity and import quotas, but he knows there have been changes in his budget and in his way of life.

"Seems to me," he says, his voice rising, "everybody's to blame. Sure, there may be a shortage, but maybe the oil companies helped it along, to push up prices and drive out that little independent guy down the street where I used to buy gasoline three cents a gallon cheaper. Meanwhile, it seems the government has goofed and not kept an eye on my interests, and the environmentalist wants a perfectly clean world at the expense of my comfort and my pocketbook."

On one point all four agree: There has been much waste in the United States.

With only 5½ percent of the world's population, we use a third of the world's energy.† Three-quarters of our energy comes from oil and natural gas. Almost 40 percent of the oil consumption is in the form of gasoline.

Iron rails are overgrown with weeds, replaced by a network of concrete superhighways and freeways. Yet one diesel-powered train of 10 to 15 cars can haul as many as 1,500 people, who would otherwise need 500 automobiles at three people to a car. Trucks burn four times as much fuel as trains per ton-mile of freight hauled.

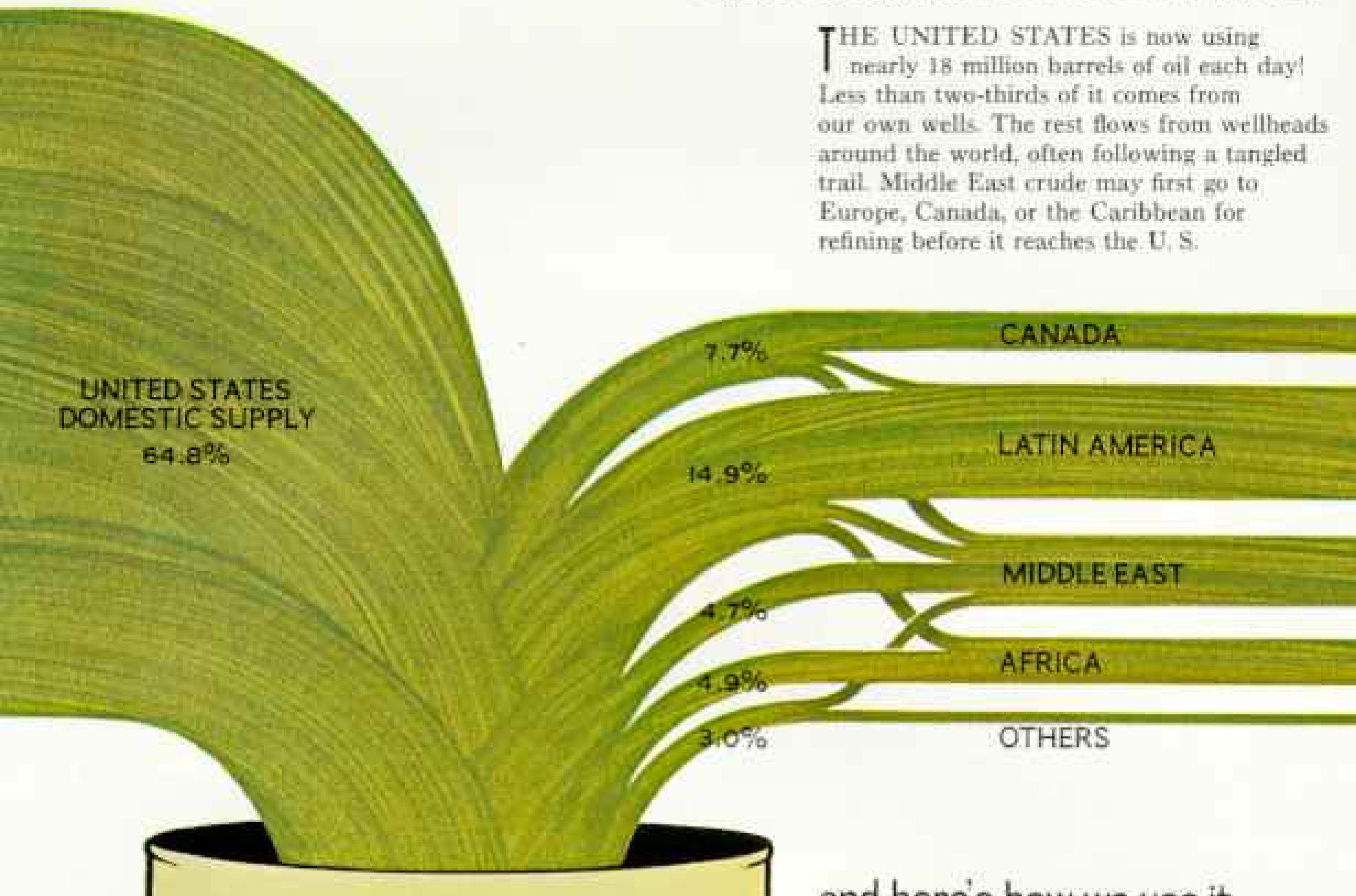
Cars that went 15 miles to the gallon were gradually replaced by gas guzzlers that gulp a gallon every eight miles, an appetite determined not only by size but also by addition of power steering, power brakes, air conditioners, and emission controls. Hordes of two-ton chariots bear lone occupants to and from offices miles from far-flung suburbs. At home sits the all-American second car,

*Alaska's dilemma, "Will Oil and Tundra Mix?" was explored by William S. Ellis in October 1971.

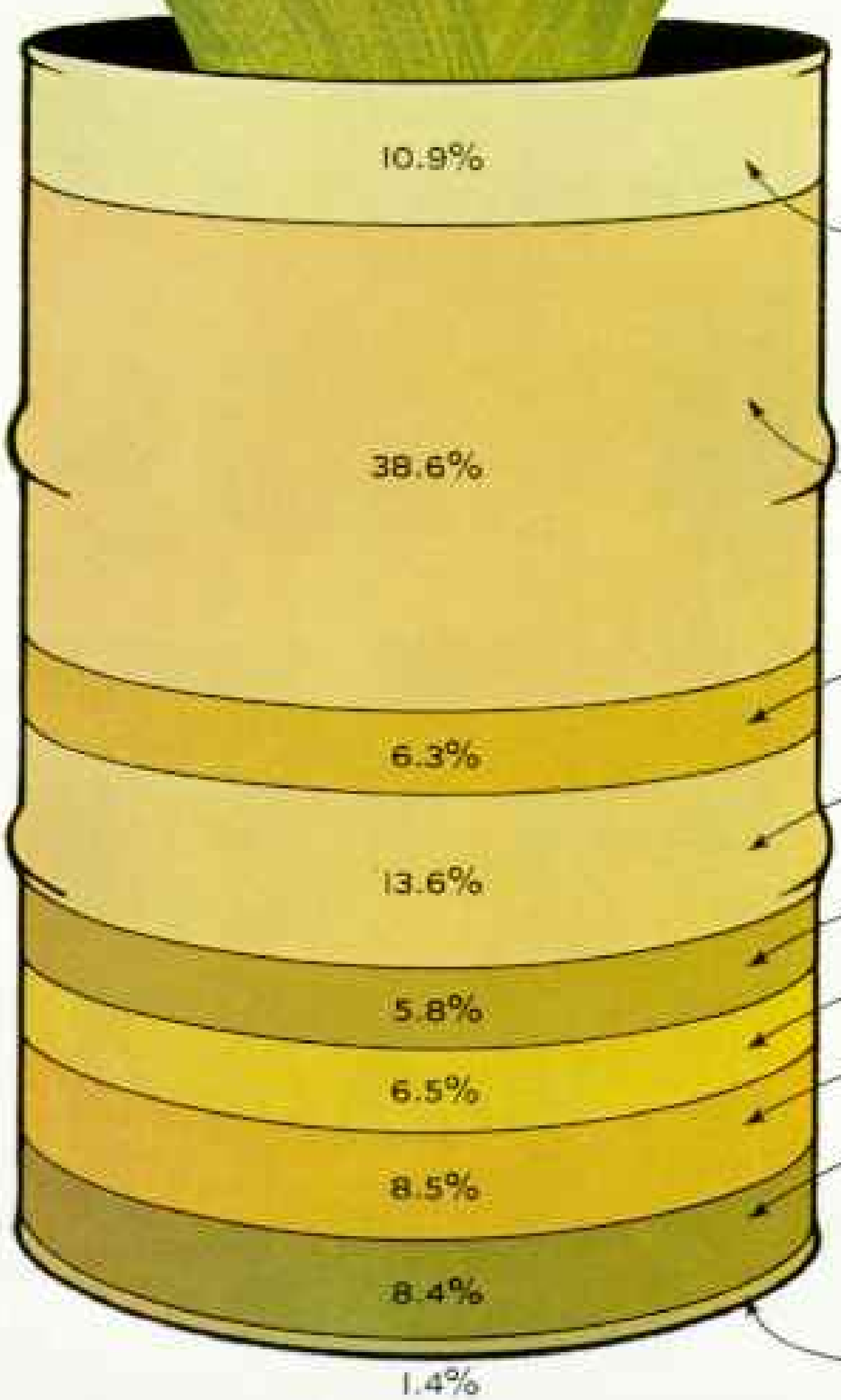
†A year before the oil crisis erupted, the November 1972 GEOGRAPHIC defined the impending energy shortage in "The Search for Tomorrow's Power," by Kenneth F. Weaver.

Rivers of oil flow into the U.S. barrel...

THE UNITED STATES is now using nearly 18 million barrels of oil each day! Less than two-thirds of it comes from our own wells. The rest flows from wellheads around the world, often following a tangled trail. Middle East crude may first go to Europe, Canada, or the Caribbean for refining before it reaches the U. S.



...and here's how we use it



ready to bear housewives to nearby grocery stores, shopping centers, schools, Scout meetings—and perhaps one of the burgeoning exercise salons. More than half of all auto trips in the United States cover five miles or less.

Nor is fuel waste limited to automobiles. Electrical consumption, sparked by the proliferation of household appliances operated at low cost, has grown at double the rate of other energy demands in the past decade.

A generation of architects has produced tightly sealed air-conditioned offices. New York City architect Richard G. Stein has calculated that the average office building would use 15 to 20 percent less energy if its windows could be opened.

"We've been living in an era of cheap energy," said Russell Cameron, a Denver oil consultant now with FEO. "We're seeing the end of it now."

Massive Transfer of the World's Money

And indeed we are. In late 1973 Iran, Saudi Arabia, and the 11 other members of the Organization of Petroleum Exporting Countries (OPEC) boosted the price of crude oil by 70 percent, then doubled that price, bringing a barrel of crude to $11.65, compared to less than $4 a few months earlier.

Such increases could create not only an oil shortage but a money shortage as well. By the new prices, non-Communist nations would shell out some 300 billion dollars a year by 1985 for petroleum, only 100 billion less than estimated total world monetary reserves.

Even so, the amount of oil being requested may not be for sale. Before the embargo the United States had urged Saudi Arabia to increase its daily production from 8.5 million barrels to 20 million barrels by 1980.

"Our plans call for developing our country over a period of 30 to 40 years," I was told in Riyadh by Hisham Nazer, Minister of State for Planning. "At 20 million barrels a day, the supply would be gone in about 20 years."

The answer to both the oil producers' depletion of supplies and the oil consumers'

Sea-locked city: A 108-mile maze of bridges links living quarters, shops, and wells in the man-made archipelago of Neftyanyye Kamni in the Soviet Union's oil-rich Caspian Sea. A four-hour, 52-mile boat trip brings residents and workers from mainland Baku, scene of the first giant oil strikes outside the U. S. a century ago.

mass expenditures may be investment. "We think the Saudis can be persuaded to increase production to 20 million barrels a day, but only if they are convinced that they would do better by investing the money at home and abroad than by leaving the oil in the ground and waiting for its price to go up," said Ambassador James Akins at the United States Embassy in Jidda.

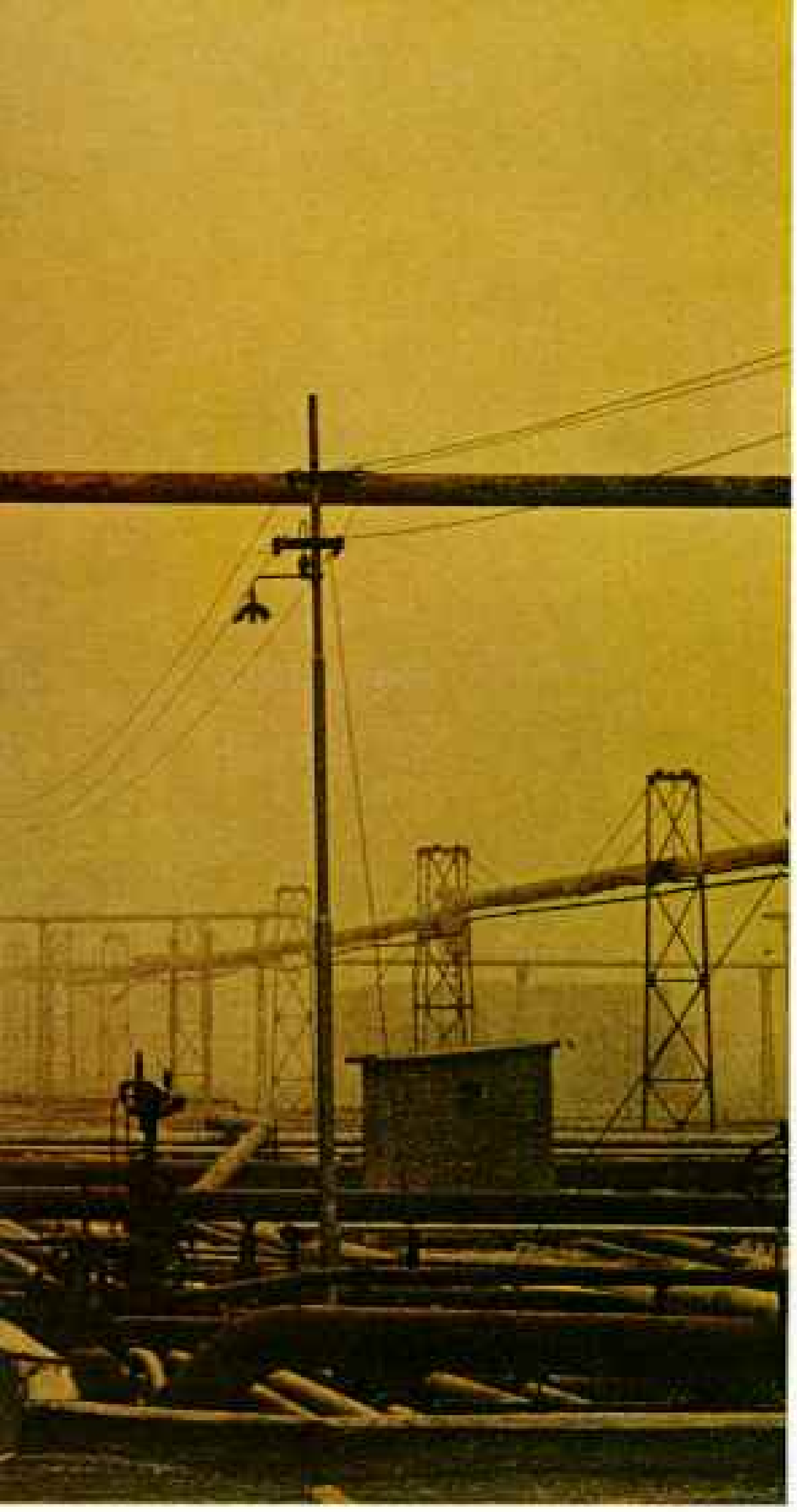
Iran Plans a Worldwide Business

Across the Persian Gulf, Iran already explores investment opportunities. A proposed agreement with Ashland Oil would make Iran half owner of a refinery and 180 gas stations in New York State, to be fed by Iranian oil.

"We have a target, to produce and refine our oil here and send it to Iranian gasoline stations throughout the world," said Parviz Tahasoni, spokesman at the National Iranian Oil Company's Abadan refinery. "The Shahanshah says NIOC must become the biggest oil company in the world." Yet, like Saudi Arabia, Iran is afraid its treasure may flow too quickly out of the ground.

Venezuela, second largest exporter of crude oil to the United States after Canada, also fears that at a daily production of some three million barrels its wells may begin to run dry in ten to fourteen years. A cutback by half could still leave Venezuela well off; its oil prices quadrupled in 1973 over 1972.

Thus the world faces a quandary. More oil is needed. But will the producing countries give it up in sufficient amounts? And if they do, can the consuming countries afford it? Will expensive fuel freeze the development of emerging countries and throw the developed



Dust storm's midday gloom dims Iran's Abadan refinery. Iran plans more refineries to create jobs and to market products as well as crude oil. The government nationalized most of its oil industry in 1951, but foreign firms still find and produce Iran's oil. Texan Harold Trent (**below**), his safety helmet embossed with a Persian motif, supervises a rig near Abadan.

ones into economic recession? That disturbing possibility brought 13 oil-using nations together in Washington last February to discuss ways to counter OPEC.

In Bangkok I dodged streams of motorized traffic to enter the office of Gene Foley, logistics director for the local Esso firm.

"Thailand imports 170,000 barrels of crude oil and oil products each day, and it has an average annual economic growth rate of 6 percent," he said. "Yet rising energy costs could slow industrialization here, in a way that the U.S., Britain, and other industrialized countries never had to deal with. It was cheap energy that propelled those nations into the economic status they now enjoy."

Expensive energy may drag them back. Japan, riding the crest of an economic boom in 1973,* depends on oil for 73.5 percent of its energy needs, and imports 99 percent of it. Until 1972, Japan had a sizable trade surplus. An economic-affairs official of Japan's Foreign Ministry, Reishi Teshima, shook his head soberly as he told me, "With Arab oil-price increases, our surplus will be substantially reduced." That was in October of 1973, two months before the price of Middle East oil doubled.

Costly Oil Waits Beneath the Deep Sea

What promise—and what problems—does the future hold?

"The U.S. Geological Survey estimates that 65 to 130 billion barrels of oil lie in the outer continental shelf," said Frank Ikard, president of the *(Continued on page 822)*

*"Those Successful Japanese" were described by Bart McDowell in the March 1974 GEOGRAPHIC.

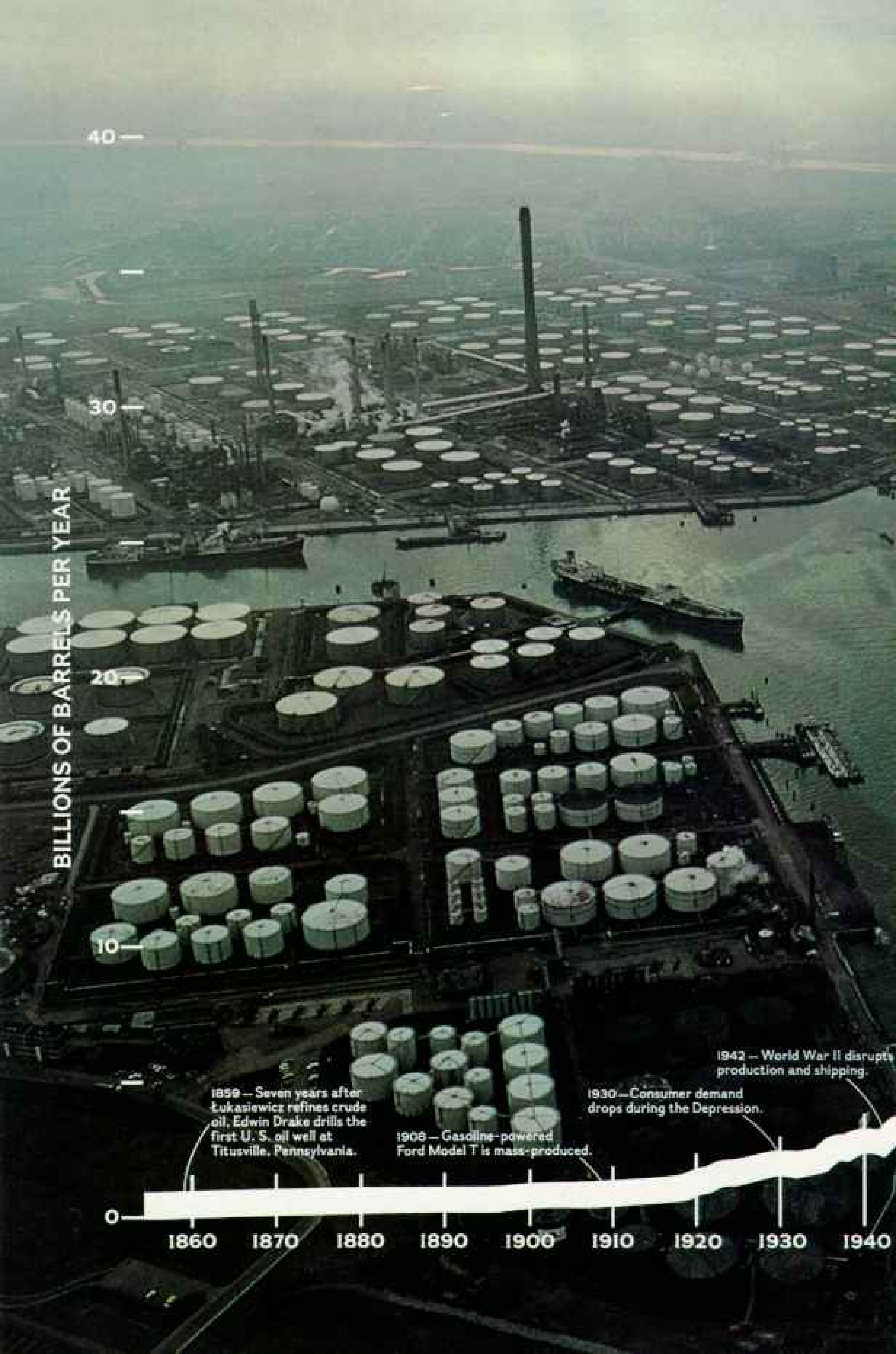
Oil-soaked sands near the surface of the earth hold as much petroleum as all known conventional reserves. Extraction is costly, but rising oil prices make the process increasingly attractive. Some 600 billion barrels lie in tar sands along the Athabasca River in northern Alberta, Canada, largest of Western Hemisphere deposits (**map, right**).

Huge rotating bucket-wheel excavators (**below**) bite 75 tons of sticky sand every minute from a mile-wide pit at the Great Canadian Oil Sands Ltd. plant, the only large-scale tar sands operation now underway. Steam and hot water then wash out 52,000 barrels of crude oil daily, one for every two tons of sand.

Rock that burns: Oil shale from the U. S. West (**right**), ignited with a blowtorch, demonstrates a future petroleum source. Some 80 billion barrels of oil, more than double the known U. S. liquid reserves, could be recovered under present technology from shale deposits in Colorado, Utah, and Wyoming. When heated to 900° F., organic matter in the shale vaporizes; it condenses as a low-sulphur crude.

Cost runs high—certainly in dollars, perhaps in environmental damage as well. The first commercial production plant, at least three years from completion, will yield 50,000 barrels of oil daily—the amount used in the nation in only four minutes. The facilities necessary to provide an hour of energy a day would cost billions of dollars, use huge amounts of water in an arid region, and fill ravines and canyons with residue that occupies more space after processing than the shale did when extracted.

B. C. BARRETT (ABOVE); EMORY KRISTOF AND JOSEPH H. BAILEY (RIGHT)


BILLIONS OF BARRELS PER YEAR
40
30
20
10
0
1859 — Seven years after Łukasiewicz refines crude oil, Edwin Drake drills the first U. S. oil well at Titusville, Pennsylvania.
1908 — Gasoline-powered Ford Model T is mass-produced.
1930 — Consumer demand drops during the Depression.
1942 — World War II disrupts production and shipping.
1860
1870
1880
1890
1900
1910
1920
1930
1940

1900— All oil discovered by 1974 may have been pumped from the ground.

1973 — Arab cutbacks partially offset by boosts in production elsewhere.

Two centuries of oil

"THE END OF THE OIL AGE is in sight," says U. S. petroleum geologist M. King Hubbert. He bases his bell-shaped curve on estimated ultimate production of 2,000 billion barrels from the world's oil wells, including 300 billion barrels already used up by 1974 and 628 billion of now-proven reserves. His chart appears here against a portion of the world's largest refinery complex, at Rotterdam in the Netherlands. If present trends continue, Dr. Hubbert estimates, production will peak in 1995—the deadline for alternative forms of energy that must replace petroleum in the sharp drop-off that follows.

1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050

Pollution stains a marsh at the British supertanker port of Milford Haven, Wales. Marine biologist Jenifer Baker upturns a spadeful of earth to demonstrate the effect of oil spills. Damage was minimal at this port, an environmental showcase, but biologists fear that widespread spills could endanger the earth's marine ecology.

American Petroleum Institute. "But we haven't drilled because a conscious public decision was made that those areas would not be opened to drilling.

"A study by the Chase Manhattan Bank determined that 1.3 trillion dollars would be needed by 1985 for oil development. There is great concern about where that money will come from. A recent offshore lease sale brought the government 1.6 billion dollars —money that the companies paid before they could bring in the first drill rig."

The move into deeper waters does not guarantee success, either technological or financial. Offshore oil drilling has only recently ventured past 600 feet in water depth. And a single production platform in the North Sea now costs as much as $120,000,000.

Future Fuel From Oily Rock

Liquid hydrocarbons from new sources—crude oil separated from oil shale and tar sands, and gas and oil extracted from coal—have raised public hopes. All are technologically possible. All face serious financial and environmental pitfalls.

A housewarming provided one of the first clues to the oil bonanza under the Rocky Mountains. In 1892 Michael Callahan, a Colorado homesteader, fashioned a fireplace out of black-streaked shale from a nearby canyon, built his log cabin around it, and invited white and Indian neighbors over to celebrate. Fire roared in the hearth. Then, incredibly, the stones caught fire—and the housewarming became a house burning.

An estimated 600 billion barrels of crude oil lie locked in shale under Colorado, Utah, and Wyoming. Experts say 80 billion barrels could be recovered by modern methods. Proven reserves of liquid oil in the United States, including the much-touted North Slope, total less than 35 billion barrels.

Oil shale is gouged from mountains either by strip-mining or "room-and-pillar" excavations—caverns with columns of rock left to support the roof. Crushed and heated, the shale gives off a vaporized organic substance called kerogen, which condenses into a low-sulphur crude oil. The remaining fine grit poses a major problem of disposal. Increased in volume by 15 percent, it will not fit back into the hole. Current plans are to fill and revegetate western canyons, despite a high salt content in the grit.

In a small canyon north of Grand Junction,

Colorado, I strolled over a hill of residue in which native grasses sprouted shin high.

"We leach out the salt by sprinkling the residue with fresh water, and seed it after a week of leaching," said Ed Baker, range conservationist with Colony Development Operation, owners of a prototype shale plant. "A couple of years of sprinkling should lower the salt level enough to support mature grass, shrubs, and trees."

"If the process works, what has held up oil-shale plants?" I asked Hollis Dole, former Assistant Secretary of the Interior and now a vice-president of Atlantic Richfield and general manager of the Colony project.

"An abundance of cheap crude oil," he said, to my surprise. "We haven't been desperate enough until now to push shale oil."

Interest has now arrived. The first of six lease sales for production on government land was held early in 1974. A working plant will probably be built by Colony Development, yielding 50,000 barrels of crude a day, perhaps by 1978. Cost: nearly $400,000,000.

"An all-out effort with government financial help could yield two million barrels a day by the year 2000, but most shale people consider that unlikely," said Mr. Dole.

Environmentalists, farmers, and ranchers would consider it unfortunate. Mountains of shale filling whole canyons raise eyebrows, but mass sprinkling for two years breeds storms of protest in an area where fresh water is in short supply. And what, environmentalists ask, of the salts leached away? The runoff water will be caught by dams and reused, says Colony. But fears remain of briny streams and torn-up, poisoned land.

How to Wash Oil From Tar Sand

Like oil shale, tar sands along Canada's Athabasca River in northern Alberta hold billions of barrels of oil (map, page 818). It can be washed out with hot water and steam. The process began to make economic sense to oil companies when prices of fuel oil and gasoline began to rise. But like shale oil, the time of significant production remains decades and billions of dollars in the future.

"We have a viable operation now," said Earl Rea, an official of Great Canadian Oil Sands Ltd., a subsidiary of Sun Oil. "With higher oil prices brought by the energy crunch, we should make a profit."

Vapor extracted from coal could supply U. S. natural-gas needs well into the twenty-first century. Liquefaction, turning coal into oil, lags far behind in research. An estimated 17 billion dollars would be needed in the next decade for the development of both processes.

Power from nuclear fission has bogged down, partly through fear of radioactive leakage and problems in storing waste products. The dream of harnessing nuclear fusion, the process by which atoms release energy as the sun does, remains far from reality.

Harnessing Sunshine, Wind, and Garbage

"Solar energy?" said government expert King Hubbert as we talked in his Washington, D. C., home. "We have it already." Swinging around in his chair, he picked up a motor-driven propeller attached to a postcard-size plate of silicon and placed it on a sunny windowsill. The propeller began to whirl—clean, pure energy from a source at least as long lasting as man's occupation of the planet.

"Unfortunately," he added, "using it requires extensive changes in buildings."

A host of other power sources lie relatively unexploited. Tides surge ceaselessly to and from our shores, and the wind bends trees and propels sailboats.

A car in England runs on pig manure. A former chemistry teacher in Michigan dumps grass clippings, leaves, table scraps, and coal into a backyard still, and the resulting brew runs his car, motorcycle, and lawnmower. Los Angeles is making methane gas from garbage. All harness a power as old as life and death: the process of decay.

Power, it would appear, is available from a wide range of sources. Money, time, and a sense of urgency are needed to tap them.

How much time do we have? The answer is keyed to the peak of world oil production, for the drop-off that follows will be swift (diagram, pages 820-21).

"Ultimate world output of crude oil is estimated at some 2,000 billion barrels," said King Hubbert. "Taking that figure, the production rate should peak about 1995." Most of those 2,000 billion barrels, he said, are recoverable by present methods. Billions of dollars would be required to get them. "But money is paper. Oil is real."

Billions for imports. Billions for pipelines. Billions for shale plants, tar sands, gas and oil from coal. But the cost is not measured in dollars alone.

With Dr. Allan Michael, a marine biologist from Woods Hole on Cape Cod, I prowled the

Petroleum's private hell, a wild well near Casper, Wyoming, gushes burning gas and oil that erupted from an underground pressure pocket. A fire fighter sprays water from behind a metal heat shield before rushing in to connect a hose; mud pumped into the well may quench the wild flow. In 1932, dynamite maimed the hand of George Curry (**below**), here working with the world-famous Red Adair oil-fire fighters.

shores of Buzzards Bay, scene of an oil spill four years earlier.

"To the layman, this area appears totally recovered," said Dr. Michael, pointing to lush marsh grass and clear water. "But look."

Reaching into the shallows, he thrust his hand deep into the grayish mud. The glob of ooze he retrieved was not gray but black, and stank of oil.

"The pollutant is still here; you just can't see it anymore," Dr. Michael said. "But several important species are missing in these waters. Little marine creatures that inhabit estuaries like this are vital because they support clams, lobsters, and fish that are taken by commercial and sports fishermen alike."

With the oil that remains, will we continue to choke our cities with cars, and our air with the effluent, at the price of our endangered health and smog-dampened spirit?

Too High a Cost for Comfort?

"The energy crisis has brought us to an important confrontation over how we want to live," I was told by a senior British conservation official. "We have gathered about us some of the greatest comforts in all history, but we have paid an astonishing price in environmental damage.

"I am reminded of an old eastern European

BIRTH BY LOWELL GEORGIA

proverb: 'Of what use is your golden vase if you can only spit blood in it?' "

Perhaps, some suggest, we can have the vase without its awful price.

"All our futuristic ideas of cities, with everybody shuttling about with their own cars and helicopters, were based on the easy and cheap availability of fuel," said Stewart Udall, former Secretary of the Interior, over lunch. "Those days are gone now. Petroleum is the most precious resource on our planet; we should use it mostly as a prime raw material, and not just burn it as a fuel.

"The quality of our lives may change, perhaps for the better. What if we don't drive as much, and walk a little more? Maybe we will tend to our own backyards more, and learn to be more neighborly. This whole thing is forcing us back to good old-fashioned thrift."

Cries of warning over shortages of many resources—wood, tin, aluminum—have been sounded for years, but none will affect our lives as directly as the shortage of oil. When that jolted the world with its threat to shelter, mobility, and livelihood, the depletion of everything came somehow into sharper focus.

If the first gift of oil was the gift of progress, its next may be the gift of concern—for the way we live, for our diminishing resources, and for our earth. □

Burma's Leg Rowers and

TWO IMPROBABLE BOATS sprint down the lake—side by side, stroke for stroke. Twenty times longer than wide, with only inches of freeboard, they look more like giant water skis than racing shells. Fifty-man crews stand upright to row, each man with one leg locked around an oar. In faultless cadence 100 legs sweep 100 oars as they churn toward the finish.

The wildly partisan crowd picks up the tempo. *"Myan! Myan!*—Faster! Faster!" Many bets ride on the outcome. Gambling is illegal in Burma, but when it comes to boat races on Inle everyone does it.

To be the champion leg-rowing crew of this lake is to be the world champion; nowhere else have people mastered that combination of balance, power, and finesse. How did they develop the unlikely skill —and when? No one knows.

And no one knows where the leg-rowing people came from—or when. They call themselves Intha, Sons of the Lake. Their neighbors the Shans, who live in the rolling hills that surround twenty-mile-long Inle, call them the Lake Burmese. One of Burma's 126 ethnic groups, the Intha are among the most intriguing. Some 70,000 of them live and work on the water, building houses on stilts driven into the lake bed. In their slender boats they seek Inle's fish, and farm floating islands that they create themselves. Widely known as fine craftsmen, the Intha excel as silversmiths, blacksmiths, carpenters, and particularly as weavers of cotton and silk.

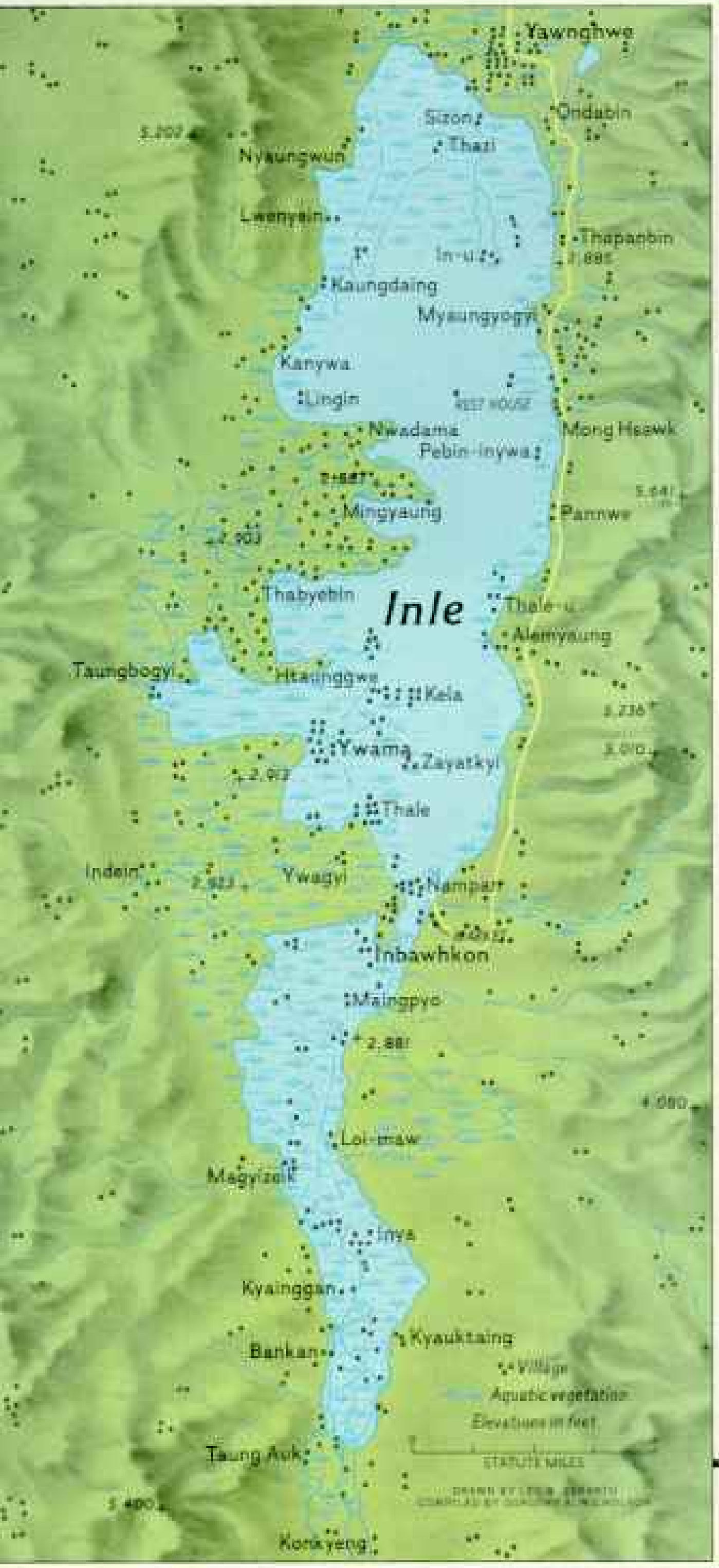
Floating Farms

Picture essay by W. E. GARRETT
SENIOR ASSISTANT EDITOR

Text by DAVID JEFFERY
NATIONAL GEOGRAPHIC STAFF

SPOTTING MOVEMENT in the clear water, a casually balanced Intha thrusts his conical trap to the lake's shallow bottom (**facing page**), hoping to match the luck of another fisherman (**left**). As the trap touches down, he will release the ring that holds the net up; the billowing mesh drops and, if fortune is kind, traps one of the carp, catfish, or eels that cruise Inle's floor. By this method, known nowhere else, the Intha catch fish for their tables and enjoy the tranquillity of fishermen everywhere.

Beyond a leg rower bringing home his catch (**above**) rise the Shan hills, where life is far from tranquil. There Communist guerrillas fight for ideology, ethnic minorities fight for autonomy, and remnants of the Chinese Nationalist army run the opium trade. All joust for power with each other and with the Burmese Government.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Rangoon
THAILAND
VIET NAM
Bangkok
CAMBODIA
Phnom Penh
Saigon

WITH AN ACROBAT'S AGILITY, a market fisherman prepares to drop his gill net overboard. Tucking the oar under his armpit and bracing the shaft with the calf of his leg, he sculls with confidence and skill learned in childhood. When he hauls fish to market, he will probably trade leg power for the put-put of a motor. Outboards have now largely replaced rowing for extended lake journeys.

Though Inle still provides the residents of some 200 Intha villages with a ready source of protein, the lake is dying. Once much larger than its present wet-season size of roughly 60 square miles (**map, far left**), it suffers from the silting action of feeder streams, and from water hyacinths, which threaten to choke it. Rimmed by swampy masses of living and decaying vegetation, the lake has little clearly defined shoreline.

PERCHED SAFELY above flood stage, Intha houses (**left**) rest on teak pilings that can last a hundred years. Most houses have woven fiber walls and thatched roofs; stores and a few homes are of wood, roofed with sheet metal.

Intha youngsters learn to swim before they walk, with the help of water wings made from gourds. Mothers keep track of toddlers by tying bells to their ankles. With plumbing at the doorstep, bathing becomes an exercise in modesty (**below**).

"SO FINE it wouldn't catch on a thornbush," goes one description of the exquisite, tightly woven silk that made the weavers of Inle famous. Now, with the Burmese Government restricting the import of raw silk as a nonessential, only a few looms still operate (**left**). Many weavers have been forced to leave the lake and seek their fortunes in the cities.

Born to the loom in the weaving village of Inbawhkon, a girl displays a bolt with characteristic horizontal patterns (**below, left**). Inch by inch the threads are dyed different colors, then wound on bobbins. Creation of the intricate designs demands a mind like a computer and hands infant soft and pianist quick. Women can produce two yards a day by working from sunup to sundown; in a weaver's house, men do all the domestic chores. Those who can afford Inle silk use it for *longyis*, the traditional saronglike garments of Burmese men and women.

Locally woven cotton cloth adds a bit of sail power to a boat laden with firewood (**right**); the fabric will serve as a blanket at night. Wood for fuel, construction, and carpentry must be ferried in, making it one of the most important commodities in trade between the Intha and land dwellers.

WITHOUT natural cropland, the Intha have devised a method of making their own. First they mat dried reeds and grasses into strips as long as 200 feet. To keep them from floating away, they anchor the strips by thrusting bamboo poles through them and into the lake bottom. Next they dredge fertile muck from the lake and load it onto work scows. Finally they scoop the muck onto the floating mats (**above**), and the farm is ready for planting.

National Geographic, June 1974

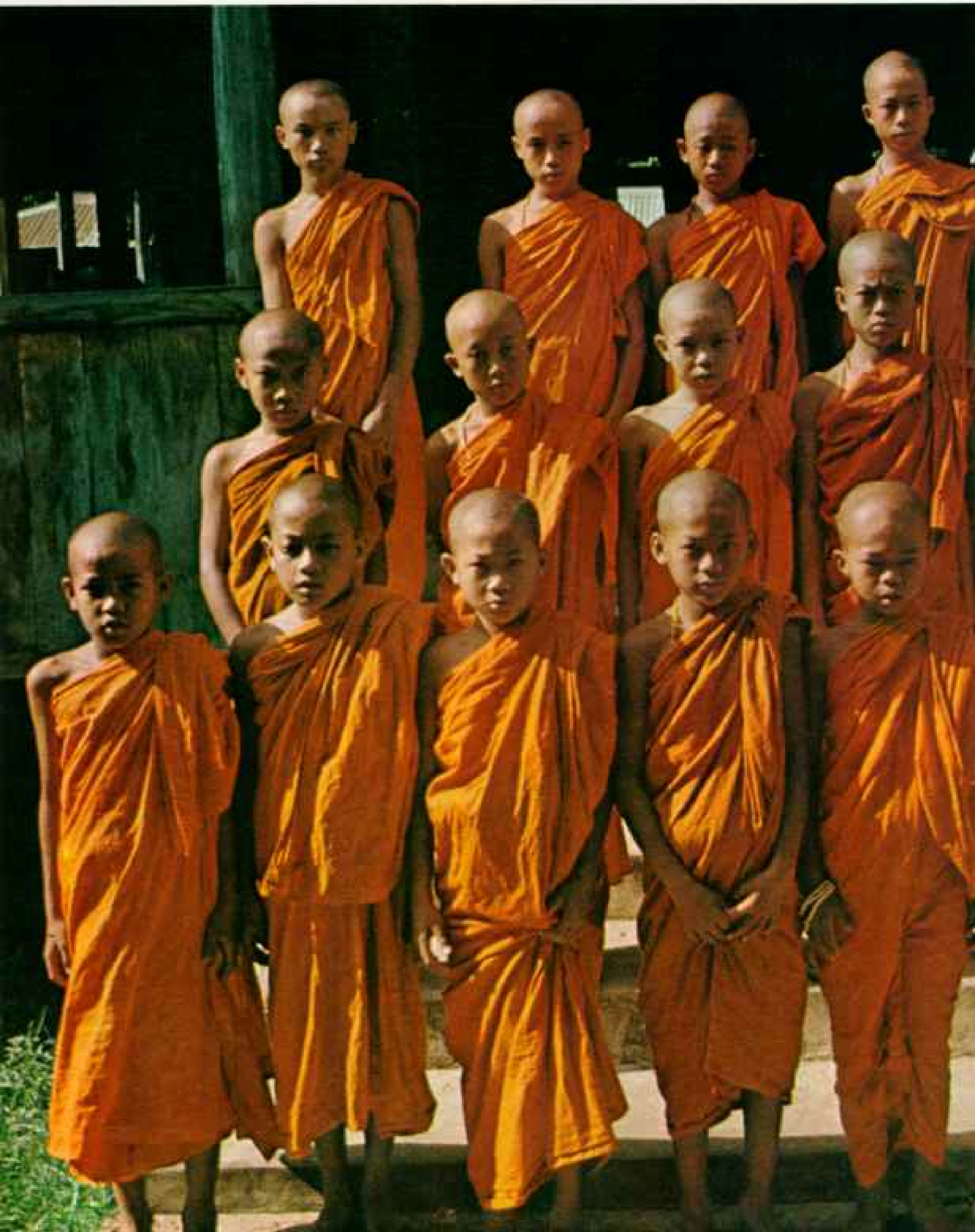
Some of the Intha make their living by towing parcels of "land" behind their boats and slicing off sections for gardens according to their customers' needs.

The Intha keep their floating farms narrow so that they can be worked from boats in the manner of the woman planting tomato seedlings (**left**). After a season or two the islands become waterlogged and sink. The gradual buildup of successive sunken plots can form a permanent island.

Though tedious to construct, the floating farms pay off. The lake provides a constant source of moisture, and its moderating influence on winter temperatures permits year-round crops. The Intha's gardens meet the great demand for eggplant, cabbage, cauliflower, cucumbers, peas, and beans throughout the Shan State. Since silk weaving has declined, the aquatic farmers have risen on the economic scale and predict, "Now we will get the weavers' gold."

READY FOR MARKET, gourds hanging from an arbor (**above**) make for easy picking. The Intha and their neighbors gather near Inbawhkon every fifth day (**right**) to trade their various specialties. One woman balances a bulky basket filled with light rice cakes (**upper right**). Farm tools made by Intha blacksmiths are used all over Burma. Repairing and maintaining boat motors has become a new and profitable trade. Even more profitable is the black market that operates openly to bring such scarce goods as outboard-motor parts, gasoline, and luxury items to the lake dwellers.

IF HE SLEPT AT ALL, Than Lwin was up well before first light glanced off the lake. Sixty people had worked all night to help his parents prepare the pork curry and bitter bean soup that would be part of a feast for 700 guests. Than Lwin was ready for the biggest event of his young life. It was his *shinbyu*, a ceremony introducing boys to the tenets of Buddhism. Through the early morning the 13-year-old sat at the center of attention, arrayed like a prince (**right, upper**). By noon he and other boys celebrating their shinbyus had



been rowed to a nearby monastery at Ywama where, heads shaved, they are swathed in flowing saffron robes (**right, lower**). They pose with solemn demeanor (**below**) as they begin a week or more of religious training under the guidance of Buddhist masters.

BUTH BY TIN MAUNG AYE

RELIGION takes to the water for two weeks each October. An ornamental barge graced by a gilded image of the mythical *karaweik* (**right**) —a symbol of Burma's onetime Buddhist royalty—tours the lake, towed by a squadron of racing boats. The barge, here being poled away from shore, bears four sacred statues under the ceremonial guard of a soldier. The figures are believed to have been brought from Malaya by Alaungsithu, a 12th-century king who dedicated his reign to Buddhism. According to the legend, he placed the statues in a cave near Inle. Discovered centuries later, they have been accorded increasing religious significance. The faithful have applied so much gold leaf that they have totally obscured the objects of their devotion (**above**).

When the leg rowers finish their barge-towing stint, they gather for the most important regatta of the year. Cash, clothing, and silver prizes await the crews that can get the most leg into the races.

SILENCE FALLS, a farmer glides home from his floating fields, and Inle again seems to be what it has always been in

the memory of the people: A culture within a culture within a culture—the Intha amid Shans within Burma. And perhaps, though modern times weave new designs for living, it will so remain until in some dim future the slow cascades of silt finally claim the lake. □

The Cotswolds, "Noicest Parrt o' England"

By JAMES CERRUTI
SENIOR ASSISTANT EDITOR

Photographs by ADAM WOOLFITT

THEY HAVE BEEN CALLED the last real bit of old England and the finest villages in the world. In short, as farmer Roger Dancer told me, they're "the noicest parrt o' England."

They wear the visage of the past, these villages of grayish and straw-yellow stone, mellow as the Cotswold fields of stubble after harvest. Snuggled into the sweeping hills, looking out on vast unsullied panoramas, they are stamped all over "Genuine Middle Ages." And yet they sit right on the edge of England's teeming southeast, where 17 million people—nearly a third of the United Kingdom's population—live.

The Cotswold paradox is up to that—and more. The Middle Ages and the Air Age maintain a zestful coexistence. The 900-year-old Mill Hotel at Kingham invites far-traveling guests to use its "small helicopter pad." At Fairford the supersonic Concorde is testing a mile from some of the most precious medieval stained glass in England. Above quaint Little Rissington the Red Arrows—an RAF aerobatics team—trailing plumes of colored smoke, ascend and dive, nine jets abreast, in awesome verticality.

The Cotswolds themselves are airborne geography, created millions of years ago when an ancient seabed reared up to form a great escarpment. It runs northeast for nearly 60 miles from just above Bath, and it is as awesomely vertical along the western edge as any Red Arrow formation, reaching an elevation of 1,083 steep feet at Cleeve Hill.

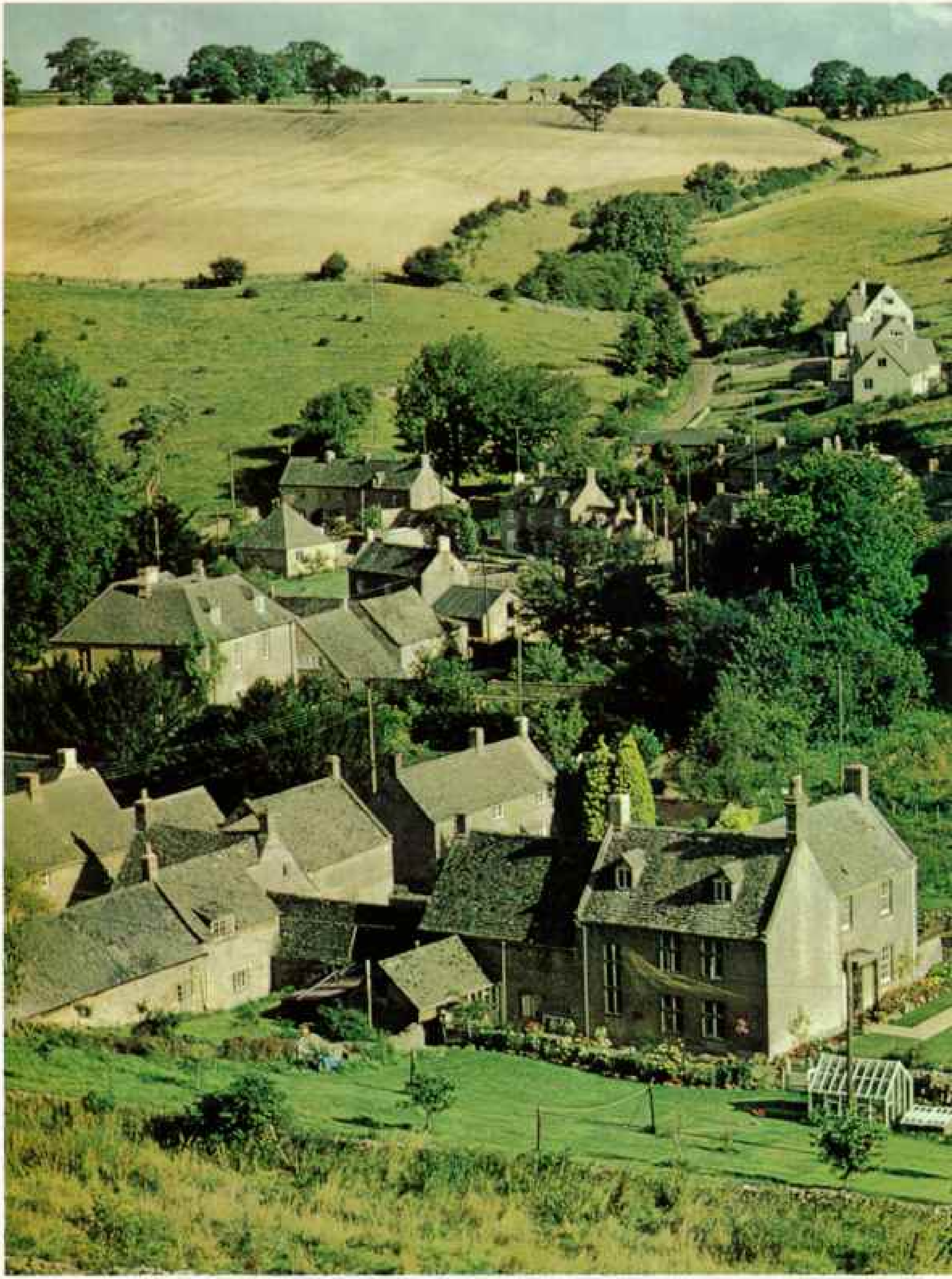
The ridge is solid limestone of a type called oolite, "eggstone," because its small round granules resemble roe. From prehistoric times Cotsallers have built with the eggstone, and its honey tones give the Cotswolds their pervasive character, harmonizing village with village and early centuries with late.

Long Bachelors and Short Wivetts

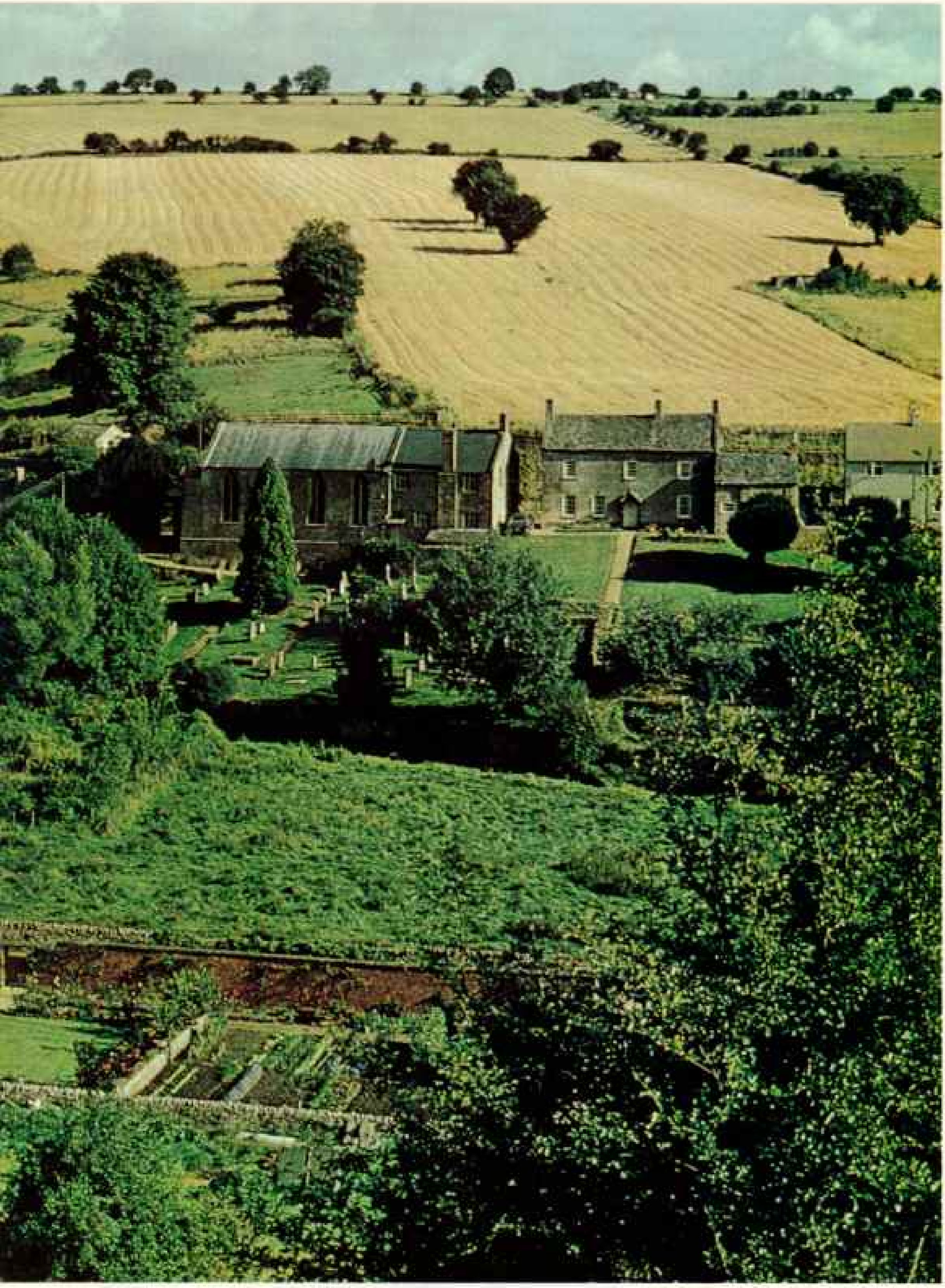
"A true Cotsaller can do anything with stone except eat it," says the old saw. And when I think of Cotsallers, I think first of the men who worked the stone, and, of them all, I think most of George Swinford.

When I tapped on George's workshop door in Filkins, he was finishing a blackthorn thumbstick, for like a true old Cotsaller he can do anything with his hands. He was wearing a green-check cap over his white hair, but his bright blue eyes and pink cheeks belied his 86 years.

Tasting the morning's calm, a member of the Heythrop Hunt sips a glass of wine before following the hounds over Cotswold field and fence. The gently molded Cotswold Hills in south-central England ring with the mingled accents of native Cotsallers and well-to-do newcomers attracted by the peace of country life.



The soul of the Cotswolds lingers in unchanging villages that nestle on the region's hillsides. Tiny gray-walled Naunton dates from at least the 12th century. Lying in the Cotswold heartland officially



designated as an Area of Outstanding Natural Beauty, she guards her medieval patrimony carefully. Even new structures in the tranquil hamlet must harmonize with the centuries-old stone buildings already there.

I identified myself as a GEOGRAPHIC editor, and George said, "Whoy, Oi 'ave me picture in that book!" He thereupon thrust the thumbstick into my hands, a five-foot staff with a V at the top for the thumb to rest in.

"Now yer must 'ave un. 'E be foine fer walkin' about in the fields, keep yer upright, 'e will, and if 'appen yer see a snake, whip un aroun' 'n peg un down."

George produced the 1948 story on the Cotswolds by Melville Bell Grosvenor, now the GEOGRAPHIC's Editor-in-Chief and Chairman of the Board. There was George, pegging in a steeply pitched limestone-slate roof, hallmark of the traditional Cotswold cottage. "Quite a arrt in it, y'know."

George walked me through Filkins to show off his "arrt." "Now there's a roof Oi did farty year ago. Can yer guess how many sizes o' slates in it? Near 30—and each 'as a name. Long Bachelors, Short Wivetts. . . ."

Why were the biggest slates always at the bottom? George looked at me as if I were daft. "Whoy, to save 'avin to carry the 'eavy uns *oop*, o' course!"

All George's slates, as well as walling stone, had come from " 'Arse Bottom Quarry." Like most Cotswold quarries, Horse Bottom is now disused. No quarry produces slates, and only two still take out stone in any quantity. A quarryman's pay is low, and Cotsallers would rather emigrate to jobs on the Austin Morris assembly line in Oxford or to General Foods in Banbury.

". . . 'e Was Too Good for Churchill"

George's great days at Horse Bottom began when the late Sir Stafford Cripps, who had a home in Filkins, took over the quarry to give Filkins men work during the Depression. He made George his foreman.

In later years, Sir Stafford, a vegetarian, was assailed for his austerity. As Labour's Chancellor of the Exchequer after World War II, he increased taxes on alcohol, tobacco, and gambling.

Brandy-drinking, cigar-smoking, beefy Winston Churchill called him "Christ and carrots" and said, "There but for the grace of God goes God."

"Sir Stafford, 'e was too good for Churchill," George said. "Come see the things 'e did 'ere." George showed me two blocks of "council 'ouses," all lovely Cotswold stone. "If the council 'ad 'ad its way, these 'ud all be *brick*," said George, expectorating the word. In the

Combing out the kinks, the Countess of Effingham cards unbleached local wool before spinning it into yarn. A member of the Craftsmen of Gloucestershire —a group devoted to revitalizing traditional handicrafts —Lady Effingham uses vegetable dyes to color the wool, which she weaves into shawls, skirts, rugs, cushion covers, and table mats.

Invaded by writers, artists, and artisans at the turn of the century, towns like Chipping Campden still provide the studios as well as the backdrops for modern painters and sculptors, and congenial homes for furniture makers, weavers, and other craftsmen.

stone-enchanted Cotswolds, brick is an unspeakable corruption.

"The council said stone 'ud cost much more," George went on, "but Sir Stafford said 'e'd dig the stone in 'is own quarry, put it up for *brick* prices—long as George Swinford were 'is superintendent. And so we did."

For George, Sir Stafford made a dream come true. "Oi was always pickin' up old things when Oi was quarryin' or buildin'. Oi had a girt mess o' stuff, and Sir Stafford said, 'George, yer must 'ave a museum to keep it right.'" Sir Stafford bought two adjoining 16th-century cottages, and in went George's collections of old craftsmen's tools and bygone domestic utensils. For three hours George guided me through.

"Now, will yer guess what *this* is?"

I missed guess after guess: a lark toaster, a top-'at stretcher, a huge-bowled "cadger's pipe" ("'Twent round the pub all night and me faither said took near 'alf a pint o' beer to put un out").

George rubbed the pipe in his palms, eyes watery. "Oi love these old things, Oi do."

Next to George (meaning right beside), my favorite Cotsaller is Laurie Lee, poet and author of *Cider with Rosie*, a Cotswold classic about his boyhood in Slad, where he still has a home. A round-eyed 59-year-old cherub (page 854), Laurie loves to recite in his bardic baritone his own fanciful versions of Cotswold history.

"I hear you're living over by Bisley," Laurie remarked to me one night. I admitted I was, at Spring Cottage in Eastcombe. "And yet you've never heard of the Bisley Boy?" I hung my head. "Well, you know, Jimmy, King Henry VIII didn't like having Elizabeth about, reminding him of Anne Boleyn. So he sent the girl to a noble family at Over Court by Bisley. She got caught by the Cotswold winter—terrible cold—and died.

"The villagers cast around, terrified of Henry's rage, for someone to take her place. They could find no girl of her age and size; but they got hold of a 7-year-old boy—red-haired, who'd had exactly the Latin studies Elizabeth had. It was that boy became queen!

"You see, it explains why Queen Elizabeth panicked at getting married, went bald in middle age, declared that in her woman's breast beat the heart of a king.

"Years ago, they dug up near Over Court a stone coffin with the skeleton of a girl of Elizabeth's age. My mother said she and her

"God willin', we'll keep it much the same," says George Swinford, 86, of his native Filkins. George helped establish a village museum in the center of town. Now the museum's curator, he holds an antique carrying stick and workman's lunch bag slung across his shoulder.

A stonemason since the age of 12, George points with pride to the village homes he helped build—and with some scorn to the occasional corrugated iron roof that has escaped his touch. "We'll catch up with 'em," he vows.

mother saw the skeleton—it's gone now, but the coffin's still there. They always referred to Queen Elizabeth as the Bisley Boy. I believe it—there are some who don't."

I found that Elizabeth is indeed part of Cotswold history. She (he?) had stayed three times at Sudeley Castle, a Cotswold-stone palace once owned by Henry VIII, whose last wife, Queen Catherine Parr, is entombed there.

A Sheep in Lion's Clothing?

It was no accident that Henry VIII had a Cotswold castle, or that Elizabeth visited it. They were keeping an eye on their assets, for the tax on wool had been the Crown's chief revenue for centuries. "Cotteswold Woolle," produced by the Cotswold Lion—a sheep whose "mane" hung to the ground—was the finest of all English fleece.

During the 13th and 14th centuries wool was the basis of English wealth, and England became the world's greatest wool exporter. By the 15th century the trade had declined, as English weavers, taught by immigrant Flemish weavers, strained the supply to produce English cloth. The Crown found juicier revenues in the export of cloth, and early in the 17th century James I made the export of wool illegal.

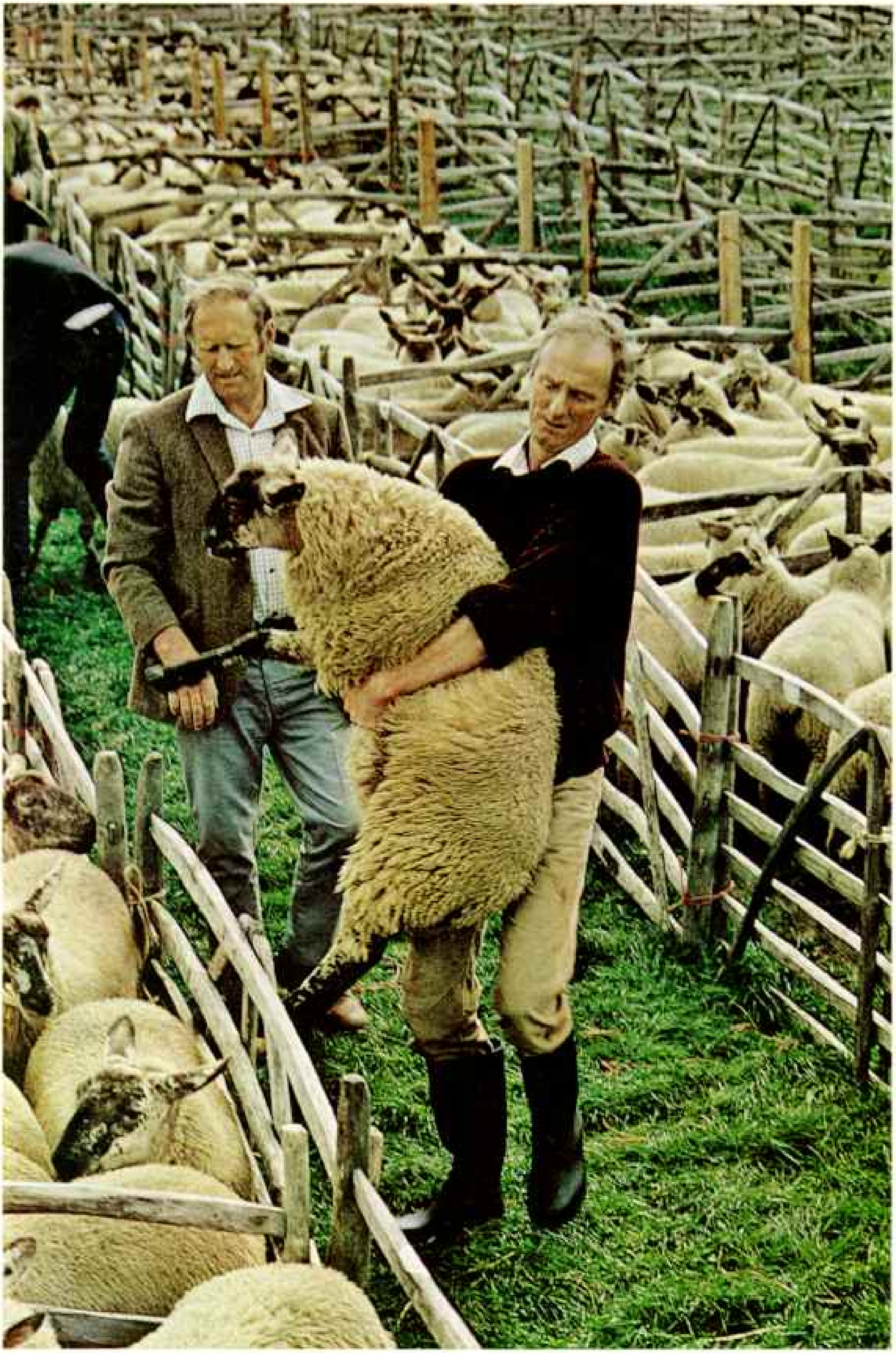
Clothmaking in the Cotswolds centered in the south, on the western escarpment, while wool growing centered in the north. The wolds of the north are long, open, flat-topped, sparsely wooded—ideal for sheep pasture. The name Cotswold probably derives from this region: "wold," high open land, with "cotes," sheepshelters. The southwestern landscape is less austere, with rounded, heavily wooded hills, steeply folded-in valleys called combes, and an abundance of streams necessary to dye and full (shrink and thicken) cloth.

The clothiers (who produced cloth, not cloaks and suits) were employing 20,000 cottage weavers by the mid-16th century. The biggest had a thousand employees, many of them resentful. Edith Brill, a Cotswold historian, told me how capital and labor drew up battle lines there almost 300 years before the Industrial Revolution.

The weavers won a minimum-wage act in 1604. The clothiers pressured and, lo, it was transmuted into a *maximum*-wage act—wage control. The clothiers decreed that wages would henceforth be paid in "truck"—the (now) hoary company-town practice of paying in provisions priced beyond their value. The weavers unionized, struck, rioted; the

Reliving its golden age, the Cotswold sheep-raising industry crowds pens at the Andoversford auctions with hefty ewes and rams (**right**). Most Cotswold sheep are now bred for meat, but the days of wool growing are well remembered. In Stroud, an early mill center, a curly-fleeced ram graces the sign of a local pub (**above**).

Medieval wool merchants made fortunes from their trade, and their wealth helped enrich the pinnacled churches of Cotswold towns. In Northleach church the memorial brass of a wool merchant includes a sheep standing on a woolpack branded with the man's trademark, crossed shepherd's crooks (**below**).



"Our horizon of woods was the limit of our world," writes Cotswold poet and novelist Laurie Lee (**right**) of his childhood days in the Slad valley. One of seven children raised in the family's 17th-century cottage, background, Lee recorded his memories of village life in his book *Cider with Rosie*.

government declared the unions "unlawful combinations." The clothiers used their influence to have the strikers arrested.

Eventually both these fearfully modern-sounding parties were ruined together. Steam power took over in the mid-19th century, and northern cities, closer to the coal, produced cheap machine woolens that drove the finer Cotswold cloth off the market.

Craftsmen Flock to the Cotswolds

With the failure of the mills, the Cotswolds lapsed into a timeless rusticity—an atmosphere attractive to arts-and-crafts types. In 1871 William Morris, a poet who invented the Morris chair, rented the manor at Kelmscott and there designed chintz, wallpaper, and typefaces. Other craftsmen followed, establishing colonies in Sapperton and Chipping Campden. Their successors still invest the Cotswolds, but, in a typical Cotswold paradox, the greatest is a handicrafter who has turned to the machine. In his Broadway factory, employing 200, Sir Gordon Russell creates cleanly beautiful furniture, including chairs that have gone to Washington Cathedral in the District of Columbia.

Of all these Cotswold immigrants, the most extraordinary was not an artist but an art collector. I stopped a farm boy on a tractor and asked the way to Capt. Edward George Spencer-Churchill's Northwick Park. "Ah, the droogie place! Up the 'ill 'bout a moile."

While I walked, I groped: What connection between the late captain, Winston Churchill's cousin, and drug addicts? His only addiction was collecting great masters and antiquities. Over half a century he crammed every room and corridor of Northwick mansion. Auctioned after his death in 1964, the collection brought $6,400,000.

The door was open at Northwick Park, a mansion of fine Cotswold stone. I stepped inside—and was thunderstruck: everywhere delicate plaster friezes exquisitely painted; lofty ceilings in cool blue or rose. A young man appeared and caught me gaping. "You should have seen it when we took it over."

"We," he told me, was Life for the World Trust, a Christian organization to help drug addicts, directed by a Baptist minister, the Reverend Frank Wilson. He, Paul Tandy, was Wilson's assistant.

"Underneath the captain's art collection this place was a near ruin. In 1967 a member of the Life council came on Northwick Park, and said, 'God wants us to have this place.' He must have. The trust that holds Northwick let us take it for five pounds a week on a 42-year lease. Now they're overjoyed at how we've improved the property."

The frieze work, carpentry, and such are therapy for Northwick's 15 ex-addicts, all men. But the basic therapy, according to Paul is: "You know you can live without drugs when you find you have a Big Friend called Jesus. I know—I was an addict myself. The doctors gave me up. Then I came here, accepted Christ, cut my hair, and learned to work."

I came on another unorthodox lifesaving institution at Moreton in Marsh, home of the unique Fire Service Technical College, under the aegis of Britain's Home Secretary. Its conglomeration of smoke-blackened, concrete

Tucked in England's vest pocket, the Cotswolds unfold their antique charms less than 100 miles from the streets of London. Beds of honey-colored and gray limestone—the area's favorite building materials—underlie the region.

"fire buildings" atop a rustic wold appeared so alien that I wondered whether I'd caught a case of hallucinations at Northwick Park.

Division Officer Norman Cook, one of some 50 instructors for the college's 3,000 students, explained to me: "The quality we particularly stress is leadership. Chaps coming here—from more than 50 countries—have never got a chance to handle a fire on their own. Once a good one gets going, along comes a bigwig and takes over. Here we set up a fire and let *them* take over."

But, as we walked among the fire buildings, not a one was ablaze. "Ordinarily we set five or six fires a day," Officer Cook gloated. "We ignite cotton bales and other materials inside the buildings; and the chaps charge out with sirens screaming, lights flashing. But right now the school is in recess."

Battling to Keep Stone on the Wolds

We came to the center section of a simulated ship of concrete, and Officer Cook invited me aboard. "Very dirty oil fires here," he said with satisfaction. "Funny we should be teaching the techniques of ship fires so far inland. We're 100 miles from the sea."

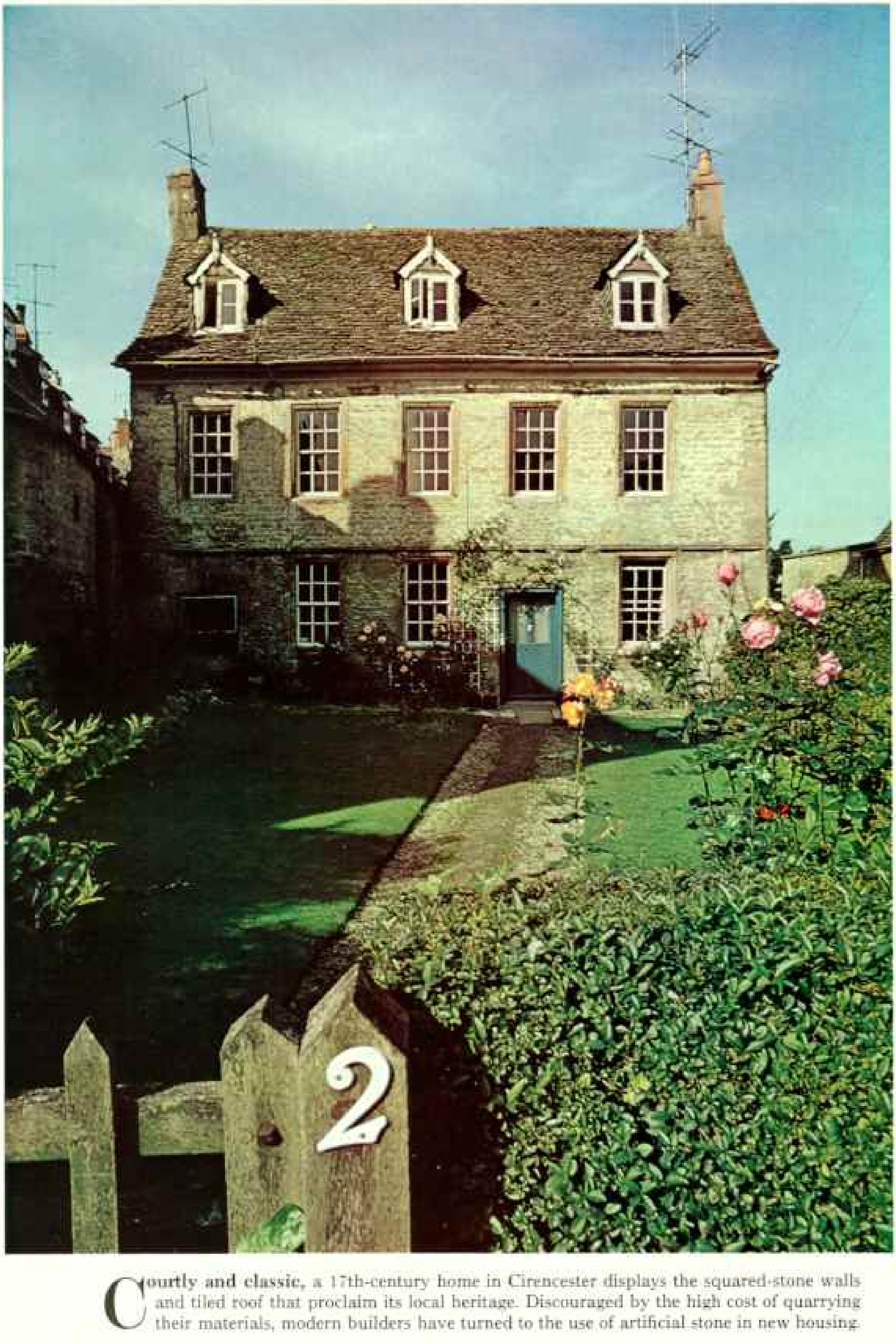
This clamorous college is something of a strain on local sensibilities, and nearby residents do not like all that utilitarian concrete poking up amid their quaint Cotswold stone. The battle of the stone continues, though the ammunition grows scarce.

Capt. John Barrow, a red-haired, cigar-smoking man of 30, told me, "I'm almost the last quarry owner who still runs a full-time operation for building stone. And here's why it's so expensive." He pointed to the quarrymen, high up on a face of his Farmington Stone Quarry. They were taking out the stone with crowbar and wedge, pickax and shovel. The captain (Eton, ex-Hussar) said, "You can't blast; the stone's too soft—see all the little shells and fossils—it just crumbles away."

Quarry manager Sam Morss joined us. "Laying the stone's expensive too," he said. "Each block must fit exact. Reason the mouldings don't match up on old buildings is those old masons were asked what they'd take for a day's work and they said two gallons of cider—in advance."

The stone, the dwindling stone, is crucial to Cotswold beauty. But—Cotswold paradox again—with the high price of stone, many Cotsallers can no longer afford to live in the Cotswolds. Even if they have an old cottage, they can't afford not to sell. Rich retirees and London and Birmingham tycoons have driven prices to dreamlike heights. Mrs. Laurie Lee, the realist of the family, told me, "Chap down the road bought a cottage ten years ago for 4,000 pounds; now it's on the market for 36,000."

When the British Government in 1966 declared the Cotswolds an Area of Outstanding Natural Beauty and issued an "official" area map, it excluded a number of traditional Cotswold districts. The excluded residents howled, for a location in the Cotswolds could add thousands of pounds to the value of a cottage. Pride was wounded, too. In a pub in industrial, excluded Stroud, a greasy-capped old chap told me: "Eighty-un Oi be, and thee won't tell Oi that Oi be eighty-un



Courtly and classic, a 17th-century home in Cirencester displays the squared-stone walls and tiled roof that proclaim its local heritage. Discouraged by the high cost of quarrying their materials, modern builders have turned to the use of artificial stone in new housing.

"She's loike a jigsaw puzzle," declares mason William Pulham (**above**), as he repairs a traditional dry wall of intricate pattern.

Patching past to present, Roy Agg nails lichen-covered tiles recovered from an old barn to the roof of a Burford shop.

year no Cotsaller. Maybe us be no beauties 'ere, like that mugglement [confused] map 'as it. But us be Cotsallers—may be *ugly* Cotsallers—well, jus' zo!"

The Cotswolds, you zee, are where Cotsallers are. Norman Collins, County Planning Officer of Gloucestershire, where most of the Cotswolds lie, thought the old boy had a point. "To set exact boundaries to the Cotswolds is like trying to say where your Appalachians or Adirondacks begin and end."

Within the bounds of the beauty area, however, building in Cotswold stone is all but mandatory, and Mr. Collins is concerned about prohibitive costs. He thinks the answer is better artificial stone. This is Cotswold stone dug as gravel, mixed with cement, and molded into blocks at relatively low cost. Some is awful, but the Bradstone made at South Cerney could pass for genuine stone.

I watched synthetic rubber poured over old stone slates and blocks to form molds. Into the molds went the Bradstone mix. The surfaces of the "reconstructed" stones reproduced the old-time Cotswold models—right down to the fossils.

The vast roof over the nave of Painswick church had recently been redone in Bradstone slates. Churchwarden Derek Hodges told me, "They're not porous like the old slates, so they should really last."

Devil of a Time With the 100th Yew

Mr. Hodges walked me round the churchyard to see the renowned old "99 Painswick yews," clipped into rounded lollipop shapes. Why 99? "Well, the story is that no matter how hard we try, the devil always poisons the hundredth."

I told Mr. Hodges I had been given a far more rational explanation, by Laurie Lee: "Slad is a daughter parish of Painswick, and we Slad people always had to pay our tithes to Painswick. We didn't like that—nor them. We knew they had a vainglory about that hundredth yew. So we lads would go over and stick rusty nails in it—always wrapping the nails in wet moss so they didn't clink. If their boys came over to Slad, we hit them on the head with cabbage stumps. From the frustration a lot of them went to Australia; some even went to America."

Mr. Hodges frustratedly knuckled his eyes. "Laurie Lee is a grand chap, but I think he takes a little license."

Painswick is one of the Cotswolds' "wool churches." At the peak of their wealth, in the

Peering over the heads of the crowd, Britain's Princess Anne (**below**) awaits results of the Cirencester Park Horse Trials. A rival contestant in the bone-twisting, 2½-mile cross-country event leans back in the stirrups as her horse plunges down the graded

15th century, the wool merchants embellished their little Saxon and Norman parish churches into cathedral-like showpieces. Perhaps it was their way of buying parole from purgatory, for they had heartlessly dispossessed many a poor farm family to make pasture for their sheep.

In the small village of Northleach there stands a massive church with a tower 100 feet high and a battlemented and pinnacled nave roof. So that no one will forget who paid for it, Northleach church also possesses six wool-merchant brasses, the greatest number to be found in any church in England.

A brass is a memorial portrait, exquisitely engraved. The rubbing of brasses—taking off the images with colored waxes onto special papers that can be framed—is a continuing fad, particularly rife among visiting Americans, who pay for the privilege. And so it has become a business (page 860).

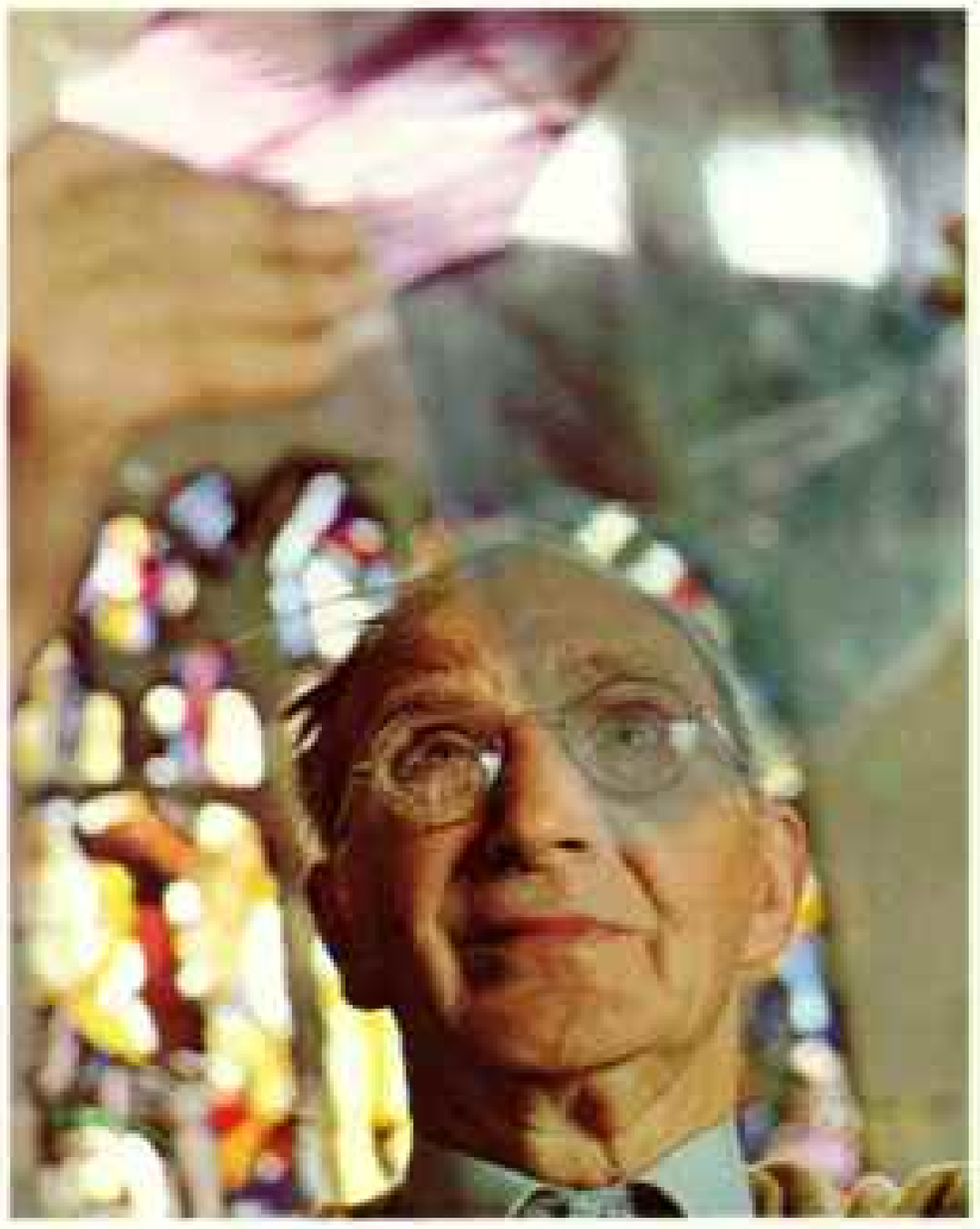
Long-dead Merchants Still Pay Their Way

"These brasses are a bargain," pretty Mrs. Mark Smith told me as she rubbed black wax into gold paper. "Chipping Campden charges up to three pounds per figure. Here it's a third." Those mercenary wool merchants, if they could know, would enjoy the fact that they are still making money.

At Cirencester church, rubbers rub facsimiles because the originals were being worn by visitors' shoes. Perhaps that is why, when a group of rubbers asked for a "student's discount," Vicar Canon Rowland E. Hill quickly granted it—"Fifty pence." In any case, silver is the more cherished metal at Cirencester:

side of a five-foot-high drop jump (**below**).

Princess Anne is not the first of royal blood to savor the Cotswold countryside. Elizabeth I stayed at Sudeley Castle, and James I and William III at Burford Priory; Charles II took his ease at the Bibury horse races.



Burning faith and bright imagination fired the medieval spirit. Brass plaques on wool merchants' tombs at Northleach entreat visitors to pray for their souls; modern tourists take wax rubbings of the images.

Alchemist of color, Edward Payne (**above**) restores the subtle poetry of stained glass. In a 15th-century window at Fairford (**right**), Satan —his head a gaping fish, his belly a growling face—swallows the damned.

the finest parish-church silver plate in the British Isles, including a silver-gilt drinking cup of Anne Boleyn's.

At Fairford church the treasure is stained glass—an explosion of color on every side. No other parish church in Great Britain has retained its complete set of medieval glass. Fairford wardens hid it not only from Cromwell, who smashed priceless windows all over England as Papist idolatry, but also from the bombs of World War II.

In what looks like a vote of confidence, the Fairford wardens are not hiding the glass from possible damage by the supersonic Concorde being built and tested about a mile away. The world's airlines are watching this Anglo-French enterprise cautiously, reluctant to order so controversial a vehicle. But the Cotsallers of Fairford welcome the future to their ancient backyard, and there was rejoicing in the town when, last September, a preproduction Concorde model built in France flew Washington to Paris in 3 hours and 33 minutes, halving the Atlantic's width.

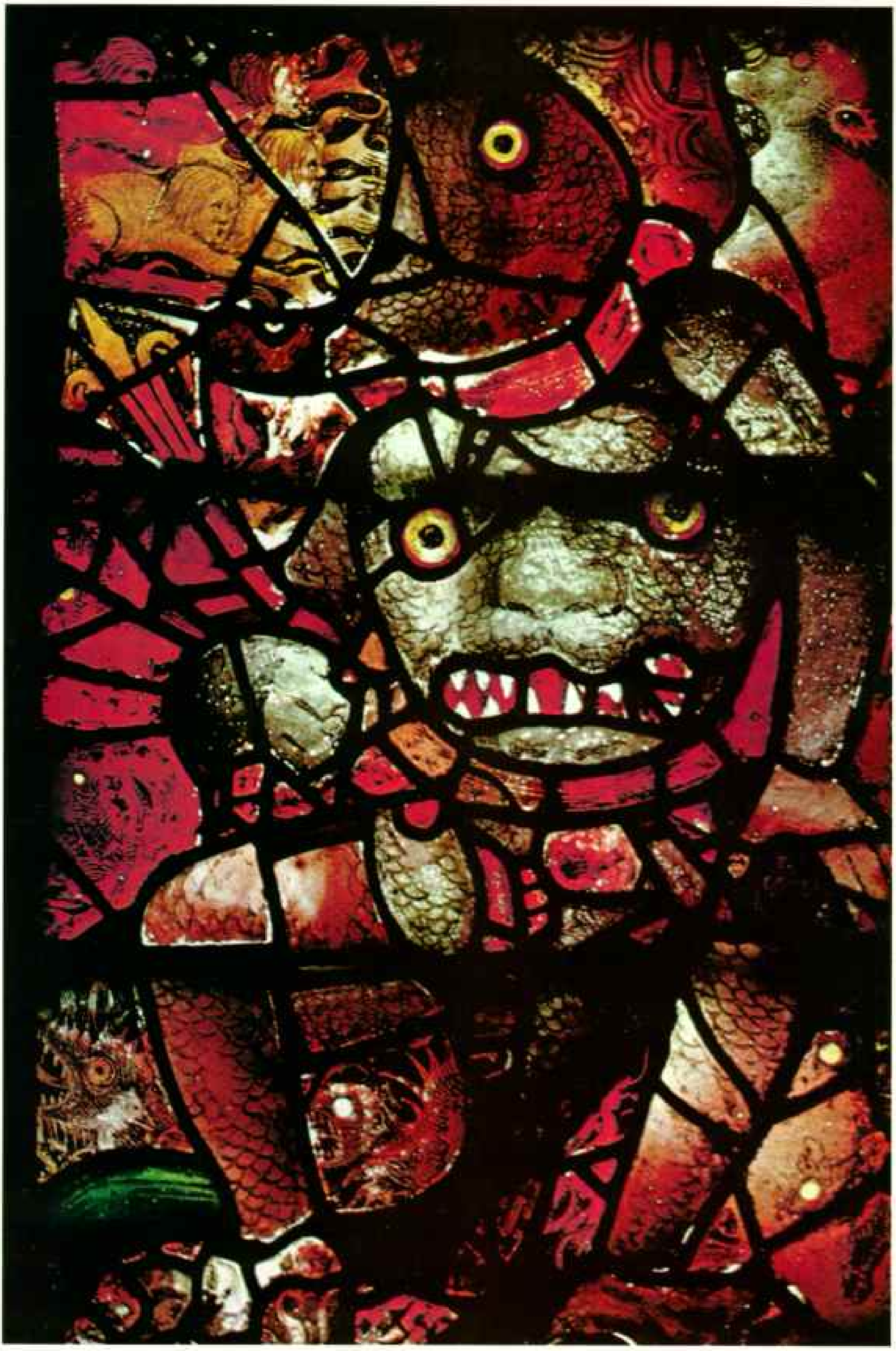
Fairford's neighbors in the south Cotswolds are also eager to join in the technology of the modern world. In the Stroud valleys many tall old stone cloth mills, mellowed into beauty, work on—housing light industries, from small pianos to hairpins.

A few mills even produce cloth. In Stroud, Lodgemore Mills occupies a site athwart the River Frome, where cloth has been made since the 13th century. With modern power and machinery, it continues the Cotswold tradition of producing only the finest cloth. Cotswold mills made scarlet for the old British Army; today Lodgemore Mills produces Scarlet No. 3 for the uniforms of the Guards, and a deep blue for officers of the Navy. "Prince Philip was married in our cloth," Ian Bearpark, one of the managers, told me.

Young Cotsallers Seek Work Elsewhere

Such light industries helped keep the Cotswolds' unemployment rate down to a mere 1.5 percent in 1973, but the big factors in that record are negative. Because of the high cost of housing, decline of quarrying, and the loss of farm jobs to mechanization, more employable people, mostly the young, are leaving the Cotswolds than are coming in.

The rich retirees and magnate commuters, many well past youth, who displace young Cotsallers, are giving the Cotswolds the aura of an elegant old folks' home. Though their



presence attenuates the vital old-time Cotswold spirit, they fight hard to preserve old-time appearances.

And so Chipping Campden, archetype of Cotswold beauty, a perfect medieval wool town, preserved as if in amber, owes its architectural survival to sophisticated settlers who fought, wisely, against change. When electricity came to the town in 1928, the High Street, which historian G. M. Trevelyan called England's "most beautiful village street," could have been ruined by a cat's cradle of wires and poles. The well-to-do outsiders living in Campden rallied, and the wires went underground.

They also bought the 17th-century Market Hall when it was in danger of being dismantled and sent to America—thus saving it from the fate of 500 tons of other Cotswold structures that Henry Ford had shipped to his Greenfield Village museum. They even bought a large hill nearby and gave it to the National Trust to keep a hotel off it.

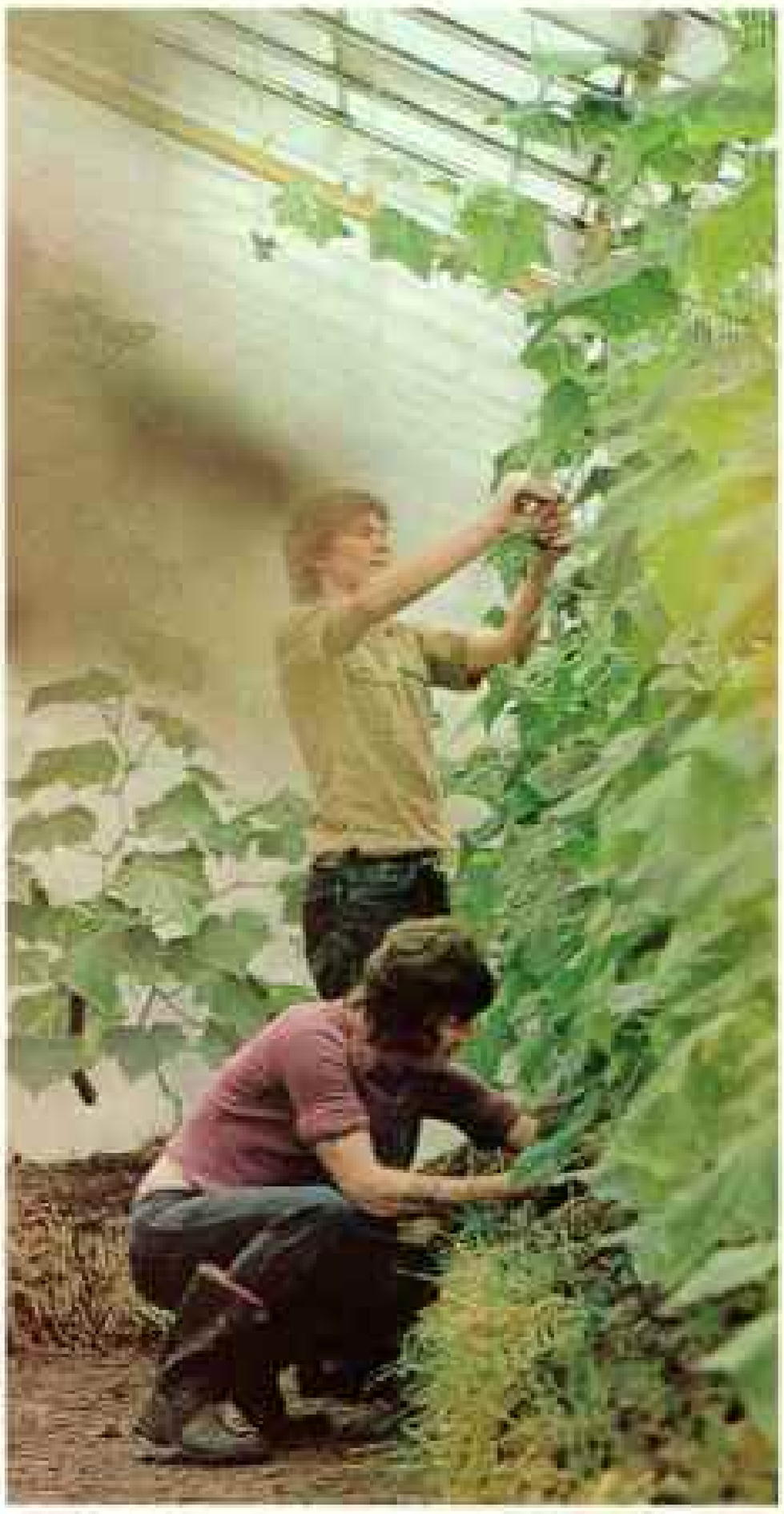
Shin-kicking Revived for Fun

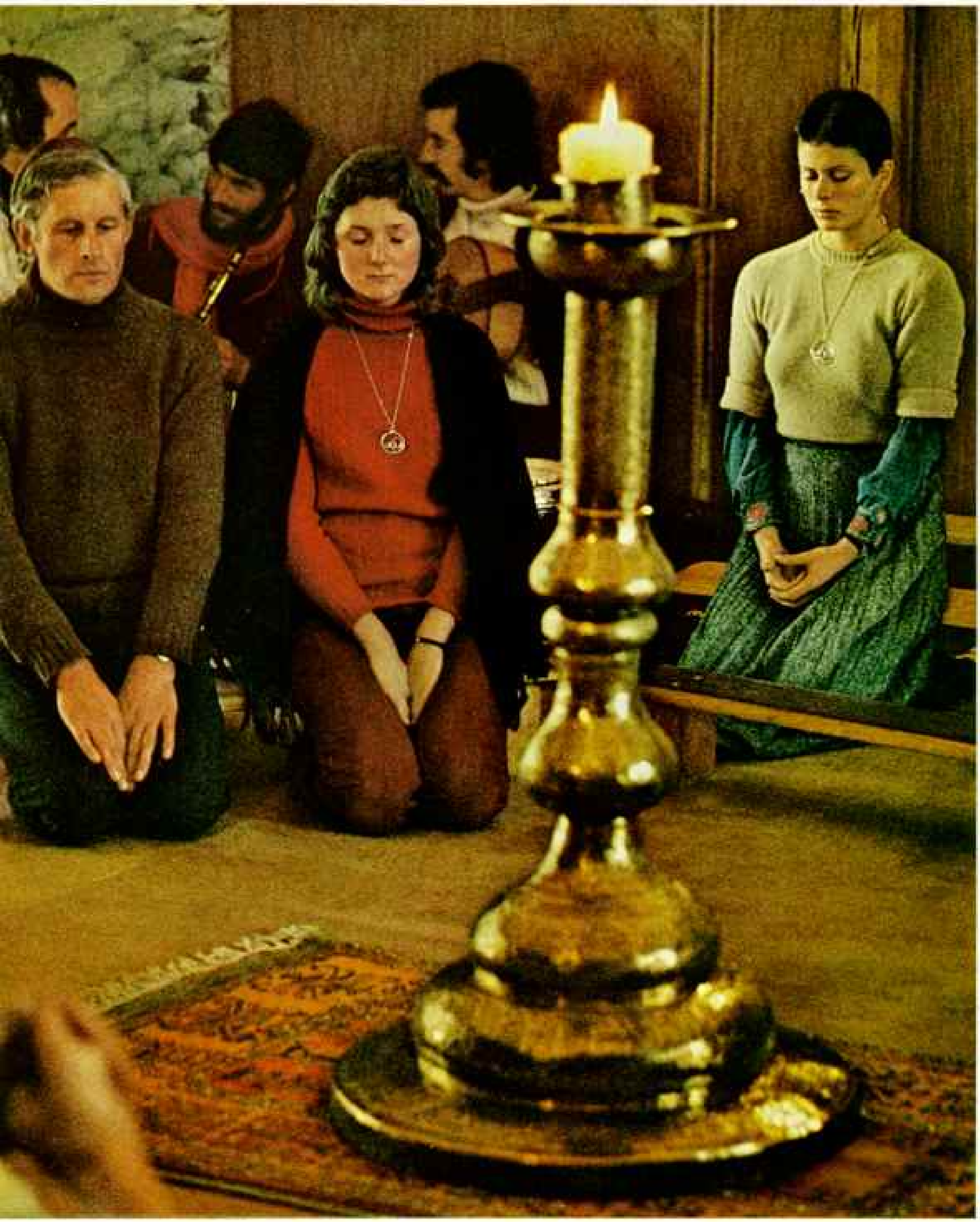
Because of their concern, historic Dover's Hill, site of the Cotswold "Olympicks" from 1612 to 1852, again plays host to such peculiar local sports as shin-kicking, for which contestants once trained by "thraping" their shins with a hammer or plank. In action, opponents placed hands on each other's shoulders and whaled away with heavy boots till one collapsed. Today blood still flows down kickers' shins, but it is only a dye.

Cotsallers fancy a bit of facsimile gore, as witness "Sapperton Battle," actually a reenactment of a battle at nearby Cirencester (today pronounced "Sirensester," though not long ago contracted to "Sisiter"). The Cotswolds were often a battlefield in the Civil War between Cavaliers, led by Charles I, and Roundheads, led by Oliver Cromwell, the Puritan-Parliamentarian who won the war but whose army lost this battle.

It began, in reenactment, half an hour late because, as an usher explained, "Them 'ave to get droonk first; else them can't stand all the knocks 'n bruises." The battle progressed, in costume, amid smoke, fire, falling horses, and knocks and bruises due to overenthusiastic amateur actors (pages 864-5).

I spoke to a Cavalier afterward, while he was having a pint. "You have to drink before the battle to *steel* yourself and after to *calm* yourself." Then he explained that he and all the other actors actually paid—club dues and





The Cotswolds play host to more than casual tourists and wealthy gentry. At Northwick Park, a center for the treatment of drug addicts that mixes hard work and religious awakening in its therapy, two young men tend the greenhouse (**left, upper**). Smiling from the doorway of a stall, Arthur Clarke (**lower**) helps to renovate the stables as part of his cure.

"Come, come, whoever you are . . . ours is not a caravan of despair," reads the creed of Beshara (**above**), a spiritual community near Aldsworth where members meditate in an old farm building on the site of an early monastery.

Clash of pike and staff marks a re-creation of the 1643 siege of Cirencester (**right**). Armed and suited at their own expense, buffs of the English Civil War gather each summer to reenact the struggles of pro-Parliament Roundheads and royalist Cavaliers.

Unlike the 17th-century armies of King and Commonwealth, the modern warriors can call it a day when the going gets rough. One of the "wounded," a grinning soldier is escorted from the field (**below**).

the cost of their costumes—to take part in this mayhem. They were members of Civil War buff societies, and he himself had come 200 miles to participate.

Cirencester, for which this battle was fought, was the "Capital of the Cotswolds" long before Charles I's days. In Roman times —A.D. 43 to about 400—it was Corinium Dobunnorum, the second largest Roman town in Britain, after Londinium. Cirencester is charming today but hardly Roman, unless one counts its Roman Forum Car Park.

The Romans have left more evocative relics nearby. At Chedworth, in a secluded, wooded combe, a Roman villa of 30 rooms has been excavated. And the churchyard at Woodchester has a splendid remnant of a 60-room villa: the largest Roman pavement in Britain, a mosaic floor almost 50 feet square. It has been exposed to public view only seven times since the 18th century, and, shortly after I saw it, it was covered with waterproof paper and sand to preserve it till the next exposure (pages 866-7).

Belated Tribute to Queen Anne

The great landlords who lived at Woodchester and Chedworth villas commuted to Corinium on die-straight Roman roads. The Cotswolds are gridded with them; several are still main highways, like the stretch of the Fosse Way that runs north from Cirencester.

In Roman days all Cotswold roads led to Cirencester—just as they do today. And on

summer Sundays they are crowded with traffic going to the polo and other attractions of Cirencester Park, seat of the Earl Bathurst. His Cirencester Park Estate owns 15,000 acres—9,500 rented to farmers. But much of the rest is open to the public.

For such a great landlord, the Earl Bathurst, a youthful 47, is a breezy and informal person. As we sipped tea on his terrace, we looked down "Queen Anne's View," a long, wide, grassy avenue between bordering woods, known as a "ride." Cirencester Park Estate has more than 60 miles of rides within 3,000 acres of woods.

"It's all man-made," the earl said. "When the first lord—later earl—Bathurst started to lay it out in 1715, it was open downs. Got so absorbed, he forgot to show his gratitude to Queen Anne for making him a lord; didn't put *that* up till 20 years after her death." He pointed to a distant statue of the queen on a column. "He just didn't give a damn. He lived to 90 and still drank a bottle of port a day."

In the earl's Land-Rover we went to the polo field, where Princes Philip and Charles sometimes play and Princess Anne competes in horse trials (pages 858-9). Then we rocketed through England's finest beech woods, with trees a hundred feet tall, to the rustic Tunnel House Inn, one of three pubs the earl owns. While sipping West Country ale, "the wine of the west," the earl briefed me on the historic ground whereon we drank.

The inn was erected about 1780 to serve

Drawing a veil across the past, volunteers shield a fourth-century Roman mosaic at Woodchester with waterproof paper (**left**) and sand (**above**), protecting it from the elements. The mosaic is exhibited only at rare intervals.

the Irish navvies who built the nearby Sapperton Tunnel, also the property of the earl though not used today. The tunnel, 2.2 miles, longest of its time, was the essential link in the Thames and Severn Canal, but since it was only 15 feet wide and high, donkeys could not pull the boats through it. "Leggers," lying on their backs, propelled the boats by pushing with their feet against walls and ceiling. They developed a painful occupational disease, "lighterman's bottom," and so had even more need than navvies for the solace of the Tunnel House Inn.

The earl and I barreled on through his 2,500-acre farm—barley, wheat, hay, 200 milk cows—everything mechanized. "We keep away from oldy-worldy farming," the earl said decisively.

At Foxholes, down the road from Idbury Manor, my headquarters for the north Cotswolds, Miss Winifred Bailey deplored the consequences of mechanization. At 77 she still farms 30 acres. "Most of this change is for the worse," she said. "More efficiency—but things like burning the straw will ruin the land." Modern combines leave behind more straw than can be baled for fodder; so farmers burn it in the fields.

"The cruelty is appalling," Miss Bailey continued. "Everything is burned alive: frogs, moles, hedgehogs, birds, the earthworms that are crucial to cultivation. Ruining the balance of nature!"

Cotswold farming today is mainly grain, dairy herds, and sheep grown for meat. Wool growing is all but finished, and so the herds of Cotswold Lions are seen no more on the wolds. About 200 survive, two dozen of them at Cotswold Farm Park, a "rare-breeds survival center," open to the public. Brought by the Romans to clothe their legions, the Cotswold Lions are Britain's largest sheep, with heavy crimped fleeces. The park coddles 20 other rare breeds of British farm animals, but the most pampered Cotswold animals are just down the hill at Guiting Stud.

There John Jennings, a retired London papermaker, breeds Thoroughbred horses. His empathy is so delicate that he has left openings between the stalls, "so they can talk to one another. Musn't be lonely. Makes them discontented."

The Cotswolds are a stamping ground of the horsey set, with five hunts dividing its attractions. The riders win cups, but blacksmiths, too, are garlanded. James Rathbone, age 78, a smith in Kingham, told me he had won "the 'ole lot o' shoein' competitions," including Championship of Great Britain in 1939. He had gone on to forge the gates to the Queen's Royal Enclosure at Ascot, and on the wall of his modest cottage I read a document, signed Elizabeth R, which appointed him a Member of the Order of the British Empire "for services to the smithcraft of Oxfordshire."

Coaching Routes Lost to Railways

The Cotswolds' most colorful involvement with horses came in the last quarter of the 18th century. Towns like Burford, Stow on the Wold, and Northleach were junctions of main coaching routes linking the West Country with Oxford and London. Around the clock, the coaches galloped down the towns' high streets, with long brass horns blowing warnings to pedestrians.

In 1830, thirty mail coaches thundered into Burford daily. By 1870 its streets were quiet. The railways had come, the coaches gone. But the coaching era left the Cotswolds a

Rooted in the centuries, an overflowing rose garden sets its blooms against the medieval stone of a Chipping Campden cottage (**below**). Beset by tourists and waves of moneyed city people driving up the price of land, the Cotswolds still lay claim to a serenity they have enjoyed through many generations. In Broadway, early-morning sunlight filters down the valley and gilds the quiet guesthouses (**right**).

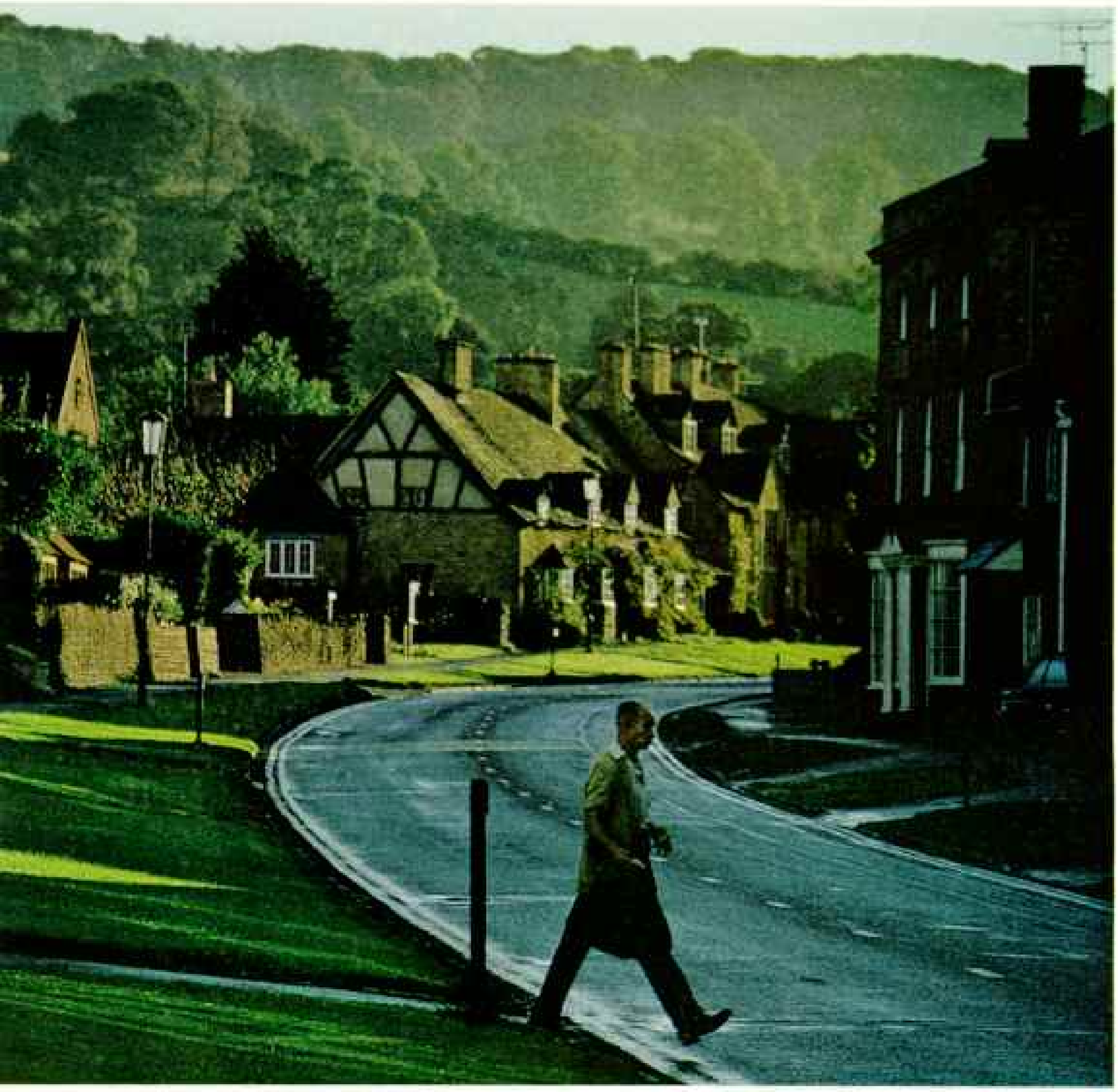
delightful legacy—the most flavorful inns of England. Coach passengers raved about "Burford bait," the gargantuan meals the inns served there. The Bull, the Lamb, the Bay Tree still feed Burford visitors well, but mercifully not gargantuanly.

I also found fine food at the King's Head in Cirencester and the George in Winchcombe. But the best food in all the Cotswolds was at Mr. Baillie's in Stroud, not a coaching inn, but a stately early-Victorian home.

Today a new coaching era has burst on the Cotswolds. "Coaches Only," say parking signs in Stow on the Wold. All through the summer, buses disgorge day trippers; sightseers' cars choke the narrow streets. Their very presence destroys the fragile beauty they have come to enjoy. William Morris, a century ago, called Bibury the most beautiful village in England. It still may be, but I couldn't see it over the car tops. Lovely Bourton on the Water has been "tarted up" for tourists with a birdland, model railway, aquarium. In the rivulet that flows through tiny Lower Slaughter, I saw one woman sitting on a camp chair in midstream bathing her feet while sipping her tea.

Back to the Cotswolds From Pennsylvania

Such is the fate of some of the most beautiful villages in the heart of the Cotswolds. In the far southern reaches of the beauty area I found little tourism—but then I found little that resembles the traditional Cotswolds. It is, however, a region intriguing to Americans. Only a few miles beyond the beauty bounds,



at the Old Bell Hotel in Malmesbury, the proprietor told me that his barman, Jack Hanks, "looks so much like Abraham Lincoln he gives Americans a start." Abe probably got his gaunt ascetic looks from his mother Nancy Hanks, whose ancestors are thought to have lived near Malmesbury.

The noted historian, the Reverend Dr. Leonard Cowie, who accompanied me on this sortie, remarked: "Good thing Abe's mother was a Hanks and not his father. Be hard on American orators if they had to say, 'Our two greatest Presidents, George Washington and Abraham Hanks!' "

George Washington also had ties to this region, as Leonard showed me in nearby Garsdon church, where we found the tomb of Sir Lawrence Washington, a cousin of George's great-great-great grandfather. And that was not the end of Americana: At Minety, a few miles north, lie the ancestors of William Penn, founder of Pennsylvania.

I drove back into the beauty area and proceeded south. Suddenly a huge sign proclaimed: PENNSYLVANIA. It was only a crossroads with a pub, but the landscape of mildly rolling hills could have fitted like a jigsaw piece into the Main Line countryside outside Philadelphia. I knew then in my marrow that I had reached the end of the Cotswolds. Not only did the great wolds end here, but, with all these American reminders around me, the New World was thrusting in. I turned the car around and headed back into the deep Cotswolds, where the old Old World stubbornly persists. □

Four new books for 1974-75

Our Nation Remembers Its Past

At home on the ranch, young Timmy Flitner hefts 12 pounds of responsibility. Equally helpful, an Old Order Amish girl fills kerosene lamps to brighten her family's simple house. The nation's tradition-flavored hinterlands unroll before you in *Life in Rural America*, available now as the first of four new Special Publications for 1974-75.

NATIONAL GEOGRAPHIC PHOTOGRAPHER ROBERT W. MADDEN (CONTINUED)

IN A WORLD beset by hostilities and violence, nations sometimes turn with nostalgia to the things that give them their special character: their earliest origins and their own traditional life-styles. The United States is no exception. Despite her deep and enduring concern with matters important to all mankind, she looks with increasing affection down the corridors of her history. And she finds comfort in the survival, beyond the urban sprawl, of cherished folkways and strong, simple beliefs.

Exploration and adventure also serve the cause of serenity, providing as healthy a respite from the problems of the present as does the fond pursuit of the past. We Americans are coming in great and growing numbers to an appreciation of our natural heritage, visiting and valuing as never before our rich legacy of unspoiled wilderness. And beyond the once-wild shores of our nation we join adventurers of other lands in a world equally alien to us all, and equally enthralling: the mysterious and wonderful world beneath the sea.

Continuing a spectacularly successful program that has already distributed nearly ten million books to Society members, four new National Geographic Special Publications, superbly illustrated and as topical as tomorrow, focus on these areas of burgeoning American—and international—interest. The first, *Life in Rural America*, is available now. The remaining three of these handsome, inexpensive volumes will appear at three-month intervals. They are *Undersea Treasures*, tales of treasure hunting and diving adventure in our own and distant seas; *America's Beginnings*, an account of the colonization of North America; and *The Pacific Crest Trail*, a breathtaking backpack journey through California, Oregon, and Washington.

Life in Rural America takes you north, south, east, and west to look into the lives and thoughts of people who live close to our marvelously varied land. Old patterns are traced, new changes discussed. You will visit countryfolk at work, and country towns at play: A truck farmer in Arkansas, ranchers in Wyoming, a dairy farmer in Wisconsin, Fourth of July in Cascade, Idaho, a county fair in Pecatonica, Illinois, a frog jumping contest at Angels Camp, California—inspired by Mark Twain's "The Celebrated Jumping Frog of Calaveras County." You'll sample country life both sacred and secular: A

A fortune from 12 fathoms: Scuba diver Alex Storm holds a handful of coins from an 18th-century French payroll ship discovered off the coast of Nova Scotia. Such wet-suited underwater explorers dive for science, for riches, and just for fun in *Undersea Treasures*, second of the series. History rises from the deep with ancient tools and copper ingots from a Bronze Age ship, cannon from a Dutch trading vessel, and New World gold from the Spanish treasure fleets.

BOB BRIDGES PHOTO

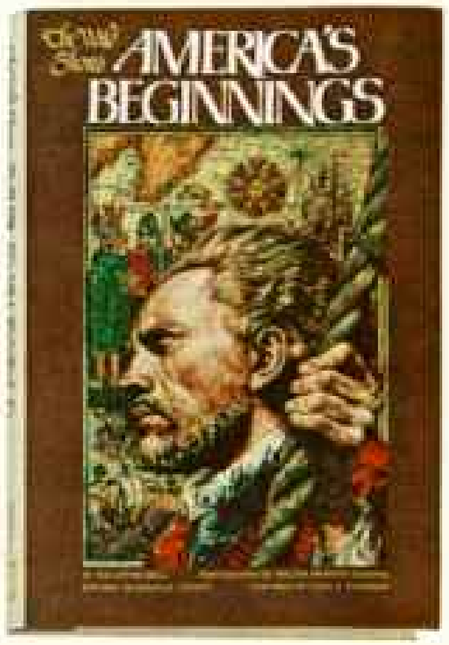
Roman Catholic mission in New Mexico, a Baptist church in the Ozarks, a grange in Maine, a three-child school in Montana.

And you'll learn what it is that draws more and more Americans to the rural life and keeps a good many of those born to it home on the farm. Ray S. Brooks, after more than 80 years in rural South Dakota, calls it a place where "I can stretch my arms without hitting someone else in the face." Billi Kaho fled bustling California for small-town life in Alaska because "Here in Seldovia I feel needed. I can leave a footprint. We all want that, don't we?"

In rural America you'll find peace and contentment, deep-rooted traditional values, neighborliness and kindness coexisting with tough-minded independence and a strong sense of an individual's worth.

What underlies the several strong and distinctive patterns woven into the fabric of American country life? You'll find some of the answers in *America's Beginnings*, a book that will take you back to the early settlements

Resplendent defenders of their homeland, Tlingit warriors in cloaks and masks make war at Sitka in the Alaska Panhandle. Russian hunters seeking furs opened Alaska to colonization in the late 1700's just as John Bradford, Pedro Menéndez, and Father Junipero Serra first settled the wild shores of New England, Florida, and California. The sagas of these men and those who followed are told in the third Special Publication, *America's Beginnings*.



JOHN S. SLAUGHTER

along the edges of an unwelcoming continent. You'll see what hardships the settlers had to bear, how much they had to learn in order to survive in Plymouth and Jamestown, St. Augustine and San Diego.

From the earliest—and often unsuccessful—colonization attempts to those of the early 19th century, *America's Beginnings* will lead you through the past on which our present rests.

The physical stage for our national drama is epitomized in the pages of *The Pacific Crest Trail*, whose author will guide you from our Mexican to our Canadian boundaries, through some of America's most beautiful wilderness landscapes. You'll sample the Mojave Desert, traverse the Sierra Nevada and the Cascade Range, delight in the beauties of Yosemite and Crater Lake. You'll join hikers and prospectors, and hear tales as tall as the mountains that molded them. Wild flowers will brighten your journey; whispering winds of lonely vistas will haunt it. And you'll soothe your soul in a solitude in

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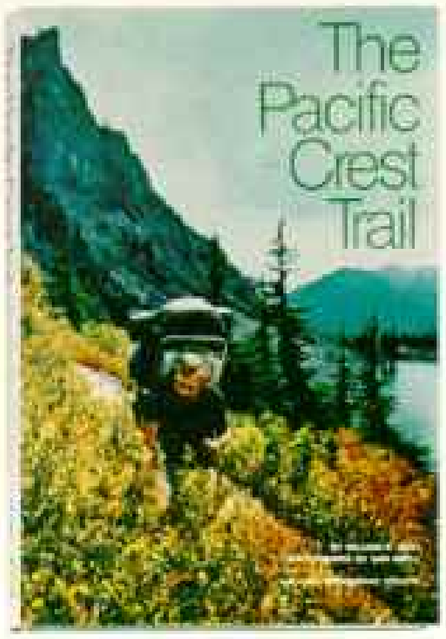
Mountains to climb, valleys to cross. *The Pacific Crest Trail*, fourth of the new series, follows a 2,400-mile wilderness footpath from Mexico to Canada. Hikers (**below**) tent for the night beneath the snow-spotted summit of California's Mount Ritter. Backpackers follow trails blazed by early explorers and wind through lands of Indian legends, sharing the wild grandeur with mountain goats, marmots, pikas, and deer.



DAVID HISER

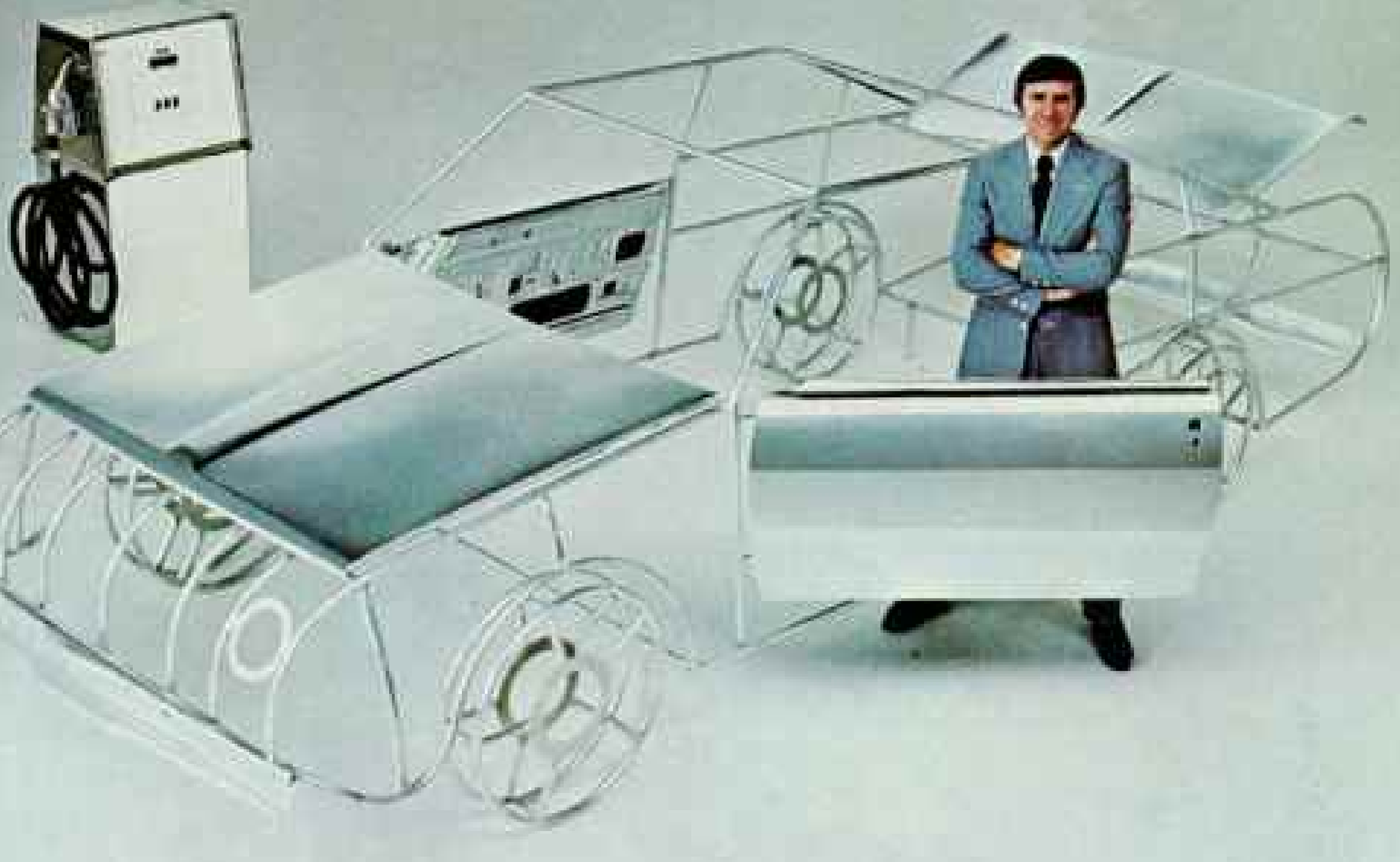
which man is not a tenant but a transient.

Beyond our shores, oceans stretch away to encompass far more of earth's surface than do its tamed lands and wild country together. *Undersea Treasures* will transport you to this water wilderness where adventurers still seek the treasures of the ages. Gold and priceless artifacts may be the goal of some, and riches their reward. But the search for knowledge draws others into the difficult and often dangerous realm in which man is neither tenant nor transient, but simply an intruder. Robert Sténuit, a sensitive and scholarly undersea explorer, tells you what brings a man of his nature to the satisfying agony of icy waters and wild seas.

Mendel Peterson, renowned naval historian, tells of treasure seekers whose success is legendary: Teddy Tucker, Art McKee, Kip Wagner.

Books such as these in the latest series have brought thousands of congratulatory letters to our Special Publications Division since its inception nine years ago. "These are the best books on the market today," writes a member from Indianapolis, "easily understood, with incomparable photography."

If you would like to reserve these four most recent books in the Society's continuing educational series, you may do so without obligation by filling out and mailing the postpaid coupon at left. □



Soon, your car will be a lot lighter. On the road, and on your wallet.

American cars must become smaller and lighter and less expensive to operate. Part of their diet to lose weight will be strong, lightweight aluminum alloys.

Four aluminum parts alone could save 345 pounds. This lighter car would burn less gas. We would also save on brake wear, tire costs and even registration in some states.

Let's take a 3,600-pound automobile and put it on an aluminum diet. We'll change the hood, trunk, doors and bumper reinforcements from steel to aluminum. In steel they weigh 380 pounds. In aluminum, only 150 pounds. That saves us 230 pounds.

There's more. We could save an additional 115 pounds through lighter supporting components that wouldn't have to support so much weight in the first place. That brings our total weight savings to 345 pounds. And

pares the car down to a lightweight 3,255 pounds. If the car had four doors, aluminum could save an additional 105 pounds.

Even after the car has served us and gone on to scrap, we could use it. Aluminum brings about $200 a ton as scrap, so it's worth recycling. And when more of it goes into our cars, they become more valuable as scrap. An additional incentive to recycle used-up automobiles.

If you'd like a more in-depth look at how aluminum in automobiles helps in the conservation of energy, please write for our brochure, *Energy, Aluminum and the Automobile*. We're Aluminum Company of America, 343-F Alcoa Building, Pittsburgh, Pa. 15219.

The reasons for using aluminum are found in aluminum itself.

ALCOA

Whatever you drive, Firestone steel radials can help you save gas.

If you've seen our television commercials, you know the story.

When we matched our 40,000 mile Steel Radial 500™ against our own original equipment belted bias tire, the Steel Radial 500 proved* it could deliver up to 30 extra miles of highway driving from a tankful of gas.

When we matched our Transteel Radial* truck tire against our own bias ply truck tire (on a huge truck like the one above) the Transteel Radial proved* it could reduce the amount of fuel needed up to 6% at highway speeds.

When you decide to put our Steel Radial 500 on your car, you'll not only put extra miles into every tankful of gas you buy, you'll put on a tire that gives you a smooth ride, quick positive handling, steel belted strength, and up to four years of average driving.

So whatever you drive, if you're worried about getting more miles per gallon, Firestone has the steel radial tires that can give them to you.

*Test results available at most Firestone Dealers and Stores.

Firestone

Steel Radial 500 · The Gas Saver

Wide watery world of the smallest service

FROM RESCUE through roaring surf to iceberg patrol and lonely lightkeeping, senior editor William S. Ellis has seen the United States Coast Guard carrying out its unending round of routine heroics. His report on the nation's smallest military arm will appear in next month's GEOGRAPHIC.

The Coast Guard spreads tough ships and tougher men far over the oceans, and far inland on U. S. rivers and lakes. A levee bursts on California's San Joaquin River, and guardsmen search for survivors (**below**). A swaying cable lifts men and supplies (**right**) to the rocky heights of Farallon Island Light Station, guarding the sea approaches to the Golden Gate.

Let your friends share such adventures. Nominate them below for membership.

RICHARD STACKS (ABOVE) AND MICHAEL HAYMAN

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

$7.50 CALENDAR YEAR 1974 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 outside the U.S.A. and its outlying areas, 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 1974 instead of the January 1974 issue may upon request become members and receive the magazine for 18 months from July 1, 1974, through December 1975. 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, $12.93 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).

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It can reveal the world to you as you have never seen it before.

The SX-70 camera closed, 1" x 4" x 7". Suggested list price $180.

Watch it happen.

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The image area is 3⅛ x 3⅛ inches.

The new

Exxon is developing energy technology for this century and beyond.

Across our country Americans are coming to terms with the energy shortage. Faced with lines at service stations and limited supplies of heating oil, we have all become aware of the need for conservation.

Yet, even with conservation, by the year 2000 our country will probably require three times as much energy as it does today. Fossil fuels will continue to supply an important part of that energy. But a good deal of America's future supply in this century and beyond will have to come from new technology.

Exxon is already working on this technology to develop several new sources of energy.

Energy right from the sun.

One of those sources is the ultimate source of almost all of our energy—the sun itself.

The sun's energy is enormous and widely available. It can be collected and converted to electricity by *solar cells*, like those that produced electrical power for Skylab.

This five-cell solar module absorbs sun rays, producing 1½ watts of electricity.

Solar energy in use today.

Today, as Exxon examines ways to improve its solar-cell technology, solar-cell units are already in use. In parts of Africa solar cells power instructional television. On boats, they maintain the charge in batteries. On marker buoys they supply electricity for warning lights and foghorns.

One of Exxon's research aims is to cut the present high cost of solar-cell electricity.

Super-batteries to store energy.

To efficiently use the energy generated by solar cells and other devices, we'll need super-batteries with much greater storage capacity. Batteries to store the sun's energy for use as electricity at night. Batteries to store energy that power plants produce in low-demand periods for later use when the demand for electricity is high.

Better batteries would also speed the development of electric vehicles. Exxon's target is a battery that would be light enough, reasonable enough in cost and charging demands, and powerful enough to drive a car 100 miles on a single charge from a wall outlet. This kind of battery, which still requires intensive research, could make possible a practical electric passenger car.

Electricity from chemicals.

We're also developing a *fuel cell*. Different from the solar cell, which uses the sun, a fuel cell generates electricity when certain simple gases, like hydrogen and oxygen, or a simple liquid fuel like methanol, are fed continuously into the cell.

Potentially, fuel cells are efficient sources of electricity. They could provide silent energy for mobile homes or remote vacation homes. They also might be designed as total energy systems for shopping centers or as a way for public utilities to supply additional power during high-demand periods.

Solar cells, fuel cells and improved batteries should come into greater use during the 1980's. Meanwhile, Exxon is looking for energy sources for the next century. Nuclear fusion is one possibility.

Improved lead-acid batteries make electric-powered vans practical for urban delivery. The next step—practical battery-powered cars.

energy.

Developing ways to convert the sun's light and heat into usable, storable energy may make solar power a practical supplement to oil, natural gas and coal in this century.

Fusion reactors - a new kind of nuclear power.

Today's nuclear power plants operate on the familiar principle of nuclear fission, a process of splitting atoms apart. Nuclear *fusion* is just the opposite. Atoms are fused together to release a remarkable amount of energy.

Fusion is the main process feeding the fires of the sun and stars. Today, at the University of Rochester, Exxon and others are participating in a laser fusion feasibility project. It seeks to use the energy of high-powered lasers to heat frozen hydrogen pellets to sunlike temperatures of hundreds of millions of degrees in less than a hundred-billionth of a second—and thereby produce a fusion reaction.

Harnessing fusion energy is one of the greatest challenges scientists have ever undertaken. However, even if our efforts or those of others are successful, commercial use of fusion reactions to produce energy is many decades away.

At the University of Rochester, Exxon is participating in a nuclear fusion project. We are attempting to simulate the action of the sun by focusing powerful laser beams on a tiny piece of matter inside this metal chamber.

We can't begin too soon.

These new energy technologies may seem far away. But if our present energy situation holds any lesson, it is that we can't begin too soon to find energy supplements to oil, natural gas and coal. That's why Exxon is already at work on the new energy technology America will need in the next century.

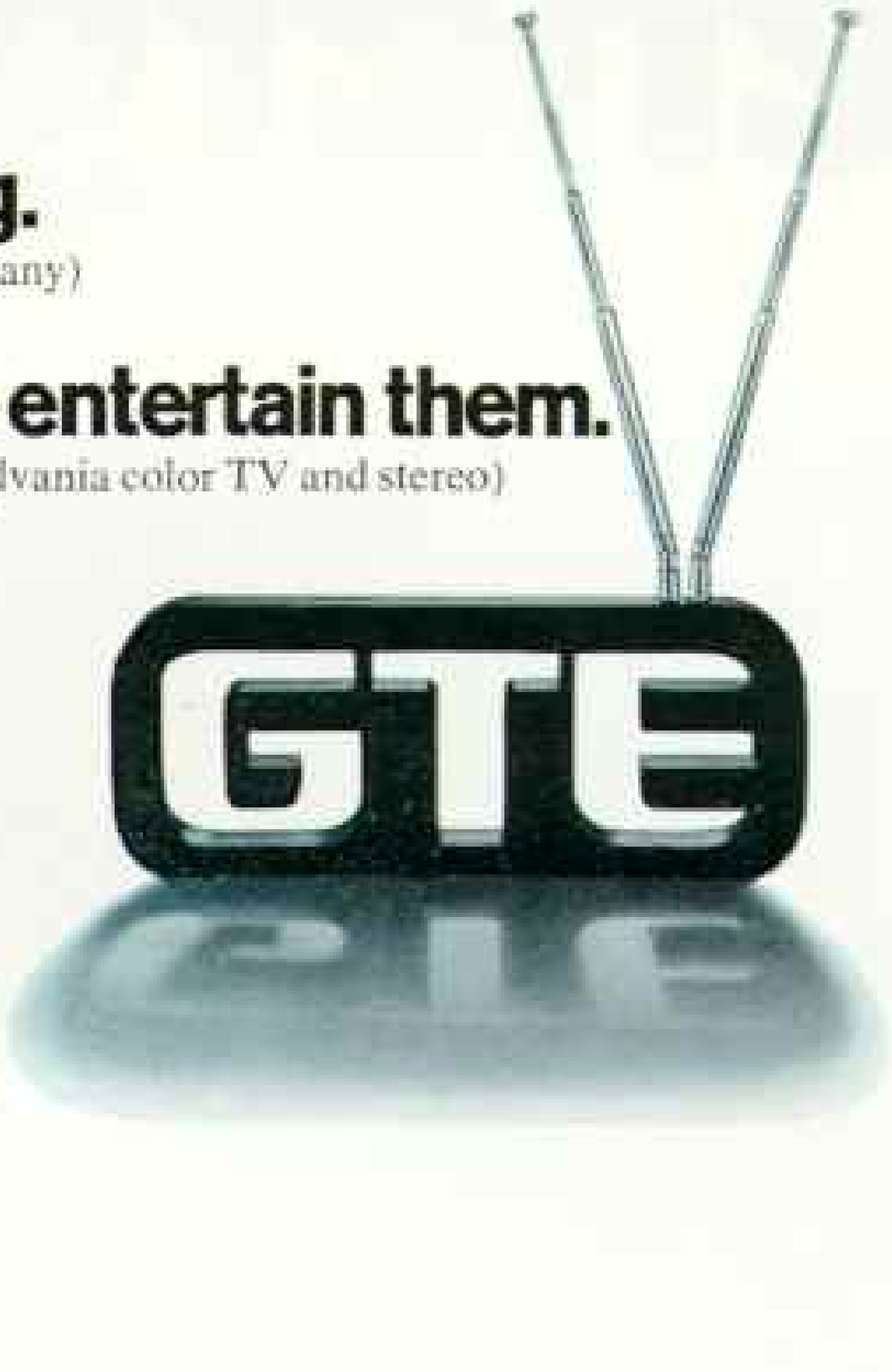
EXXON

We get people talking.

(To 23,000,000 people we're the telephone company)

We entertain them.

(Sylvania color TV and stereo)



We brighten their lives a bit.

(Sylvania lighting for home, industry and photography)

We're GTE.....

(a growing concern for your growing needs)

How to hold your own in any discussion of motor oil.

One way to hold your own with a service station attendant when he asks you what type and grade of oil you use, is to know the answers.

The answers are basically two in number—the first covers the A.P.I. "service" rating or type; the second covers the SAE Grade (weight).

The "service" rating, developed by the American Petroleum Institute, is an indication of two things: 1) the type of service under which the oil is to be used, and 2) the fact that the oil has passed certain performance tests imposed upon it by the automotive and petroleum industries. There are five service ratings.

At the bottom of the list is the SA oil, a straight mineral oil. Then there is the SB oil, which came into being in the 1930's. Neither is desirable for cars built after 1963. Next come the SC and SD oils—detergent oils specifically designed for 1964-67 cars (SC) and 1968-71 cars (SD).

Finally, there is SE motor oil—the finest oil currently available, and required to protect the warranty for most cars from 1972 on. It offers the best protection against corrosion, wear, and engine deposits under the most severe conditions. (SE oil is also suitable for all older cars.)

The viscosity numbers refer to the thickness of the motor oil. The thicker the oil, the higher the SAE grade number. For example: 5W, 10W, 20W/20, 30 and so on, denoting the thickness of the oil. The correct weight for your car will vary with the outside air temperature. Check your owner's manual for the proper viscosity for various temperatures.

All of this information is nice to know, but it is not absolutely necessary to know, if you remember the name of one particular motor oil.

That oil is Gulfpride Multi-G. It is a multi-viscosity oil. It meets the viscosity requirements at all temperature conditions. It is effective in all climates and seasons. And since it's also an SE oil, it meets the manufacturers' requirements in most new car owner's manuals.

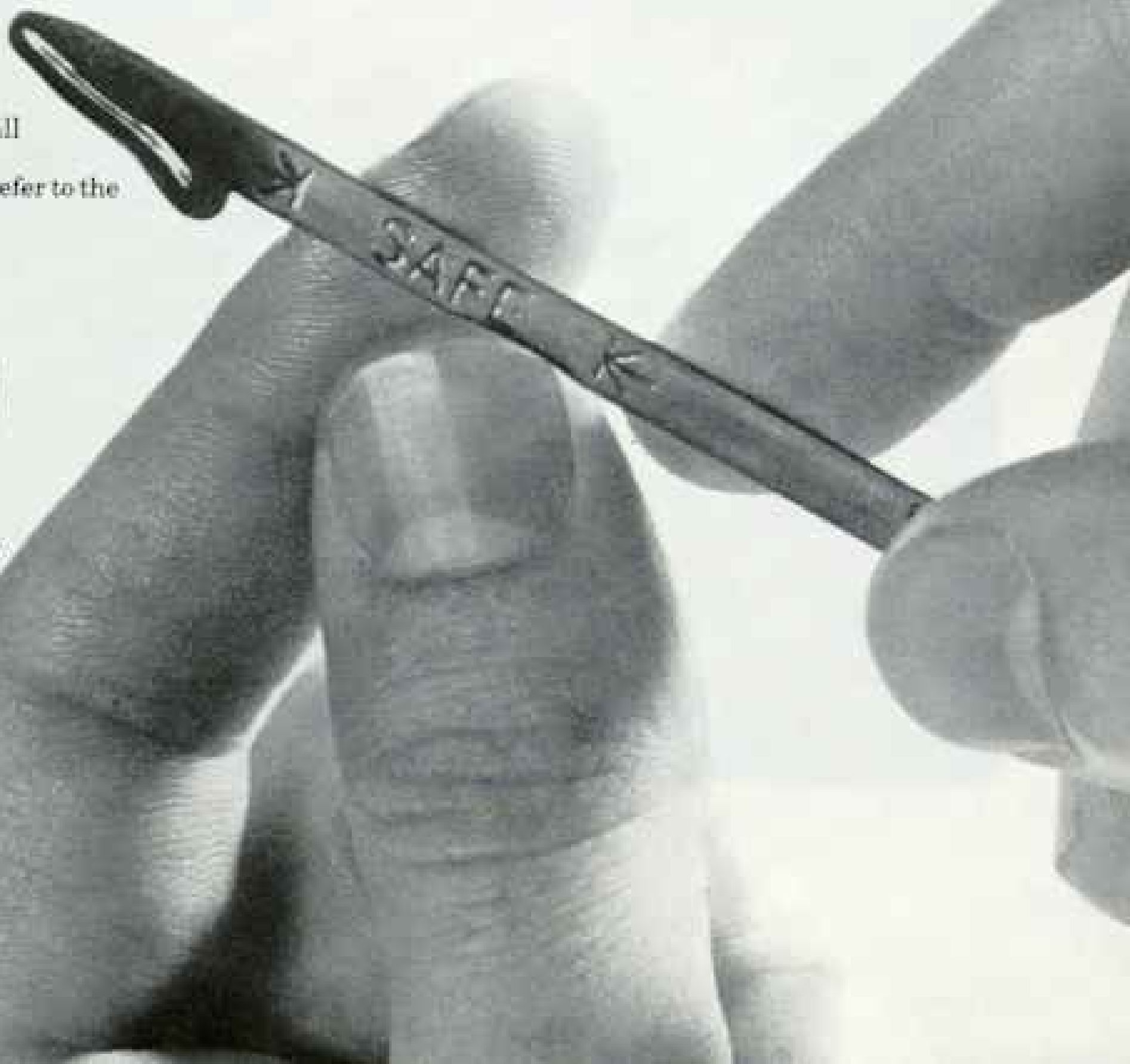
So, to avoid having to remember a lot of numbers and letters next time you change oil, just ask the man for Gulfpride Multi-G.

Incidentally, every second time you change the oil, change the filter. So that you can start completely fresh with your fill of Gulfpride—rather than letting some of the dirty oil contaminate the fresh.

If you'd like more information on motor oil, ask at any Gulf Service Station, or write: Gulf Consumer Information, Box 1403-C, Houston, Texas, 77001. We'll try to answer any questions you might have about your car.

You see, at Gulf we'd like you to learn all you want to know about your car. And our products. That way we can keep you on the road. And us, too.

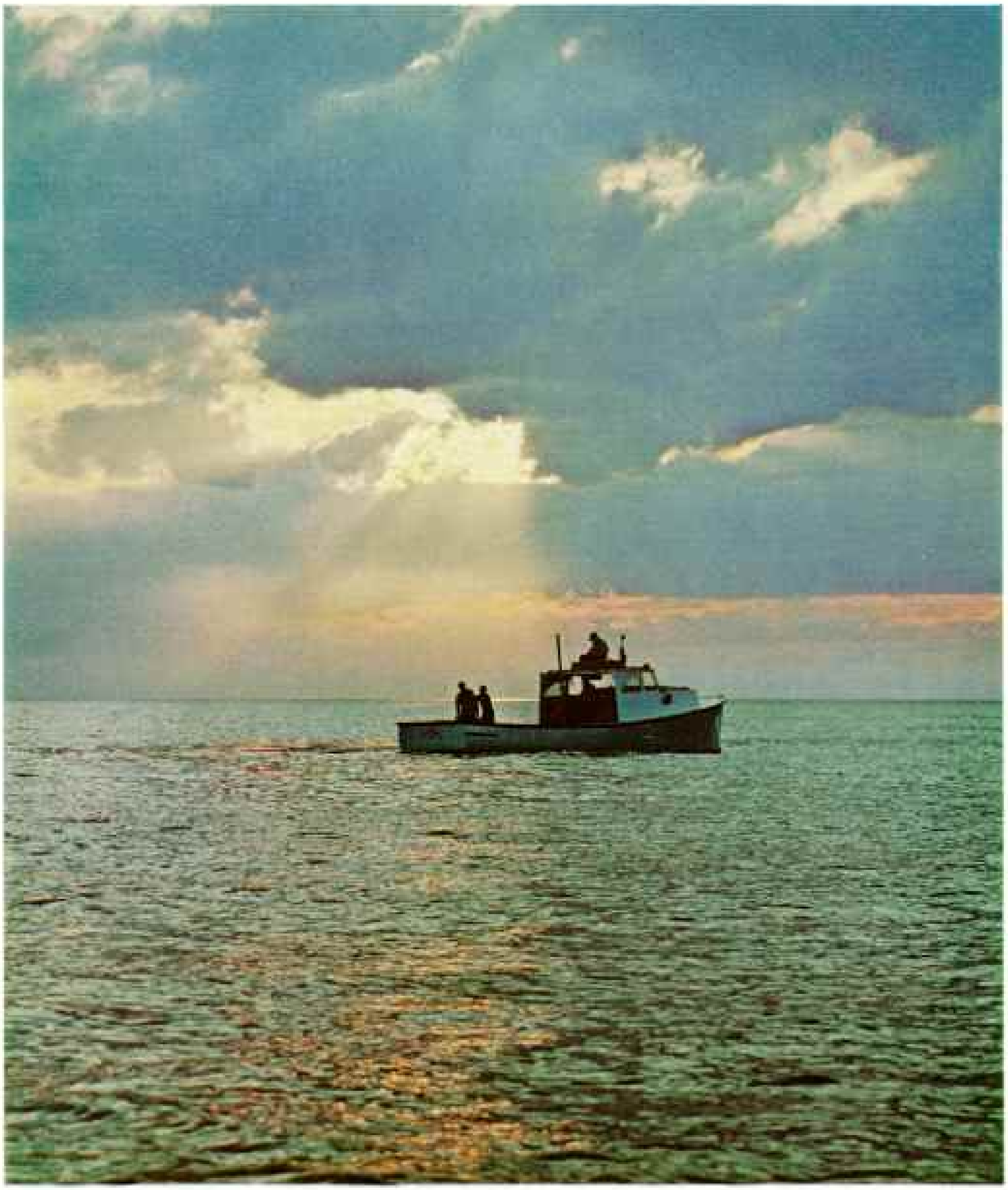
Gulf goes a little bit further.



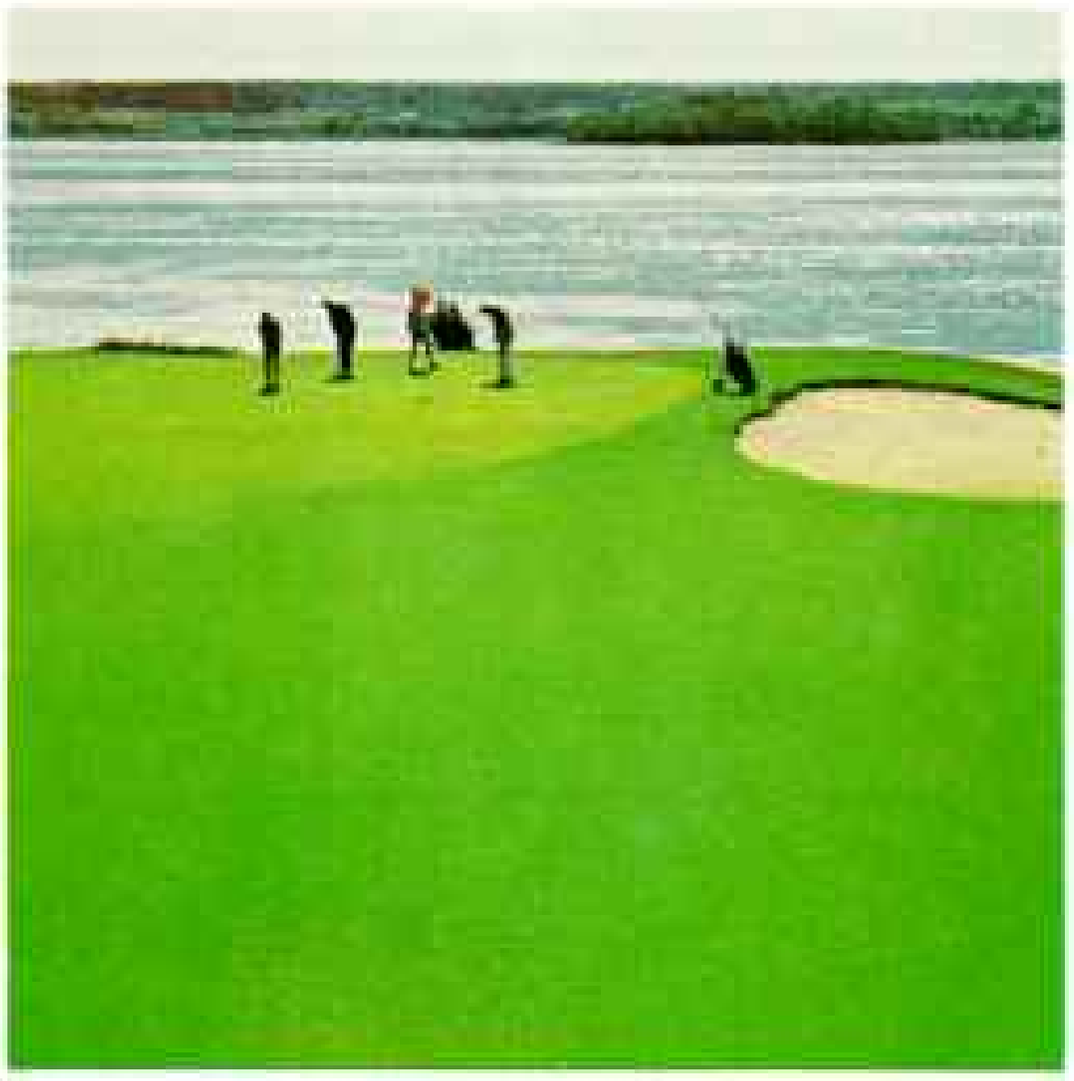
Gulf

GULF OIL CORPORATION

NEW BRUNSWICK



Head North by North East–
sense the seachanges



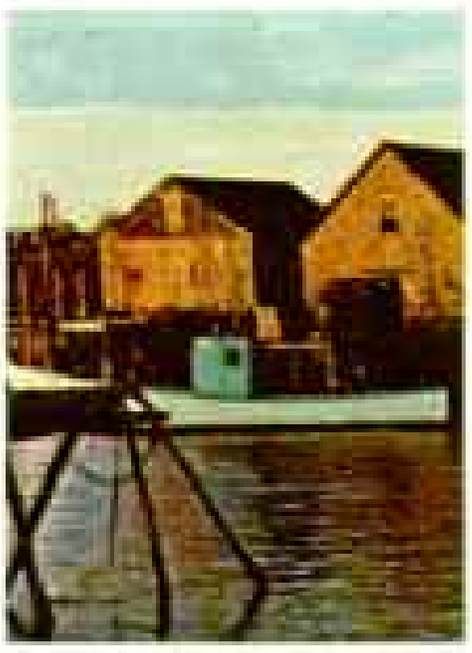
New Brunswick lies cradled on three sides by the Atlantic, and the coasts, running more than six hundred miles from north to south, change constantly and with the ebb and flow of the tides.

From the Heron marshes, clam flats and wide white beaches of the Baie de Chaleur, from the tip of Miscou Island through the meandering sand spits and shifting dunes of the eastern shore, and along the rugged and picturesque Fundy coast—boasting the world's highest tides—New Brunswick offers almost uninterrupted ocean vistas, and an easygoing style of life by the sea.

You can watch the ocean trawlers set sail from any number of coves and inlets, wander beneath the massive spires and arches of the Hopewell Rocks, or test your skills on a couple of Atlantic Canada's most scenic seaside fairways.

You can go for a shore lunch, buy lobster fresh from the ocean, try your hand at salt water fishing, or take a ferry to the secluded life of the Fundy Islands. Wherever you wander, fine seafood, and a warm 'down east' welcome await you.

New Brunswick is the most accessible of Canada's Maritime Provinces—less than a day's drive from Boston or an hour by air.



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Eastern's Walt Disney World. 7 days/6 nights. From $84 to $137. You gotta believe!

Something special from the official airline of Walt Disney World. Pick any of 16 selected hotels. Stay 5 nights and get the 6th night free. Along with 2 days of transportation to Walt Disney World. Ticket books for 18 attractions. And admission and transportation within the Magic Kingdom. You also receive sightseeing tours of Kennedy Space Center, Tampa Busch Gardens, Sea World and Cypress Gardens. Price includes round trip transportation between hotel and airport. Two children under 12, sharing rooms with parents, only $42 each.*

"We couldn't believe our ears."

"We always wanted to vacation in Puerto Rico. But, the way prices have gone up, going anywhere, seemed like a problem. But, through Eastern, we got more vacation than we expected for much less than we figured. As great as that sounds it's nothing compared to the children's band we heard on the streets of San Juan."

Eastern's San Juan/St. Thomas. 8 days/7 nights. From $74 to $169. You gotta believe!

Fabulous San Juan. Great beaches and great nightlife. A choice of 21 selected, air-conditioned hotels. Plus, you get a day in the duty free shopping paradise of St. Thomas.

*Prices do not include airfare, meals, local taxes or transfers unless otherwise indicated. Hotel rates are per person, double occupancy. Prices in effect until 12/15/74. And you can charge the whole vacation on the American Express card. Why not let us plan a Personalized Vacation® to make all your vacation plans come true. Just call Eastern. Or see the travel specialist, your travel agent.

EASTERN THE WINGS OF MAN

How to get to Nova Scotia in spite of everything

In most cases, Nova Scotia is a lot closer than you think. And we've got gas to fuel up your car when you arrive here and wherever you travel in our province.

Or how about taking a plane so you'll have more vacation time to enjoy? There are direct, non-stop, daily flights from New York and Boston. (Don't forget to have a rented car waiting for you at the airport.)

You might even think about floating your car to Nova Scotia. Yes, floating your car!

You have a choice of three, large and modern car-ferries for the relaxing trip. For your enjoyment on board each ferry there's a fine restaurant and bar; a duty-free shop and a casino.

The car-ferry "Bluenose" sails daily in the summer from Bar Harbor, Maine to Yarmouth, Nova Scotia. "Prince of Fundy" and "Bolero" also sail daily from Portland, Maine to Yarmouth.

Now that you know there are different and interesting ways to get to Nova Scotia, you might be asking yourself why Nova Scotia is worth getting to.

The fact is, Nova Scotia is worth getting to if all you wanted to do was look around.

You could wander through the antiquity of Annapolis Royal and escape through the centuries at the Port Royal Habitation, a perfect recreation of the oldest white settlement in North America north of Florida. At Louisbourg explore the reconstructed fortress.

And Nova Scotia has history you can drive through as well as walk through. Try the Evangeline Country of the Annapolis Valley, the famous South Shore Lighthouse Route, the Eastern Shore Marine Drive, the spectacular Cabot Trail and our Sunrise Trail boasts some of the best beaches in Nova Scotia.

If you want to swim, scuba dive, sail or deep sea fish, Nova Scotia has nearly 5,000 miles of picturesque, indented coastline with more quaint harbours than you'll ever be able to count.

There are acres of secluded park lands with hiking trails, more championship-calibre golf courses than you'll be able to challenge in one stay. There are horses to ride and boats to rent.

You'll find the shopping interesting, the resorts and hotels very accommodating, the dining rewarding and the evening entertainment exciting.

But then again, just about all of Nova Scotia is a must.

So why not start making plans to get here?

We're certain you'll have the kind of vacation which will make you want to come back again and again.

For more information on Nova Scotia vacations, write Nova Scotia Information Offices, 616 Forest Ave., Portland, Me. 04101. Telephone 1-800-341-6709 (Toll free in New England except Maine.) In Maine 772-6131/630 Fifth Avenue, Suite 3115, New York, N.Y. 10020. Area Code 212-581-2420/ P.O. Box 130, Halifax, N.S.

Nova Scotia

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Our goal was to make getting there as much fun as being there.

When we designed our GMC MotorHome, we had something quite special in mind. We wanted a motorhome that would actually be fun to drive.

Which is why a GMC MotorHome looks the way it does. Aerodynamic. And low—lower than any other motorhome. So it can handle crosswinds. And corners.

That's also why we've provided it with front-wheel drive, a 455-cubic-inch V-8 with automatic transmission, and tandem rear wheels with air suspension. So it can handle highway speeds. And off-highway bumps.

Not that we've ignored living comfort. In fact, 15 floor plans, in four different color-coordinated decors, are available.

If you want specifics, send for our 28-page color catalog. Simply write: GMC MotorHome Headquarters, Drawer Y, Dept. 323, Lansing, Mich. 48909.

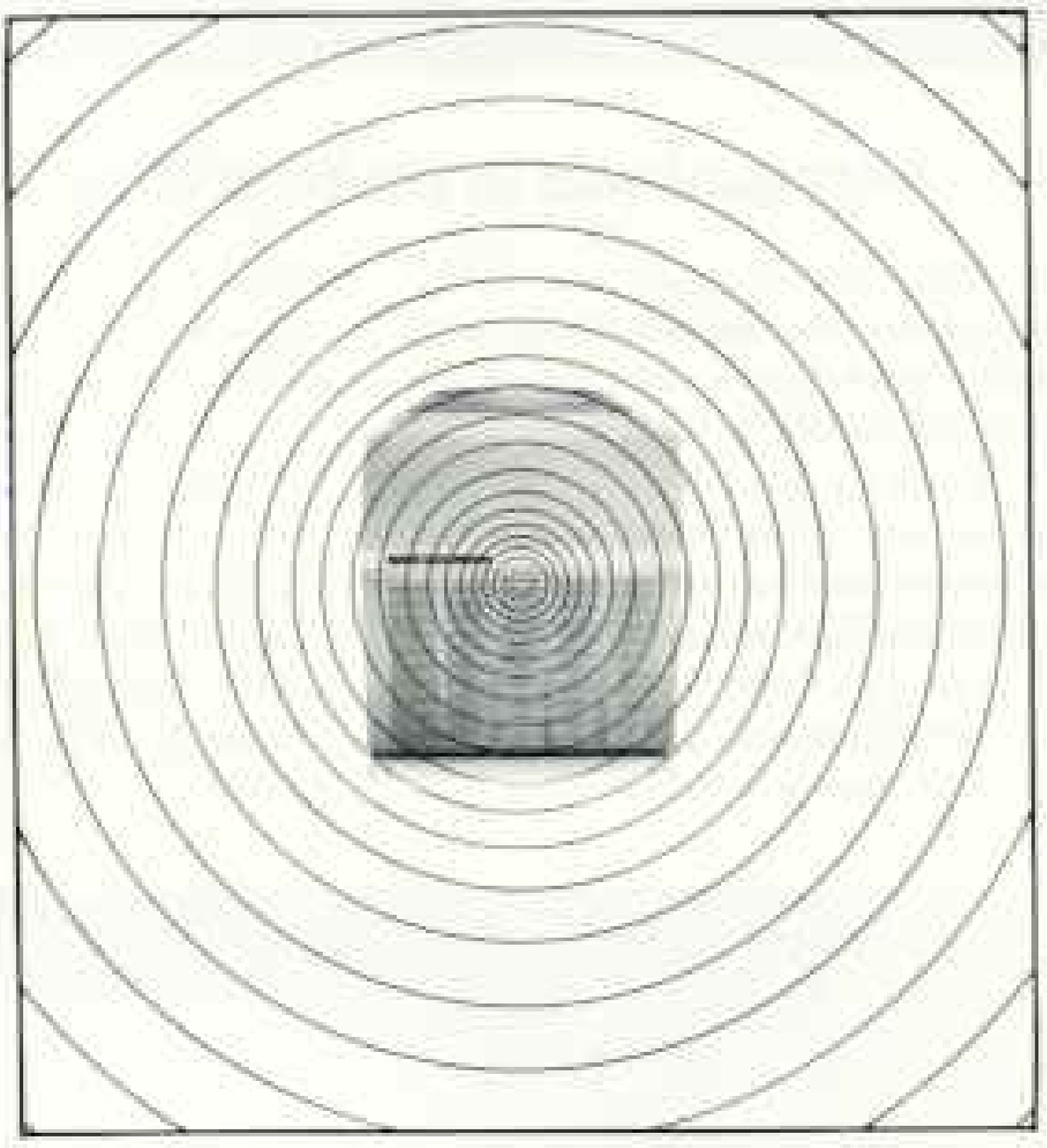
Better yet, see your local GMC MotorHome dealer.

The GMC MotorHome. It doesn't look like a box. It doesn't ride like a truck.

GMC

The MotorHome from General Motors.

Now, more than ever, you need an efficient, quiet central air conditioner. Now, more than ever, you need GE.



Efficiency Rating
9.8

Sound Rating
18

In these days of power shortages, it's essential that your central air conditioner be efficient. And, of course, it has always been desirable that it perform quietly.

General Electric's *Executive* air conditioner is designed to do both. It is our most efficient unit and quietest outside of all our residential condensing units.

In addition we offer a *Deluxe* and *Standard* line, each an excellent performer in its own price range.

The chart you see here shows the Energy Efficiency Ratio and Sound Rating Number of each unit. EER is a measure of energy output per unit of electricity used. The higher the EER number, the more efficient the unit.

SRN is a measure of the outside sound level of the unit while it is operating. The lower the SRN, the quieter the condensing unit.

All models have General Electric's exclusive Climatuff™ compressor and Spine Fin™ coils. Moreover, each is eligible for our General Electric Central Air Conditioner National Service Contract Plan.

Your General Electric dealer can help you make a choice. He's in the Yellow Pages under "Air Conditioning Equipment and Systems."

EXECUTIVE			DELUXE			STANDARD		
EER	Model & Coil	SRN	EER	Model & Coil	SRN	EER	Model & Coil	SRN
9.3	TA936L XA960A	17	8.1	TA836R XA1023A	18	7.1	TA724R XA1023A	19
9.3	TA948L XA960E	18	8.6	TA836R XA1031A	18	7.3	TA736R XA1031A	19
9.8	TA960E XA972A	18	8.1	TA836R XA1034A	18	7.2	TA736R XA1034A	19
			8.0	TA842R XA942A	18	7.2	TA742R XA942	20
			8.0	TA948R XA948A	19	7.2	TA748R XA948A	20
			8.0	TA960R XA960A	19			

This data is for electric split system, air-cooled condensing units with coil alone (type RCU A/C) listed in the January 1974 Air Conditioning & Refrigeration Institute Directory.

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- ☐ #1001. Orient Panorama. Tokyo, Beppu, Kyoto, Taipei, Hong Kong. 15 days $1087. Go on to Singapore, Penang, Bangkok. 23 days $1369.
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PARKER 75

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For the same reason Rolls-Royce makes Bentley.

A Bentley differs from a Rolls-Royce only in its grille design. A modicum less in price, the Bentley is for people who like to go first class in a quiet way.

Above, you see the Parker 75 Ball Pen (in back) and the Parker 75 Classic Ball Pen. In solid sterling silver, the former costs $15, the latter $12.

Obviously their differences are slight. The 75 Ball Pen has a greater girth in hand, and a cap-actuated point. (An easy pressure extends the point for use or retracts it into its gleaming sheath.) It has a high clip for trim, pocket-level appearance.

The 75 Classic is a somewhat leaner breed, precise in the hand, with a point that's pushbutton-controlled.

Beneath their elegant exteriors however, both mount the same durable engine: a microscopically textured tungsten-carbide ball, seated in stainless steel, linked to an ink supply that writes better months longer than the ordinary ballpoint.

Each pen puts down the same clean, crisp track seemingly without effort. And each skims across the page like some Grand Prix racer.

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Which one should you give as a gift? Happily, there is no wrong decision. People who appreciate the important nuances own both. Which one should you select for yourself? It's all a matter of personal taste.

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World's most wanted pens

The Parker 75 Ball Pen is available in sterling silver, 14K gold-fill, vermeil or brushed stainless steel. The Parker 75 Classic Ball Pen is available in sterling silver, 22K gold electroplate, vermeil or brushed stainless steel. Matching Pencils. Engraving areas will accommodate full monogram.

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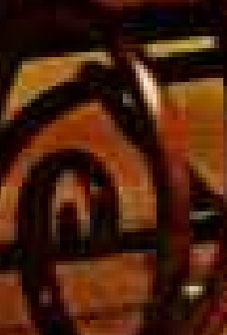

You have a choice, too. Andersen Windows are available in primed wood or Perma-Shield® vinyl-clad wood—for the added beauty of windows that won't need painting.

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Kodak

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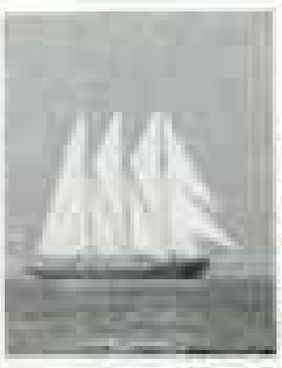

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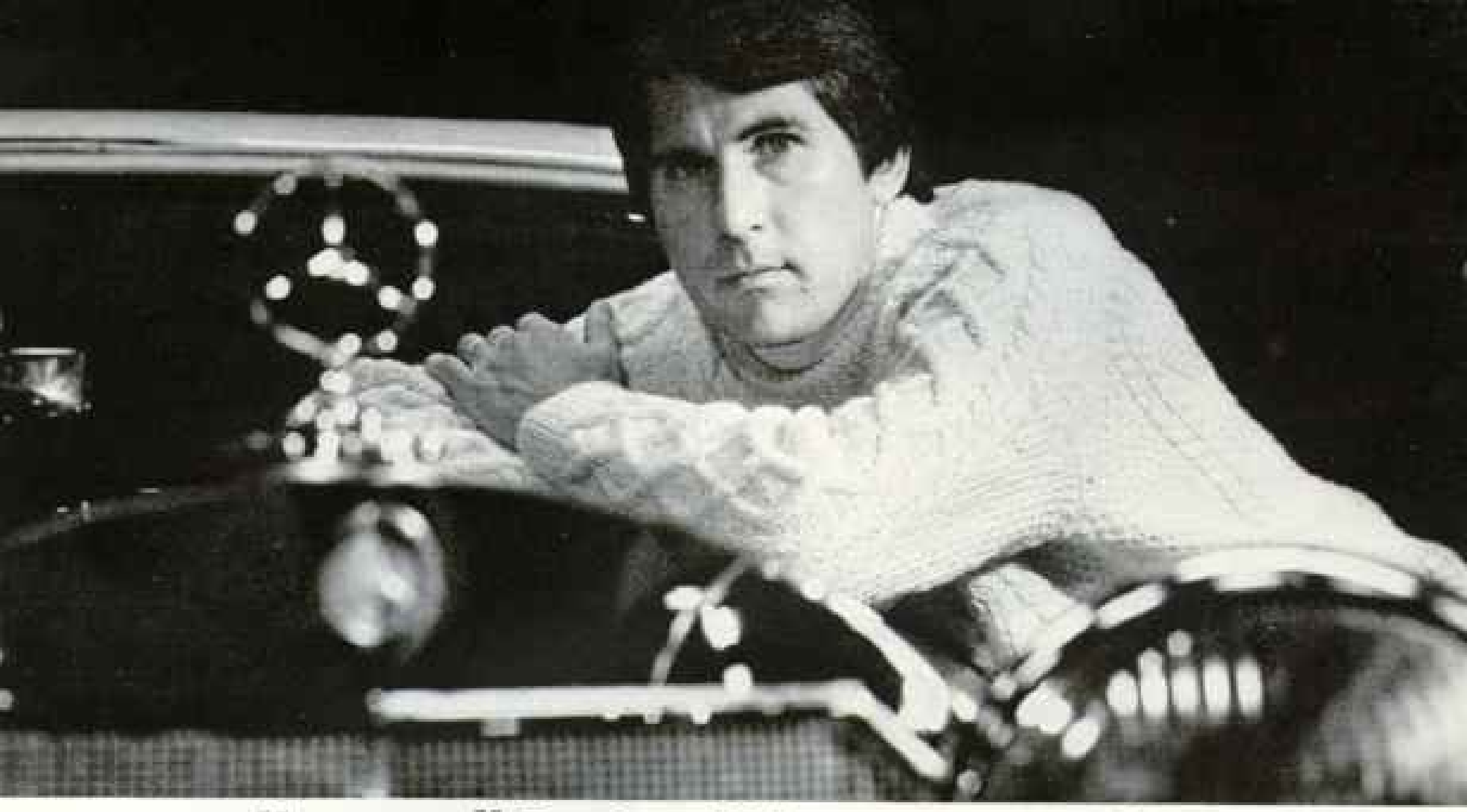

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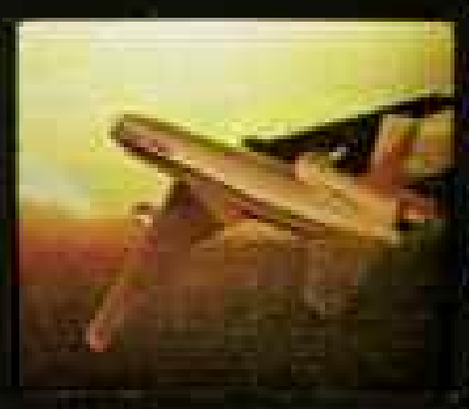

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Someday, you're going to need a Nikon

According to photographer Morton Beebe, he and a writer companion were the first two men ever to walk on both ends of the Earth. And they did it within the same year! Beebe took these photographs, with his Nikon cameras. The frosted Major on a floating ice island near the North Pole. The ship near Cape Hallett, in Antarctica.

It was a challenging assignment for man and camera. Temperatures hovered around 60° below zero. Beebe often lost the tip of his nose, frozen to the metal of the camera. Cameras were often left outside in the cold, because heavy layers of frost would form if they were brought inside. They had to be operated with gloves, or with stiffened fingers which often stuck to the camera. And there was little time for photography: the arctic day was just three hours long at that point.

Beebe got the photographs, as you can see. The Nikon cameras performed faultlessly. As they have on so many other difficult assignments, in the hottest, coldest, most humid and driest parts of the earth. That's how rugged, how reliable a Nikon camera is. That's why it's the near-universal choice of serious photographers everywhere. Although we don't recommend using a Nikon in extremely cold temperatures without special preparation. Beebe did it...with regular off-the-shelf cameras.

It may be a sunny 75° day in your backyard, but someday, somewhere you too, if you're serious about photography, are going to need a Nikon. You're going to need one of its many unique capabilities. One of the over 40 incredible Nikkor lenses of the Nikon System. Or maybe, if you get around like Morton Beebe, you'll need the incomparable precision and reliability. But you will need a Nikon. Maybe tomorrow. Be ready. We'll help you get ready...ask your dealer about the Nikon School of Photography coming to your area soon. Write for Folio 19. Nikon Inc., Garden City, N.Y. 11530. Subsidiary of Ehrenreich Photo-Optical Industries, Inc.

(In Canada: Anglophoto Ltd., P.Q.)

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