

VOLUME CXLV

NUMBER ONE

THE NATIONAL GEOGRAPHIC MAGAZINE

JULY, 1958

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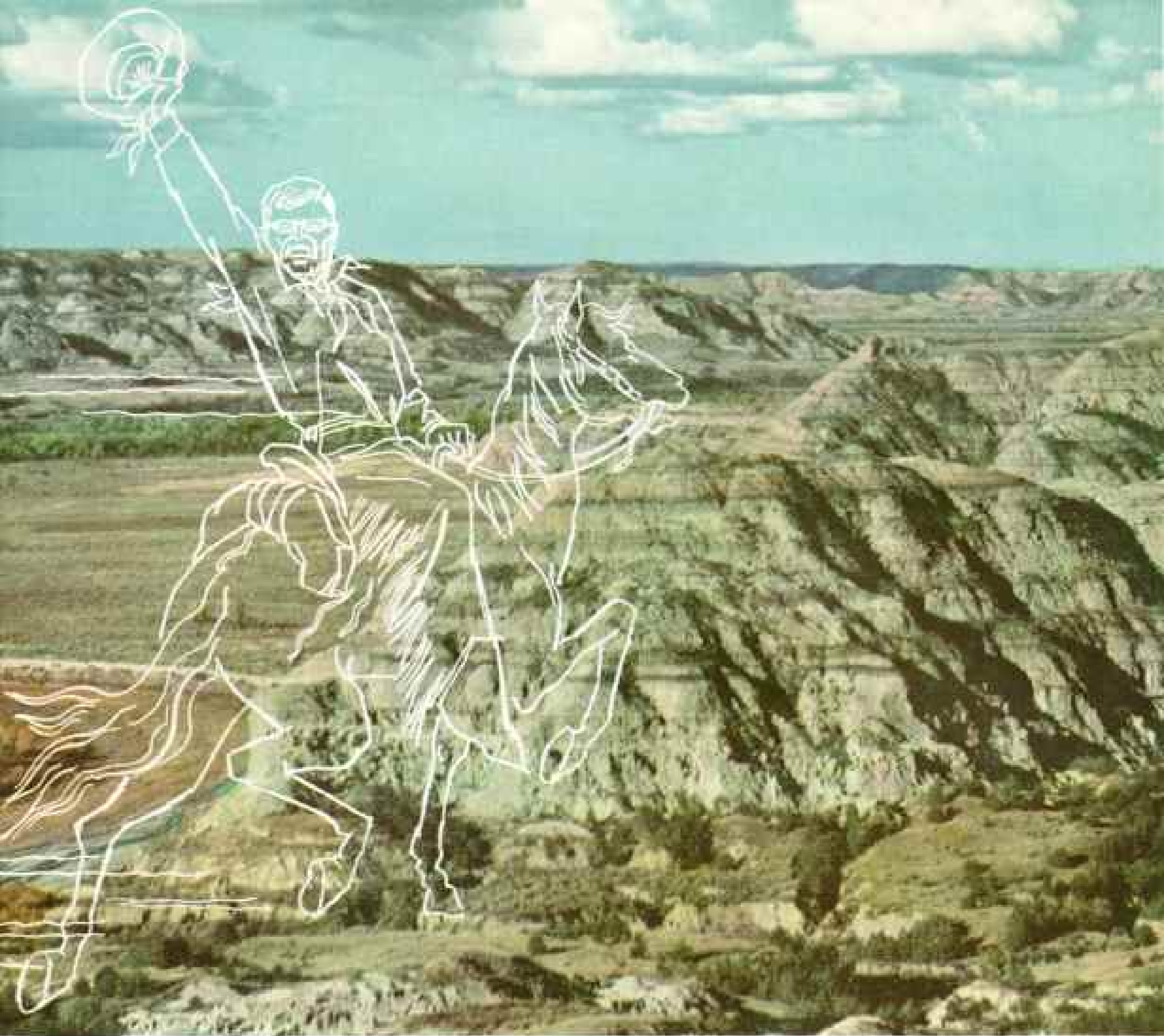
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See Theodore Roosevelt National Memorial Park, in North Dakota's beautiful Badlands.

T.R.—the cowboy who rode herd on our natural glories

Most Americans think of Teddy Roosevelt as part bull moose and part steam-engine. But mostly, T.R. was the Fourth of July r'ared back and walking on its hind legs. *He was a man on fire for his country,* and it was the natural glories of this land that lit the fuse.

They've made a wonderful park of his Elkhorn Ranch and the Badlands where he worked as a cowboy and found health and strength. Here, you can see the open range that made him first appreciate his country's greatness. You can ride the trails that gave his imagination new directions. You can climb the ridges that lifted his eyes, and gave him the power to lead his Rough Riders up San Juan Hill in '98.

This is the centennial of T.R.'s birth; if he were around today, he'd be "dee-lighted" that the conservation policies he fostered have been so wisely continued. He knew America would always need breathing space, open waters and green, growing forest—the heart lifting glories of Nature that men must have to grow strong and great.

* * *

FREE TOUR INFORMATION If you would like to visit Theodore Roosevelt National Memorial Park, or drive anywhere in the U.S.A., let us help plan your trip. Write: Tour Bureau, Sinclair Oil Corporation, 600 Fifth Avenue, New York 20, N.Y.—also ask for our colorful National Parks map.

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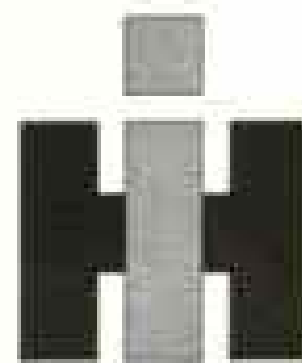
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**"DESPITE APPEARANCES,
I AM NOT REALLY
INTERVIEWING A HORSE"**

So writes Assistant Editor Beverley M. Bowie, of the National Geographic, here using one Austrian Lipizzaner colt as a desk while another considers nibbling his notes. His report on Vienna's famed performing horses—which turn white as they mature—will appear in an early Geographic. In this issue Mr. Bowie writes of Henry Ford's fascinating Greenfield Village (page 96).

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... AND INQUIRY ABOUT**

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ONE**
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Members of The Society roam the world through the pages of their official journal, the NATIONAL GEOGRAPHIC MAGAZINE. Annual dues of **\$6.50** include subscription to the Magazine, and bring frequent 10-color map supplements. Members' enthusiastic nomination of friends for membership explains The Society's phenomenal growth.

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Members and others may make gifts or bequests of money, securities, or other property to The Society for "the increase and diffusion of geographic knowledge." Such gifts are deductible for tax purposes.

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Photoelectric exposure meter is built in. Ends guesswork under any and all lighting conditions. Gives easy-to-use EVS readings by reflected or incident light, for films from 5 to 1300 ASA.



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Master of every picture situation... the new Kodak Retina Reflex Camera

... gives you professional full-area ground-glass focusing plus clear split-image rangefinding ... has easy-to-read photoelectric exposure meter built in ... fast-action film-wind ... lens interchange ... complete photo-aid system. Masterful design combines with beautiful craftsmanship, in a camera you'll wear proudly anywhere.

If you are one of the fortunate people who buys a new Kodak Retina Reflex Camera this year, you will gain more than a masterful camera, more than a supremely fine picture-taking instrument.

You will have the satisfaction of choosing a classic—at its introduction. You will own a personal share in the great Retina tradition.

Awaiting you is a rare experience.

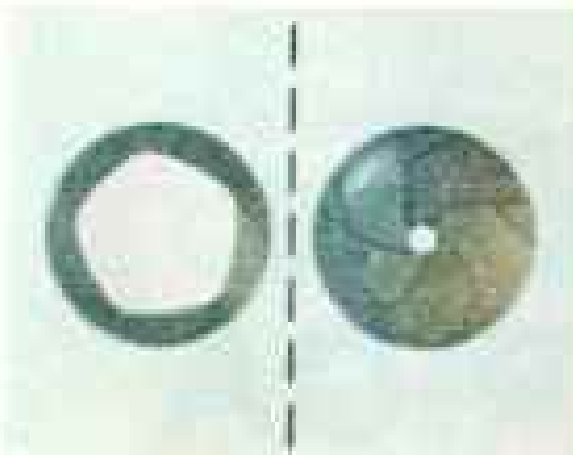
For this is the finest of all the modern 35mm pentaprism reflexes—built to make you the master of every picture situation.

An ultra-sensitive photoelectric exposure meter eliminates all exposure guesswork. You wind film with a single thumb-stroke for fast-action sequences. And through a variety of specialized aids, your Retina Reflex keeps pace as your picture-taking interests grow.

Let your dealer demonstrate the magnificent new Kodak Retina Reflex Camera. With six-element Retina Xenon-C 50mm $f/2$ Lens, \$215, or \$22 down. Prices are list, include Federal Tax, and are subject to change without notice.

*See Kodak's "The Ed Sullivan Show" and
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Automatic diaphragm closes down to pre-set aperture when shutter is tripped—you don't have to do it by hand. Works with all lenses. Shutter speeds 1 to 1/500 second; flash-synchronized.



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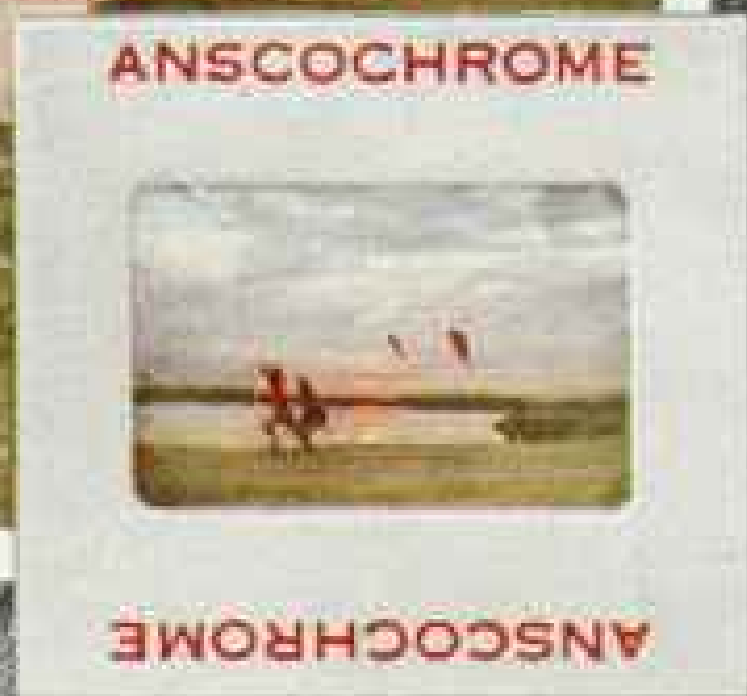
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'58 FRIGIDAIRE

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...its ability goes far beyond its price

The talented new Argus C-44 with f:2.8 Cintagon lens and new turret viewfinder attached. Surrounding it are its accessory 100mm Telephoto and 35mm Wide-angle lenses.

The new Argus C-44 is indeed an astonishing camera — it fairly bristles with features you look hopefully for in other cameras costing hundreds of dollars more.

For example . . . It is the only camera at or near its price that offers you the versatility of interchangeable lenses on a lightning-fast bayonet-type mount. It brings you the convenience of a quick-computing, lens-coupled rangefinder-viewfinder . . . the precision of an f:2.8 Cintagon lens and 1/300 shutter.

That is not all. This new C-44 for 1958 is equipped with a split-second thumb lever film advance that lets you take pictures as fast as you can flick your thumb and trip the shutter.

Would you like more? The remarkable C-44 even goes so far as to give you a rapid film rewind crank that fits down into the frame, pops up when you're ready to use it, lets you reload your camera in a twinkling. All these features are built-in, and all are included in the price.

And there is an exciting new accessory: a variable-power turret viewfinder (shown on camera). This instrument shows you the full-size picture which each accessory lens takes. Cost: \$24.95.

It all adds up to this one last thought: you ought to get your hands on the talented new Argus C-44—soon. The price is \$99.95.



C-44 ACCESSORIES:

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35mm Wide-angle Lens: \$56.50.
50mm f:1.9 Cintagon Lens: \$89.50.
L-44 Clip-on Exposure Meter: \$17.50 with case. Flash: \$8.25. Case: \$12.50.

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“As a new driver, remember you have some mighty important obligations. Your own safety—the security of others—your family’s peace of mind—all of these depend on your care, your caution, your courtesy when behind the wheel.”

MOST parents spend some anxious hours when their teen-agers first begin to drive—and with very good reason. For statistics tell us that it is in the 15-to-19 age group—the ages at which most young people usually start driving—that accident fatalities are at their peak.

One of the first things that should be impressed on young people is the power and speed of today’s cars. If this power is misused—if the driver “steps on it” for a thrill—he is asking for an accident. But if he learns to respect power and the necessity for keeping it under control, he will be a safer, more skillful motorist.

In addition they need to become thoroughly familiar with the traffic laws of their community and all safety regulations, including those that apply to pedestrians.

Young drivers should also learn the importance of con-

stant attention to driving. The driver whose attention is diverted can lose control of his car before he realizes it.

Careful studies show that properly trained young drivers—especially those who take courses offered in many high schools—make far better drivers than others trained by less competent teachers. If your school does not give safe driving courses, ask your police department where competent instruction is given.

Young drivers gain a lot from parents who set good examples of safety. Parents who strictly observe speed and all other traffic regulations can be far surer that their teenagers will do likewise when trusted with the car.

Today about 4 Americans die in traffic accidents every hour, and about 150 are injured, some severely, during each 60 minutes! We can reduce this toll if every one of our nation’s 78 million drivers—*young and old*—will drive at all times with care, caution, and courtesy.

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And Sam Snead's one man who's been on the go enough to know. Finishing a tournament in Augusta one day, he might have to start another in Chicago the

next. So he flies or takes a fast train, rents a new Hertz car *there*. That's The Hertz Idea!

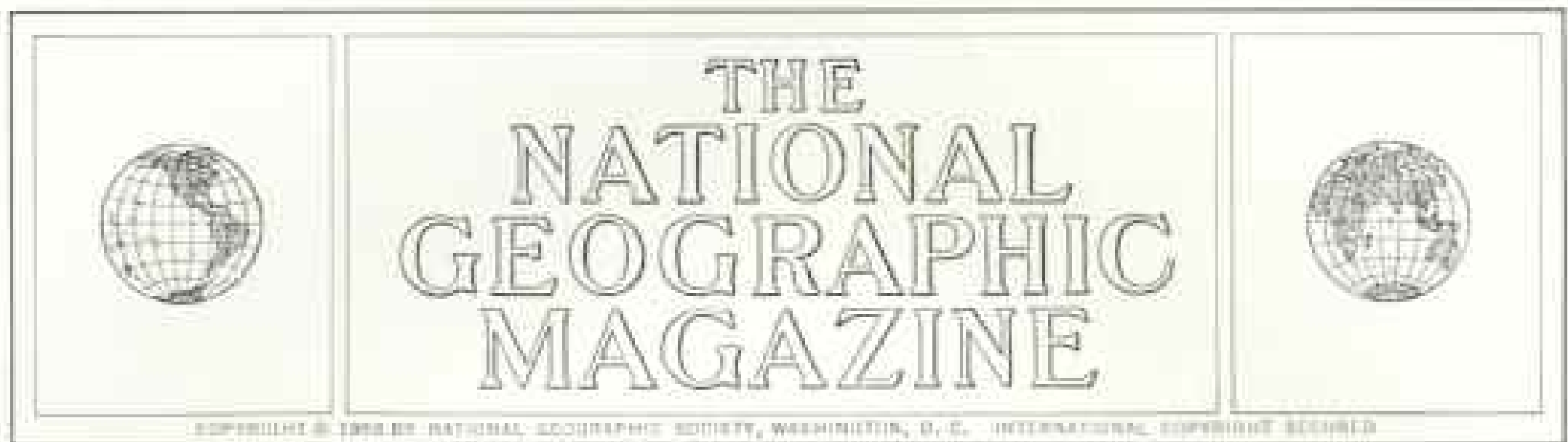
Hertz has more offices *by far* where you can rent a new Turbo-glide Chevrolet Bel Air or other expertly maintained car. National average rate's only \$38.50 a week plus 9 cents a mile—including all gasoline, oil and

proper insurance. Call your local Hertz office or travel agent to reserve a car in the U. S., Canada or wherever in the world you're going. We're listed under "Hertz" in alphabetical phone books everywhere. *Ask about "Rent it here . . . Leave it there" service!* Hertz Rent A Car, 218 S. Wabash Avenue, Chicago 4, Ill.



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West from the Khyber Pass

Threading 4,000 Miles of Southwest Asia's Dusty Roads, the Author
Renews His Friendship with the People of the Moslem World

BY WILLIAM O. DOUGLAS

With Photographs by Mercedes H. Douglas and the Author

AT a press conference in Washington, D. C., I outlined our plans. We would go by automobile along the southern edge of Russia from Pakistan to Turkey. We would cross deserts and mountains over some of the worst roads in the world.

"Aren't there bandits on the way?" asked one reporter.

"Well, we've been warned about some tribal areas," I replied.

"What if the car breaks down?" another asked. Perhaps he knew about my mechanical aptitude: I can barely tell one end of a screwdriver from the other.

"That's simple," I said. "I'm taking along my wife Mercedes to fix the car."

The Making of a Mechanic

Mercedes, who has a flair for machinery and a mind of her own, took this joke quite seriously. Before we left, she obtained a manual on car repair and learned how to use it. She also shopped for spare parts that would fit the 1956 station wagon awaiting us in Asia.

The car belonged to our friend Mary Watkins, of Rockville, Maryland. Mary had been touring Southeast Asia for a year and wanted to drive across the Near and Middle East.

"But I won't do it alone," she had written.

We were happy to oblige. Mary is a zesty traveler with wide interests. She is also an enthusiastic amateur archeologist.

The city of Peshawar, on the western edge

of Pakistan, lies at the mouth of the narrow Khyber Pass (map, pages 10 and 11). It was here that we completed the outfitting of our car and began our long journey west.

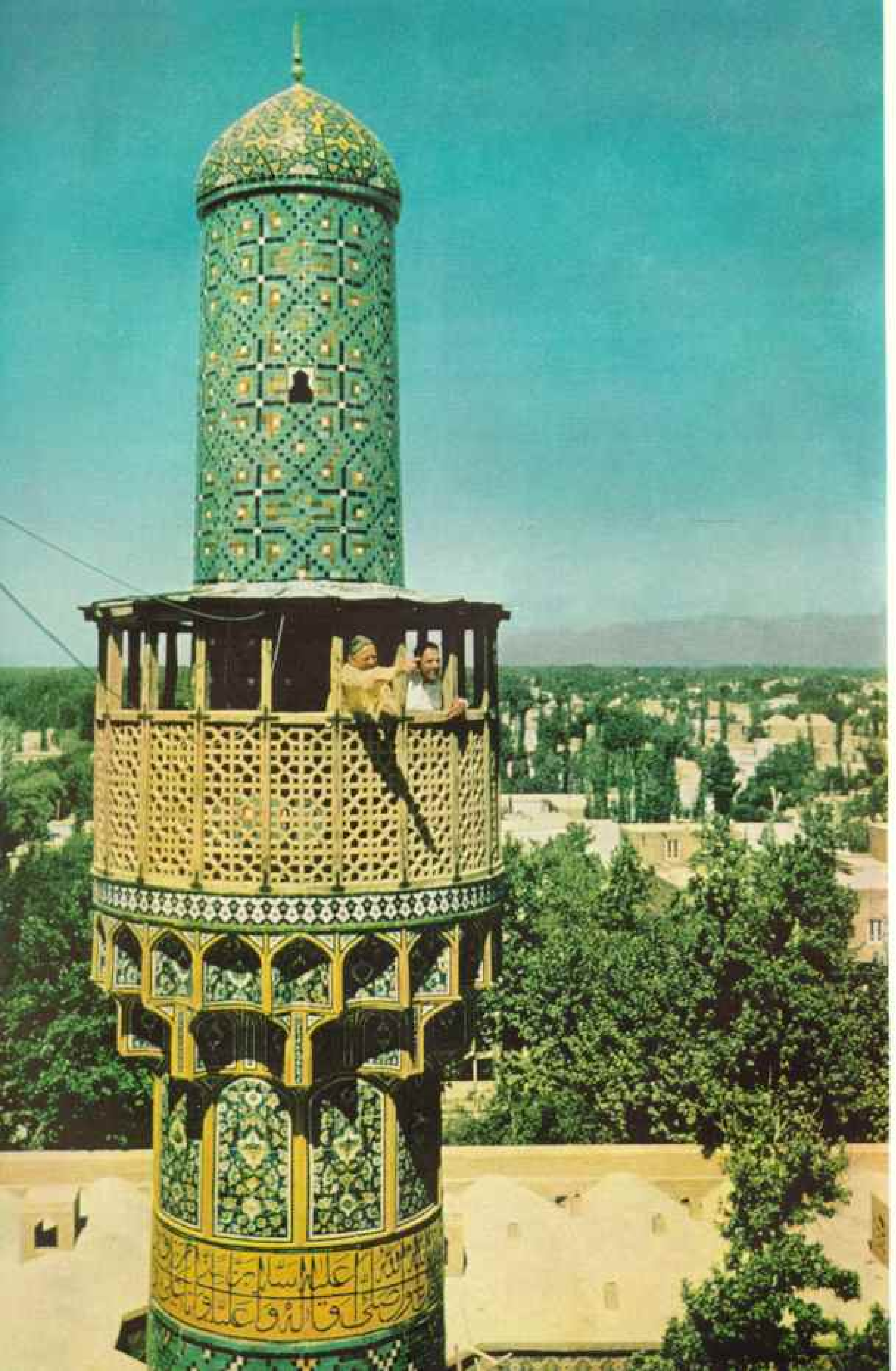
To buy a spare battery and extra leaves for our rear springs, we turned to the Peshawar bazaars—winding streets lined with small shops. The merchants often live on the second floor, where balconies command a view of the street and where, I was told, hashish and opium—or even murder—can be bought.

Along these streets coppersmiths and potters work at their trades. There are shops filled with leather sandals and cartridge belts. Tobacco, snuff, and spices are on display; blocks of stalls are filled with luscious fruit, protected from the fierce summer sun by ragged awnings.

Aghans, Pathans, and Turkomans for-gather in teahouses where samovars boil constantly. There are shops full of sweets and

The Author

Dedicated to the bettering of understanding between West and East, Associate Justice William O. Douglas of the United States Supreme Court has repeatedly crisscrossed Asia. Four books, beginning in 1951 with *Strange Lands and Friendly People*, have recorded his interviews with the kings and commoners of these ancient lands. Here the National Geographic presents a warmly personal record of the Justice's most recent venture into the East. A book-length account of the trip, *West of the Indus*, will be published this fall by Doubleday and Company.



Automobile Odyssey Through Asia: a Supreme Court Justice Roams Byroads of the Storied East

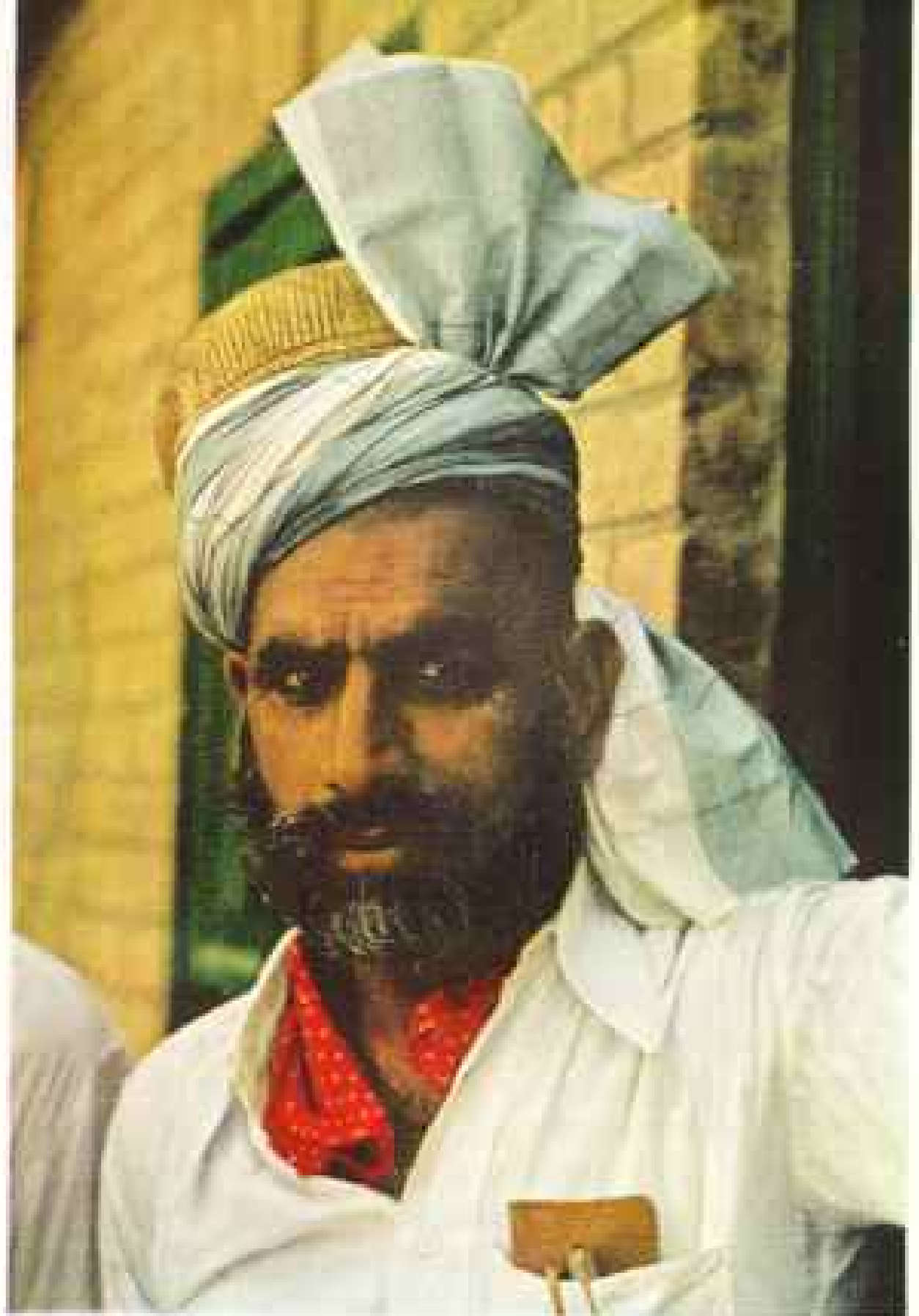
Touring the Moslem East last summer, Justice William O. Douglas and his wife skirted the Iron Curtain for 4,000 miles from West Pakistan across Afghanistan, Iran, and Iraq, and on to Istanbul.

Motoring along the shoulder of Russia, they explored sun-seared plains that centuries ago felt the conquering might of Alexander the Great. They walked the streets and climbed the towers of ancient Isfahan, garden city of Iran (left), and mingled with men of many tribes in Pakistan's Peshawar (right).

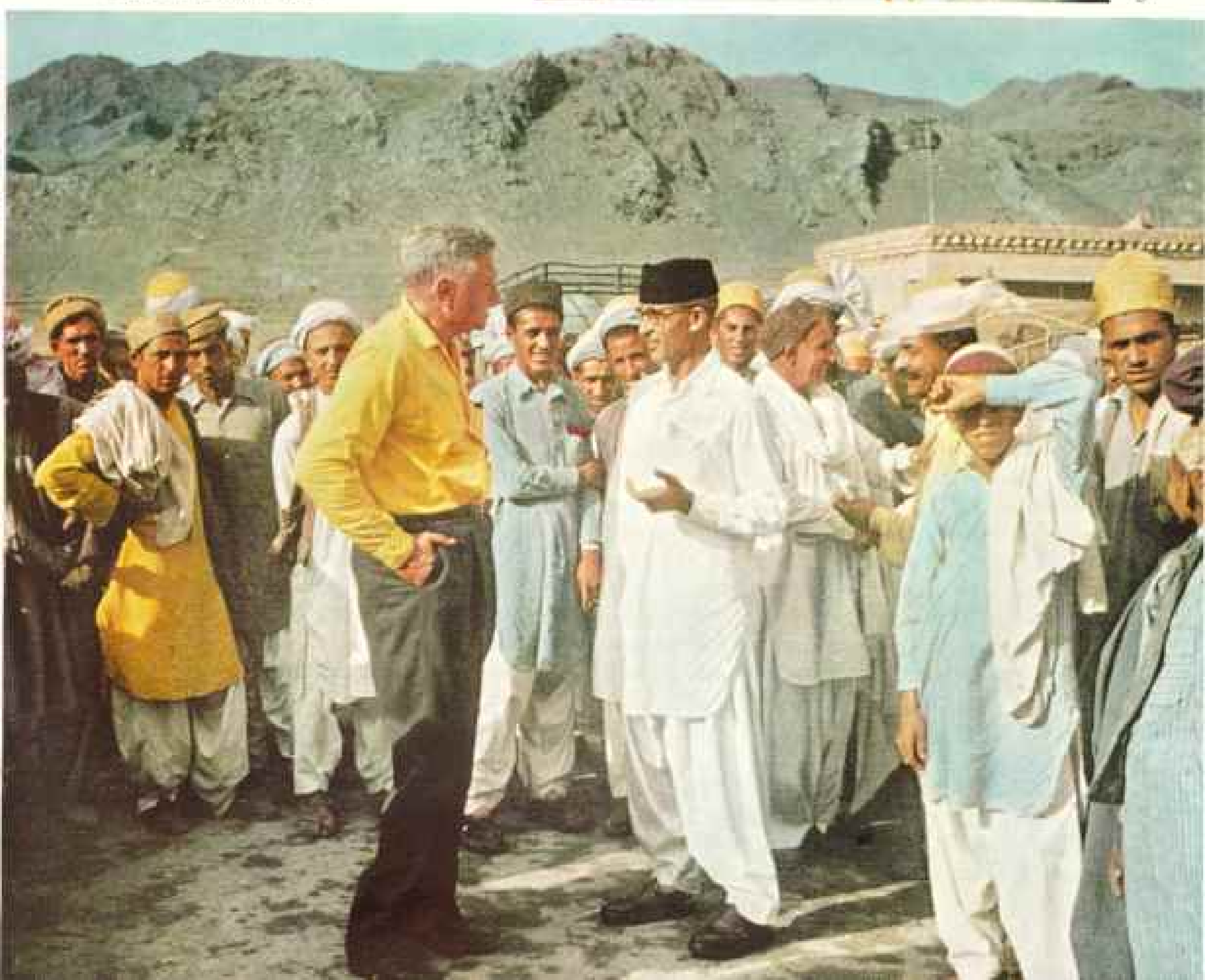
There, at the portal to the Khyber Pass, the westward journey began. At All Masjid, narrowest point in the historic pass, Justice Douglas talked with tribesmen dressed in pajamalike pantaloons and loose, full-bodied shirts (below).

"For two months we literally lost ourselves on Asia's back roads," says the author. "Only thus can a traveler get close enough to feel the heartbeat of her people, to know their warmth, their longing for equality, their pride in race and culture."

Illustrations by William O. and Mercedes H. Douglas
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3



others where live birds are sold. And above the roar of the bazaar ring the cries of the hucksters peddling trinkets or cold drinks.

After buying the parts for our car, I purchased a story in the Street of the Storytellers, famous in Central Asian history. For a rupee, a wizened old man with flowing gown and skimpy beard told me a fanciful tale of Alexander the Great, who by 327 B. C. had conquered Afghanistan.

A Woman's Revenge in Babylon

"To Alexander," said the old man through my interpreter, "a woman was a danger far greater than an armed man."

In Afghanistan, the story continued, the beautiful Roxana danced for Alexander and overpowered him with her beauty. They were married and Roxana followed the army. But she still resented the Greeks who had conquered her country.

She got her revenge one day at a great feast in Babylon, when Alexander ate and drank more than anyone else. Pointing to a pool in the garden, Roxana said, "You would not dare to swim now." Moved by wine, Alexander jumped to his feet and plunged into the cold water. From that swim he supposedly got a fever and died.

"That is how," the old storyteller cackled, "an Afghan woman outsmarted the man who conquered Asia!"

On the Route of Alexander the Great

We would soon cross and recross the path of Alexander. But first we had to load our station wagon with its luggage, camping gear, spare parts, and—eventually our most valued ally—ordinary baling wire, with which Mercedes effected repairs when all else failed.

The days in Peshawar were oppressively hot. I saw one well-shaded thermometer that recorded 110°. Nights were little cooler. For the most part the Pakistanis slept outdoors. If you pulled your car off the road at night you could always hear snores.

I found only one remedy for sleeplessness in Peshawar. I stood under the cold shower in my pajamas and went to bed dripping wet. I had to do this once at bedtime and twice during the night in order to get eight hours' sleep. But it worked.

Partly to escape the heat, we made a three-day side trip east and north from Peshawar to the state of Swat. The entrance to Swat reminded me of our own Connecticut Valley.

The river was broad and purling, the water blue and sparkling. Green fields stretched as far as I could see. Inviting side roads led off under green arches of trees to plains where farmers were transplanting rice.*

Swat is a rich principality, a part of Pakistan, but it is still ruled by the Wali of Swat. He invited us to an informal dinner. The Wali, bald, stout, broad shouldered, five feet eight and in his mid-fifties, is a friendly, outgoing person. His English is fluent; so this night he and I covered a lot of ground.

The Wali is proud of the progress he has brought to Swat. His country of more than 500,000 people now has free—though not compulsory—schools in most villages. In 1952 he established a college. The Wali is also proud of his six hospitals and the fact that all medical care in Swat is free. I turned the conversation to law.

Swat's Courts Scorn Lawyers

In most civil cases, the law of the Koran is the law of Swat. Should a case arise which cannot be settled by a mullah, or village religious leader, the aggrieved person may petition the Wali for permission to sue. In more serious criminal trials—such as those involving murder, rape, and adultery—the Wali himself sits in judgment.

In a recent murder case the following facts appeared: A married woman disappeared. Her mother grew suspicious and went to the police, who found the wife's body in a well. Eventually the husband confessed that he had choked her during a fight.

The Wali, invoking tribal law, ordered the man executed. It is customary in Swat for the nearest relative of the condemned man to do the killing. But the man's children were all quite young, and the Wali thought it would be unwise to wait until they had reached maturity. So he allowed the brother of the wife to be the executioner.

The police tied the defendant hand and foot to a tree. Then the brother-in-law stepped off a dozen paces and, turning, shot the man with his rifle.

"How many lawyers do you have in Swat?" I asked the Wali.

"None," he said.

"Who represents the defendant in a civil suit, or the accused in a criminal case?"

* See "Pakistan, New Nation in an Old Land," by Jean and Franc Short, NATIONAL GEOGRAPHIC MAGAZINE, November, 1952.

Afghan Rugs Start a Long Journey from Kabul to America

Tiny stalls line a labyrinth of dusty alleys in the capital's kaleidoscopic bazaar. Cobblers, smiths, hatters, and cloth merchants ply their trades, and rug vendors offer the exquisite handiwork of village folk.

A porter carries four rugs the author bought for his Washington, D. C., home.

Flat on the ground, Mercedes Douglas braces a loose exhaust pipe. Mrs. Douglas served as chief mechanic on the journey; for months before leaving home she studied car repair and shopped for spare parts. Mrs. Mary Watkins (left) traveled with the Douglases.

Water bags for desert travel festoon the car.

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"The defendant himself," said the Wali. "But the judge, of course, sees that he gets a fair trial."

I asked what would happen if an accused felt that he needed a lawyer.

"None would be appointed. You see, Mr. Justice, up here in Swat we have concluded that a lawyer only makes a lawsuit complicated and confusing!"

Back in Peshawar we made final arrangements for the trip west. Even the weather shared our mood; an unseasonable storm the night before our departure dropped the temperature a refreshing 40 degrees.

By six o'clock Mary, Mercedes, and I were on our way. Peshawar had slept late this cool, rainy morning; only a few bullock carts creaked through the streets. And when we entered the pass, the clouds began to break up. In 10 minutes the sky turned blue, perfect for color photographs. It was to be this way for more than six weeks.

There are three routes through the Khyber. We drove on a black-surfaced, two-lane road built by the British and well maintained by the Pakistanis. Above us ran a railroad; below wound an ancient caravan trail which leads west through the pass across Afghanistan and Iran. It is marked at highway intersections with signs understandable by anyone: pictures of a camel or a train of donkeys.

Pathans Live by Ancient Code

Much history, most of it bloody, has been written here by invaders—Greeks, White Huns, and Mongols among others. The British, latecomers, arrived in force during the First Afghan War, and were cut to ribbons by the Pathans: men of a dozen tribes of fierce, proud, independent hill people.*

The Pathans still live along the Khyber, clinging stubbornly to their ancient code: bravery in warfare; hospitality to every stranger, even though he be an enemy; and the avenging of insult.

Most of the modern Pathans still run sheep and goats. I have seen them with their herds high in the Hindu Kush Mountains of Afghanistan, where many go every spring. Some,

however, have become sedentary farmers, and most of the men of one tribe—the Shinwari—are truck drivers.

This bright, cool morning we saw some of the Shinwari driving on the road. When I signaled them, they invariably stopped, stepping down from the cab with wide grins that showed their excellent white teeth.

Mosque in Khyber Pass Honors Ali

At the narrowest point in the pass the Pathans have built a mosque in memory of Ali, son-in-law of the Prophet Mohammed. We could not tarry, however, for the trip to Kabul was a long one, and I wanted to arrive before dark. So we hurried down to the mouth of the funnel that empties onto a small plain. Passing through a gate, we entered Afghanistan, leaving the surfaced road for gravel.

On an earlier trip I had cleared customs at Loe Dakka, an outpost on the Kabul River about eight miles from the border. Now I naturally headed the same way, hardly noticing a large new structure we passed on the way.

That was my first mistake, for it was there that we were supposed to clear customs. My second mistake was in not having an interpreter. The languages of Afghanistan are Pushtu and Persian. I know no Pushtu and my Persian is limited.

I worried about this as I pulled into the shade of the Afghan administrative building at Dakka.

From the building emerged a tall, thin man with a three-day black beard. I handed him our passports and followed him inside to his barren office.

He extended his hand and asked me in Persian for other papers. Then he called in an assistant and they both talked to me in Persian. I could only shrug my shoulders to indicate ignorance.

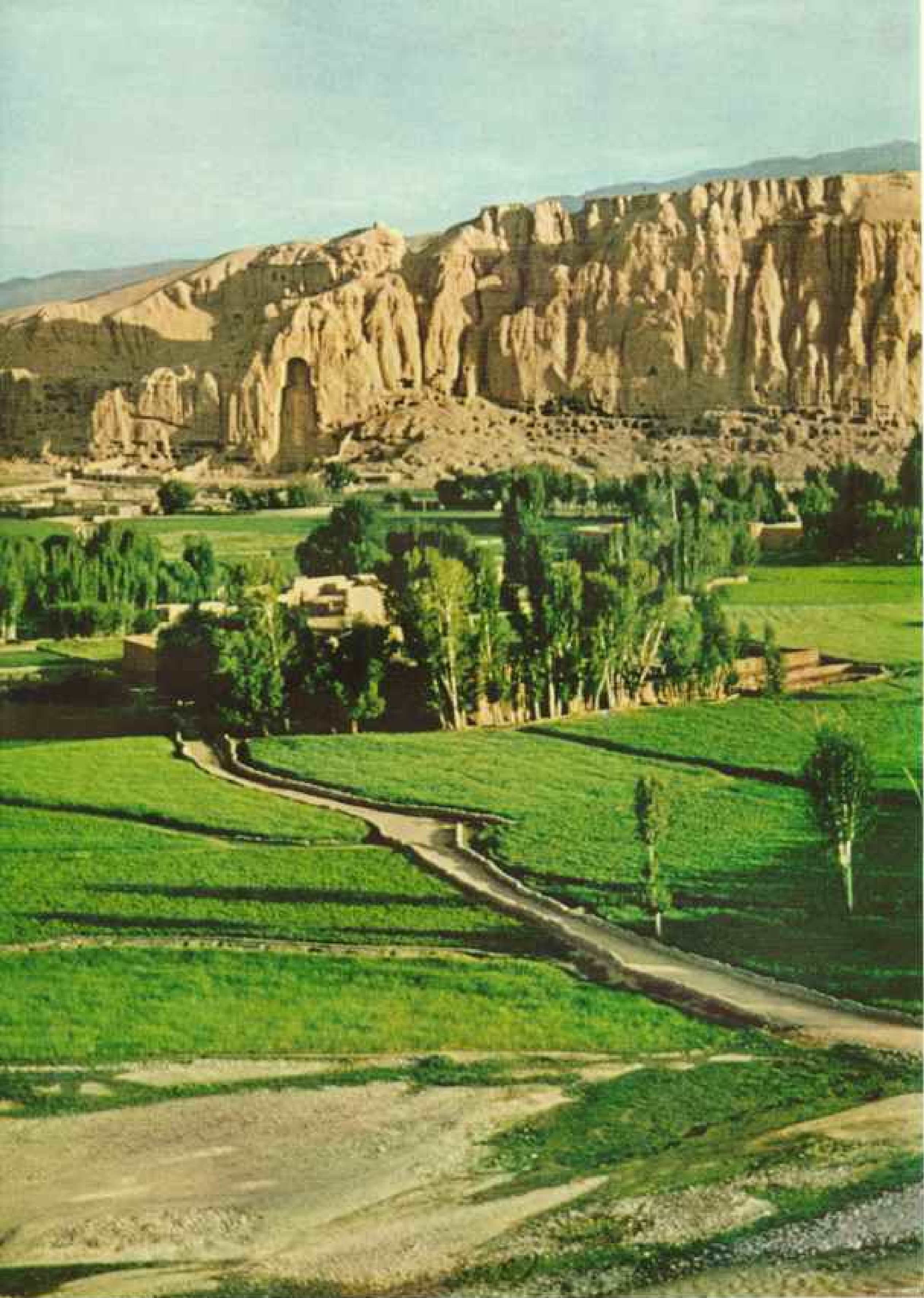
Finally there was a light in the eyes of the assistant and he said, "Customs."

* See "South of Khyber Pass," by Maynard Owen Williams, NATIONAL GEOGRAPHIC MAGAZINE, April, 1946.

Mountain Tribesmen, Dealers in Wood, Crowd a Kabul Market Place

This market offers kindling and charcoal, scarce commodities in forest-poor Afghanistan. Camel and donkey caravans haul in faggots gathered in remote mountain areas. Sellers turn profits into flour, rice, tea, and cotton cloth.

Lack of lumber prohibits frame houses in this city of 300,000. Mud-brick and stone dwellings use only a few wooden beams above the three-foot-thick walls.



8 Emerald Acres of Clover and Beans
Carpet Afghanistan's Bamian Basin

Beyond the verdant fields and tree-lined roads, caves of long-dead monks honeycomb the cliffs. Here, centuries ago, devout Buddhists sought seclusion from



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the world to meditate on the mystery of life. In the face of the towering wall they carved a giant Buddha (left and page 12) and a smaller image

(center). Scaling the sheer rock to reach their gloomy cells, the monks looked out upon this 8,000-foot-high valley, cool, green, and cloaked in silence.



"Asia welcomes the stranger who will fill the role of neighbor, drink its tea, and share

I replied that customs was *inja*—here.

"No, no," was the reply. He pointed toward the border, indicating that I must clear customs there. Then the man in charge raised another problem—something about our passports. After he had counted 15 on his fingers and pointed to the visa, I decided that our visas had expired, either 15 days ago or 15 days after their issue.

We could not go on, for our way was blocked. The alternative was to return to Peshawar for a new Afghan visa. And U. S. Ambassador and Mrs. Sheldon T. Mills expected us for dinner in Kabul that night.

An idea came to me. I pointed to the telephone: "Please call Kabul." Remembering an old Afghan friend, the Foreign Minister, I added, "Mohamed Naim."

Afghan Judges Wield Great Power

There was great activity when the call came through. "American *kazi*?" the assistant asked me. *Kazi* means judge.

"*Bali, bali*," I assented, and he fairly hugged me. Then Dakka went into action. A big room—obviously for VIP's—was opened up. We were ushered in, and a servant brought ice-cold fruit juice.

This special treatment was perhaps in part due to the fact that judges in Afghanistan are very powerful. The saying is that their power, stemming from their authority as religious leaders, extends "from frowning to death."

Two men once came before an Afghan judge, seeking settlement of a dispute. Each claimed to be the owner of several handfuls of coins. Whom should the judge believe?

The judge discovered the coins were oily, and made an instant decision: they belonged to the man who had greasy hands. Which one? He asked their occupations. One was a cloth merchant, the other a shepherd. Clearly, the coins belonged to the shepherd, because the handling of sheep is bound to get lanolin on the hands. And so he delivered the coins to the shepherd. That was not all. He ordered that the eyes of the merchant be removed.

Such a punishment is officially outlawed in Afghanistan today. But that very merchant, I was told, may still be seen wandering in the Kabul bazaar.

The dirt road west from Dakka traverses what many writers call the Afghan desert; there is no touch of green except along the



its worries," reports Justice Douglas after a two-month trek from Pakistan through Turkey

Kabul River. A herd of gazelles crossed the road ahead of us. A jackal slunk off to the south. The only vegetation was camel-thorn and scrub, until we reached Jalalabad and its shade of willow and poplar trees.

In the confusion of crossing the border we had forgotten to have the gasoline tank filled. So I asked a young man on the street: "*Benzine kojast?*"

He accompanied us to a filling station, where we faced a new problem. The government has a monopoly on gasoline; to buy it, one must have coupons.

We had none. Applying for coupons in Jalalabad would, I feared, involve us in an afternoon of red tape. So the volunteer guide, the filling station attendant, and I faced each other blankly. Then Mercedes had an idea.

"Our one-dollar bills," she said.

An Unusual Act of Friendship

We carry an emergency supply of United States dollars; we have found everyone, everywhere, willing to take them. Mercedes produced a dollar and laid it on top of some Pakistani rupees. The Afghan attendant hesitated, then took \$2.00 worth of rupees and the dollar bill, and gave us 10 gallons of gas-

oline. I signed a receipt to make the transaction as legal as possible. Then came an unusual act of friendship: Both the filling station attendant and the volunteer guide asked us to lunch. I declined with thanks, but I wondered whether we would be as thoughtful to a traveling Afghan in the United States.

We ate in the car as we drove through a hot, winding canyon. At a tributary of the Kabul River I unloaded the ladies and took the car across in low. Mercedes and Mary had to wade the stream.

"A blessing in disguise," I told them. "You will get wet and refreshingly cool."

In another few weeks the car would never have made the grade that lay before us. Most Afghan gasoline comes from Russia; woefully low in octane, it quickly fouls American motors.

The mountain road climbs through barren canyons, reaches many false tops, winds down for a spell, then leads to a new summit. There are 30 miles or more of sharp curves and no guardrail; in winter trucks often hurtle into the canyons.

I noticed that when I applied the brakes I got a violent pull to the left. I warned Mercedes and Mary, when it came their time to



drive, to be careful. Had I known what we learned next day in Kabul, I would have been too frightened to drive those dizzy curves at all. Vibration had loosened the nuts which secured our control of the left front wheel.

When at last the twisting road debouched onto the plain of Kabul, we were less than 15 miles from the city. Here we saw hundreds of families camping on the plains and tending their evening fires. Camels were grazing. The cries of playing children were shrill. We passed the brick kilns for which Kabul is famous, and then entered the city itself.

Political and economic capital of Afghanistan, Kabul has a population of some 300,000. When I saw it in 1951 many of its streets were dirt; now, with Russian aid, the main thoroughfares have been paved.

We saw two men and a woman who looked like Americans. "Where is the American Embassy?" I asked. One man gave me directions in perfect English.

"Thanks a lot," I said. "You folks here with the Point 4 aid program?"

"Point 4?" the speaker gasped. "We are Soviet citizens."

Russians Making Changes in Kabul

Realizing the success of U. S. economic aid to foreign countries, Russia has started a major program of its own. The most dramatic changes we noticed have been made by Soviet technicians, who are in Afghanistan in force. Russian jeeps and diesel trucks drive everywhere. Russian engineers survey roads and design bridges. Russian road-building equipment was the only kind we saw.

Kabul cannot be called a modern city; yet its progress exceeds that of the rest of the country. For one who enters Afghanistan steps back, by Western standards, several generations. There are still no paved roads outside Kabul. There is no sewage system in the towns. There is no railroad. There are a few airports; Kabul has fair air service—three flights a week to Tashkent in Russia and several to New Delhi, Karachi, and Tehran. But industrial development, as we of the West know it, still lies ahead.*

In Kabul we scoured the bazaars for auto accessories, for the way ahead would be rough. For one thing, we needed a funnel.

The search seemed endless, for every tin-smith had his own special kind. We finally found a small, mouselike man who wore steel-rimmed glasses and hopped about his stall in sprightly fashion; after disappearing into the rear, he returned with exactly the one we needed. We paid his price without haggling and went in search of a blacksmith who could make a set of U-bolts for our rear springs.

We found him in a section of the bazaar where ironsmiths and garage owners are neighbors. His shop could have been anywhere in the world, so familiar did it seem. The only difference was in the proprietor; he was a swarthy Pathan with a dark heavy beard and tightly wound turban.

Women Go Veiled to the Bazaar

Another day we went shopping in the rug section of the bazaar. Stalls here are crowded together on a narrow cobbled road; in each, rugs cover the floor, hang on walls, and stand rolled in every corner. The turbaned proprietors, descendants of many Central Asian peoples, sit barefooted on their wares.

Most of the people moving through the bazaar were men. Occasionally a woman would come through; invariably she would be dressed in the *chadari*, a tentlike dress that completely covers the head and body. Even the slits for the eyes are veiled (page 40).

Mohamed Ali Lowangin, acting as our guide, led us to a stall owned by a tall man with a thin mustache—a Mongol, Mohamed Ali told us. Here we found a rug just fitting Mercedes's requirements for our upstairs hall.

The haggling started. In half an hour Mohamed Ali turned to me.

"I need help," he said.

He enlisted the aid of a heavy-set Pathan from another stall. The Pathan turned upon his competitor with scorching words.

"What are they talking about?" I asked Mohamed Ali.

"The Mongol's father," he replied.

I whispered again, "Now what?"

"The Mongol's grandfather."

"Now what do they say?"

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "American Family in Afghanistan," by Rebecca Shannon Crosson, September, 1953; and "Back to Afghanistan," by Maynard Owen Williams, October, 1946.

Hewn from a Gibraltar of Sandstone, Bamian's Colossus Rears 16 Stories

The 175-foot Buddha lost hands, legs, and half a face when Moslem invaders sacked the thriving crossroads community in the 7th and 8th centuries. For the adventurous visitor, a dizzying catwalk at extreme upper left leads to the head of the sightless figure.



White Pigeons Spread a Living Prayer Rug
Before the Tomb of Ali

Muslims of all sects revere the memory of Hazrat Ali, son-in-law of the Prophet Mohammed. Ali died in Iraq but, according to Afghan belief, the faithful



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entombed his body here at Mazar-i-Sharif in northern Afghanistan. The shrine's brilliant cupolas cast their sparkle for miles across hot, wind-blown plains

running pancake-flat toward the Russian border. Special wardens feed the multitudes of pigeons that swarm the outer court.

"They're discussing the Mongol's great-grandfather. All," added Mohamed Ali in a whisper, "were thieves."

The clenched teeth of the Mongol showed that my new Pathan ally had made telling blows. At last the Pathan whispered to Mohamed Ali, who turned to me:

"We have a good price for you."

"You mean," I asked, "there's going to be no physical violence?"

Mohamed Ali passed the message along to the Pathan and they both laughed. We thanked the Pathan, paid for the rug, and left (page 5).

We had difficulty finding here an interpreter knowledgeable in English and Persian, and also available to travel with us to Herat. But there was an Afghan chauffeur on the

Dining Afghan style. Mercedes Douglas sits on the ground and eats with her fingers. With unleavened bread she scoops up bits of lamb, rice, and yoghurt. Tea and broiled chicken complete the meal.



American Embassy staff who was due for annual leave and wanted to earn additional money. I liked Mohamed Aslam instantly. He was a devout Moslem, married, the father of two children.

Aslam joined us at five the morning we left Kabul. So heavy was the load on the station wagon's roof that it actually buckled when we lashed a rope across the rack.

Our route would lead us across the mighty Hindu Kush and through the northern country along the Soviet border. With the lighthearted Aslam at the wheel, we wound through the valley of the Ghorband River, now dirty and brown from heavy rains. Magpies flew everywhere, filling the canyon with their cries.

Every square foot of the river bottom is cultivated. Rice, corn, and wheat are the main crops. This is also grape-growing country, much of the crop being exported to Russia as raisins. Every other farm seemed to have a tall mud tower with slits for ventilation; inside, the raisins are dried on trays.

Small family groups, with all their possessions loaded on donkeys, moved along the road. Babies and chickens were tied onto the packs; sometimes a goat led the way. These were migrant farm workers following the harvest up the Hindu Kush.

As we passed each group, Aslam would shout the Afghan greeting: "*Istala mashi!*" It means "May you never be tired"—and it reflects the friendliness one feels along the Afghan highways. The reply is "*Kwar mashi*—May you never be poor!"

Across the Snow-capped Hindu Kush

Slowly the valley narrowed to a winding defile. Even here land was farmed in thin, irregular strips. At the head of the canyon we came to a group of mud teahouses and merchant's stalls. This was bleak, barren country, with hardly a bush or a tree in sight. Then the road climbed steeply to Shibar Pass, 9,800 feet high.

Shibar is a historic pass. Generations of raiders brought captive Hindus past these peaks of perpetual snow. Such bitter journeys gave the range its name, Hindu Kush—"Killer of Hindus."

We saw the great snow peaks for some minutes as we dropped off the Shibar. Then we were again in a canyon, approaching Bamian, a village of several dozen mud houses.

Once Bamian was a great center of Buddhist learning. When the Chinese traveler Hsüan



An Afghan Governor Entertains His Visitors at a Poolside Luncheon

"A man of action," the author calls Gholam Haider Adalat, head of remote Maimana Province. "His roads are the best I saw in Afghanistan; he has built two new schools for girls and a fine new hospital." In a shaded garden at Qaisar, the official (left) queries his guests on events in the Western World. Justice Douglas in foreground wears a brimless hat of karakul.

Tsang came from the north in the 7th century and visited Bamian, he found 10 monasteries and 1,000 monks, and a village filled with people who had "the utmost devotion of heart."

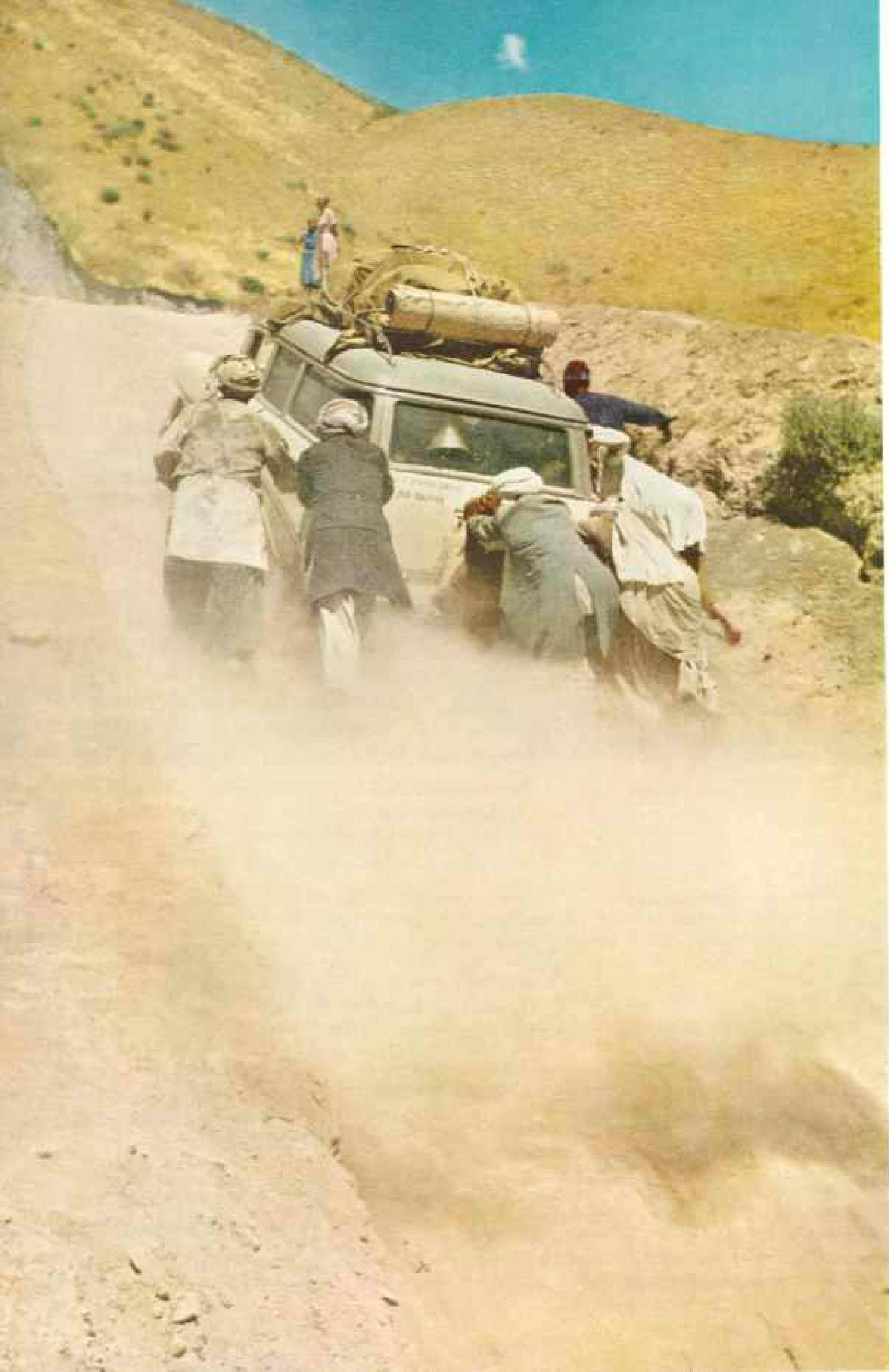
In a sandstone cliff on one side of the valley are carved huge figures of Buddha; the largest is about 175 feet tall (page 12). We climbed a steep path to the head of the great Buddha, and then explored some of the caves that pock the cliff. It is easy to visualize devout men meditating in these one-room cells. But eventually their peace and their monasteries were destroyed by invading Moslems.

It was almost dark by the time we reached the hotel, where an attendant waited at the door with a lantern. The wide, uncarpeted staircase creaked and echoed to our footsteps. There were kerosene lamps in our bedrooms

and a trickle of water from the tap at the washbowl. A cold north wind rattled the windows. In the dining room that night we ate by the light of a solitary flickering candle.

But the clear calm of the next morning brought Bamian a fresh beauty. To the north and south rose spurs of the Hindu Kush, purple below white peaks. The valley was dark, rich, soaked in color and quiet. I had been impressed before by the serenity of the sites Buddhists chose for their monasteries. Of them all, Bamian must head my list (pages 8-9).

As we left the village, our road quickly lost elevation and gained temperature. The Bamian River gorge is gaily painted in swirling pink, brown, green, purple, and copper, as if some gigantic finger had played in the molten rock. Apart from our own Southwest,



these gorges of the Hindu Kush are the most colorful I know.

We stopped at a small teahouse where turbaned Afghans sat eating rice and lamb with the aid of *nan*, the region's flat, unleavened bread. The proprietor, a small, wiry man in an indigo coat, brought us *chai*, tea. It was delicious.

Then I took our canvas bags to a filthy irrigation canal to get water for the radiator. As I filled the water bags, the son of the teahouse proprietor came down with a bucket. The water from the ditch went into his father's samovar to make our delicious tea!

After lunch a dust storm came from behind and pushed our own grit ahead of us, hiding the road. It was insufferably hot with our windows closed, but the dust was insufferable with windows open. Mercedes and Mary closed their windows; I opened mine. We were all miserable.

Drifting loess hid the depth of road ruts; in spite of the fine advice Aslam was getting from the ladies in the rear seat, we scraped bottom again and again.

Suddenly the muffler dropped off. Mercedes brought it inside, where it stayed for the rest of our Afghan journey.

That night, in the guesthouse at Pul-i-Khumri, Mercedes became severely ill. She was no better at 5 a. m., when we rose to get an early start, but insisted on being on the road. Then I found the left rear tire flat. There was no compressed air here; Aslam and I discovered that it takes 20 strokes with a hand pump to produce one pound of pressure in a tire.

Remote Valley Shelters Huge Flocks

In a dozen miles or so the road emerged into a broad valley perhaps 10 miles across, where barren mountains with easy slopes formed a huge bowl.

"Look!" Mary shouted. Before us I saw hundreds of camels and thousands of sheep. A small boy appeared, then a man of 40, then one of about 60, each wearing a turban, a patched coat, and loose, flowing trousers.

Aslam engaged the oldest one in conversation: Would he agree to have his picture taken?

The old man was all smiles at the prospect.

After taking pictures, we prepared to leave. Then the man told Aslam he wanted us to visit his camp.

From a knoll I could see a dozen or more black tents half a mile away. It was blistering hot, and Mercedes was still weak. But she agreed to accept the invitation. As we walked, I learned that the old man was a *malik*, the head of a tribe of nomads who wander the plains and hills of north Afghanistan. He and I led the way to the encampment; all the while he kept shouting commands to the women, who collected in one tent (page 20).

"He is telling them not to hide, that we are friends," Aslam explained. But I turned toward a group of tents where the men were gathered.

In the Tents of Afghan Nomads

These men, all barefoot and dressed in flowing trousers and rather dirty shirts, shook hands and ushered me into the shade of a black wool tent whose sides were rolled up so that every breath of air could enter.

We talked about sheep and camels, horses and donkeys. Judging by the value of their livestock, these nomads were wealthier by far than the average Afghan peasant. But they had no schools, no bazaars, no medicines. Their babies were born in black tents and a midwife attended the births. They were illiterate and wholly unaware of what went on in Kabul, let alone the world.

Yet I felt a warm glow of friendliness in this circle of men. A few of them were talented musicians; one brought out a homemade guitar and played plaintive music. Two other men sang. Their theme was the loneliness of people in a dry, barren land.

Meanwhile, I saw that the women of the tribe had Mercedes and Mary completely surrounded. Mary had learned in her travels that if she took out her mirror and applied lipstick and powder, she could overcome the shyness of Asian women. So Mary and Mercedes had passed around their compacts.

Soon I heard a scream. Then the whole crowd broke into laughter. Several of the nomad women, consumed with curiosity about Western undergarments, had got down on their

Turbaned Afghans Push the Douglasses' Car up a Slippery, Rutted Hill

Across Afghanistan the travelers fought loess, a wind-borne dust that plasters the roads in foot-deep deposits. Here spinning tires raise a swirling cloud that coats their car and clothes, penetrates suitcases, and even sifts into cameras.





Nomads Roam the Face of a Hot, Barren Land

Dwelling in black wool tents, these tribesmen herd camels and sheep in the lonely hills of northern Afghanistan. Patches of melons and wheat add to their diet of milk and cheese.

Exceedingly friendly, the herdsmen entertained the Douglases—the first Westerners to visit them—with the plaintive music of homemade guitars.

Girl of Shakh, wearing a cap of silver and embroidery, weaves a *maimouri* rug. Women of this western Afghan village make carpets in their homes; men dye the yarn.

"We saw hundreds of baby donkeys trailing their hard-working mothers," says Mrs. Douglas. "This one caught my fancy near Shakh."



knees to crawl under the skirts of their visitors.

The malik insisted we stay all night. He wanted to kill a sheep and roast it for us. But Mercedes was feeling miserable, and our timetable was tight. Reluctantly declining, I shook the hand of our host and said:

"I'll come again and visit you."

"*Inshallah*—if God wills," I added, as we turned to go.

We were well behind schedule when we arrived at Mazar-i-Sharif, and the hotel was the worst we had hit—iron cots with bedbugs, dry bathroom taps, and electric lights but no current. I asked the swarthy attendant to get us water for drinking. In my best Persian I emphasized that it had to be "*ab-i-jush*"—boiled water.

"Bali, bali, ab-i-jush," he replied.

Our bottle of drinking water soon collected a big deposit of dirt on the bottom. It had come from a brown irrigation ditch running through the bazaar.

Mercedes felt worse than ever. Since the thought of solid food was repulsive to her, I brought in our two-burner kerosene stove and set it up in the bathroom. Dried chicken soup, hot powdered milk, and crackers tasted good. For two days our battered stove spelled the difference between comfort and despair to an invalid in a bug-ridden, ill-smelling hotel on the wind-blown plains.

At Mazar-i-Sharif is a famous shrine in which, say Afghanistan's Sunni Moslems, the son-in-law of Mohammed lies buried (page 14). Mercedes, though still weak, went with us to see it. That night she came down with a fever and a bursting headache. Aspirin did not seem to help; so Aslam and I had a conference.

We had an ice bag, but no ice. However, some ice is cut from ponds in winter and stored in sawdust. I had seen a merchant in the bazaar selling cold soft drinks, and noticed that he had a piece in his pushcart.

I sent Aslam with the ice bag to ask the vendor to fill it. Not more than 15 minutes passed before Aslam returned with a grin and the ice pack crammed with shaved ice—all for ten cents. Mercedes had a good night; her fever was gone when the alarm went off at 5:30 a. m.

With a roar from our unmuffled exhaust, we left at 4:20 a. m. Our destination was Andkhui, 20 miles from the Russian border; the road was said to be the worst in all Afghanistan, and we wanted to pass it before the heat of the day.

Strange Escort Brings Good Luck

Shortly after a flaming sunrise came clouds of grasshoppers; some that fluttered in the window were more than three inches long. Following the grasshoppers flew flocks of starling-like birds with yellowish-white bodies and black wings. Aslam called them *sach*.

Apparently they had been feeding on grasshoppers. But when the station wagon appeared, they left the hunt and joined us. It was an amazing performance. For mile on mile at least a hundred of these birds kept in front of our car and only a few feet above it. When the road turned, the flock turned. Aslam was delighted, almost jumping up and down behind the steering wheel.

"Good luck!" he cried. "The *sach* always bring good luck to the Afghans."

With the good luck the *sach* brought us, we made it to Andkhui over roads piled with soft, drifting loess and grooved with ruts so deep that repeatedly we found ourselves stranded on the high center, with our wheels spinning futilely in the air. Then there was nothing for it but to push and dig.

In summer the 10,000 people of Andkhui, a town of mud houses, live in a constant dust storm. It shows in their faces and clothes. Even the leaves of the few trees are loaded with grime.

The people are mostly Turkomans. They

Grim Shell of a Mud-brick Citadel Perches Above Afghanistan's Herat

Alexander the Great fortified the city in the 4th century B. C. Later, Mongols repeatedly sacked it; on one occasion, the Afghan historian Khondamir records, 1,500,000 residents perished. Each time, Herat rose from its ashes. In the 15th century the crossroads metropolis ranked as one of the East's great centers of literature and art. Napping in the shade, shrouded figures (foreground) sleep on a stony mattress.

Straw Canopy Shades a Tire Changer in 120-degree Heat

"As we motored through a narrow defile near Robatak," recalls the author, "the searing heat of the canyon walls hit us like furnace blasts. A worse place for a blowout would be hard to imagine. The wheel lugs were too hot to touch; we had to use gloves." The Douglasses' chauffeur-interpreter pumps up the patched tire.



are Moslems, tall and angular, and wear black karakul hats even in the heat of summer.

Andkhui, in fact, is the karakul center of Afghanistan. These sheep produce lambs which are slaughtered within 30 days of their birth. Their curly, fleeced skins, so prized in Western lands, sell for only \$5 in the bazaar at Andkhui. It didn't take long for Mercedes, in temperature well over 100°, to acquire the makings of a new fur coat.

Afghan Women Remain in Seclusion

We would have enjoyed staying the night at Andkhui, but we had an invitation from Governor Gholam Haider Adalat (page 17) to visit him at Maimana, 88 miles farther west, so we drove on.

The Governor's house is a huge two-story residence with a spacious walled garden as big as several city lots. It was dark—10 p. m.—when we arrived. A table was laden with food, and there were comfortable chairs and sofas. We ate with the Governor and then excused ourselves almost at once, for we had had a long, hard day.

Next morning we sat for several hours in the Governor's garden, visiting with him and meeting his family. His wife was in purdah, like all Afghan women.

In Afghanistan purdah extends to every public appearance of a woman. As a result, most Afghan men go to the bazaar for food.

"I wish purdah would end," our driver had said, "so my wife could do the shopping."

That day we battled dust again, and in the evening we experienced the most frightening moment of the trip. We were now in the sheep country of western Maimana, and climbing steadily. The motor developed a great knock.

It was dark when we decided to pull off the road and cool the engine. We hated to do it, for we had worked hard to pass two trucks and dreaded eating their dust again.

The trucks had no sooner passed than they were swallowed in murky darkness. We could hear them in the distance, laboring up the escarpment. Our turn came next.

Once more we hit the deadly combination of slippery loess and deep ruts. Soon the axle began to scrape, and in a few seconds we were hung high again.

We pushed the car back a few feet. It was hopeless. The only thing to do was to unload the car, drive it, empty, up the narrow canyon, and carry the baggage to the top. How long a haul it would be, no one knew.

I began to feel uneasy and derelict on account of the women. It was not very long since three traveling Americans had been murdered in a lonely section of Iran. So I was conscious of bandits. Then I heard Mercedes gasp.

"Aslam!" she screamed.

I turned quickly to find myself surrounded by four—then eight—men. They had appeared without warning. I was certain that this was the end.

Acting as coolly as I could, I turned a flashlight into the faces of the strangers. All eight were grinning.

"They are the crew from the trucks up ahead," Aslam explained. "They've come to help us."

The eight Afghans went to work at once, unloading and piling our baggage on the side of the road. Then, while Aslam steered, they pushed the car. It disappeared in a great cloud of dust.

The Afghans silently loaded most of the baggage on their shoulders and carried it up the canyon. At the hilltop they insisted on loading the car and helping us lash the baggage on the rack. Then they stood around laughing and joking.

I was overwhelmed by this act of kindness and tried to give each of them a sizable tip. They refused.

"In our country," one of them spoke up, "we take care of one another. Every truck stops at the top of a hill to see whether anyone is coming. We waited to help you."

Friendliness Recalls Pioneer Days

The episode set me thinking. When we settled our West, we had our barn-raising and quilting parties. Civilization, so called, has carried us beyond such amenities. People in Afghanistan are still close to each other; their country, backward in some respects, is far advanced in friendliness.

An exception, though, is the Afghan sheep dog. Time and again as we passed the *yurts*, the domed tents of sheep tenders, these vicious dogs chased our car.

Near Herat a big red one came charging toward us. He reached the road going 30 miles an hour, and lunged straight for Aslam, who was driving with his window open.

By luck, the ventilating window formed a small shield for Aslam. Otherwise he might be dead today. The dog hit it with his shoulder, shattering the glass into hundreds of



Four Iranian Mechanics Work Four Hours. Total Cost: \$1.65!

The Douglas party arrived in Behshahr just as the last drop of gasoline drained from a punctured tank. Garagemen jacked up the car, resting the rear axle on wooden blocks. Then they removed the tank, cleaned it, and welded the hole with an acetylene torch.

pieces. Aslam, visibly shaken, slowed down. As the dust cleared, I saw the animal slinking away with a limp.

We reached the hotel in Herat about two o'clock in the morning. A sleepy manager appeared.

"Four of you?" he stammered. "I expected only one."

Aslam found a bed in the servants' quarters. Mercedes decided that I should take the single bed; she and Mary would sleep on sofas in the lobby.

"Impossible," snorted the manager. But that was the viewpoint of a man who knew women only in purdah.

"I'm too tired to argue," said Mary, who was already spreading a sleeping bag on a lobby sofa.

Though we stayed only two days in Herat, it became one of my favorite spots (page 23). A green city of 80,000, it lies in a huge bowl rimmed on two sides by low hills. Herat's buildings, with few exceptions, are

low, flat mud houses. The dirt and cobblestone streets are wide and clean, and their sides are lined with pine and tamarisk.

On the edge of the present city stands a huge mosque dating from the 12th century. A bronze bowl five feet tall stands in the courtyard. It was the custom of Shah Sultan Hussein, who rebuilt the mosque, to summon the poor to the bowl and feed them each year on a holy day. On festive occasions the Shah would have the bowl filled with sherbet—a sweet, cold drink that we of the West later froze into a dessert.

Wire Fence Marks Iranian Frontier

Aslam could not go with us to Iran, now only a few miles away. Parting was hard, for we had enjoyed his cheerful company. We said goodbye several times and drove off leaving him standing forlornly in the street.

We passed through customs quickly, filled the tank with the last of our Russian gasoline, and drove across a frontier marked by a wire



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A Fountain of Emeralds and Diamonds Sprays from a Persian Crown

Six keys, each guarded by a different man, unlock the Tehran vault holding these treasures. Government officials, showing the Douglasses the hoard of gem-encrusted crowns, swords, belts, helmets, goblets, tiaras, watches, and other regalia, estimated their value at \$60,000,000.

fence onto the barren plains of Khurasan. Roads were noticeably better than those in Afghanistan, and I stepped on the gas. But as we approached 30 miles an hour, the motor knocked alarmingly.

About an hour from the town of Torbat-e Jām a policeman on a motorcycle flagged us down. He greeted me with a "Salaam" and handed me a letter written in ink:

"Dear Sir - Vilyom Duclac—

I got information that you . . . will reach to Torbat jame at noon for this reason my duty told me to come to Hasanabad for you. I am sorry you did not come yet, for this reason I am going halk to racol to my gonderme to stay nove the town and guide you. Anyhow this proud for me that to serve my duty in the best way.

Captain ARAD
Chief of Jendarmy in Torbat-jam
Sincerely yours
Arad"

At Torbat the gendarmes guided us to Cap-

tain Arad's house and we were invited to lunch—chicken, yoghurt, and nan, and for dessert, cake, cookies, melons, plums, grapes, and cherries, for which this area is famous.

Then we drove on across a desertlike country where barren, broken peaks loomed purple in the distance. When at last we reached Meshed, after dark, I turned off the motor and it gave an ominous cough—the last wheeze left. In the morning the car had to be towed to a garage.

Arabian Nights Caliph Buried in Meshed

Meshed, in the province of Khurasan, is a plateau city of 250,000 population. Its point of greatest interest is the Shrine of Imam Riza, which rises above a mass of poplar trees near the center of the city. Here also is buried the Caliph of *The Arabian Nights*, Harun al-Rashid, who lived in the 8th century.

From one of the minarets of the golden shrine I had a broad view of Meshed and the surrounding land. Most Khurasan farmers are tenants, and Islamic religious institutions

Justice Douglas Visits with Iran's Shah at His Shemirān Summer Palace

"We talked of Iran's strategic geographic position," reports the author, "and the Shah told me of his state visit to the Soviet Union. He paid me the finest compliment an American can expect abroad when he said: 'You are one of the few foreigners who understand us.'"







Persian Seiners Beach Their Catch from the Caspian's Brackish Waters

At Pahlavi, a major Iranian port on the Caspian Sea, fishermen wade the shallows to set their big net. Then they labor slowly toward shore and spill their harvest onto the sands.

Caviar from Caspian sturgeon finds a ready market in Russia, which shares with Iran this largest of the world's landlocked seas.

An Iranian housewife does the family wash along the Caspian shore (opposite below).

Holiday crowds from Babol Sar, at the sea's southern end, throng the beach on Friday, the Moslem Sabbath. Families camp for miles along the shore, each stretching a bit of canvas for shade. Vendors of leek melons and roasting eels parade the strand. Only the most sophisticated Iranian women appear in bathing suits; the majority, like this family group trailing a shirt-sleeved stroller, still prefer the traditional tentlike *chadari*.

Photographs by Jean and Franck Blau, National Geographic Staff, and (lower right) William O. and Mercedes H. Douglas © N.G.S.



own much of the land. The shrine alone owns about one-ninth of all the agricultural acreage of this province, along with bazaar real estate rented to shopkeepers. To take care of its properties, the shrine employs 1,700 people.

The shrine's museum, beautiful and well cared for, has one of the finest collections of Islamic manuscripts in the world. Rare pottery, carvings in ivory and turquoise, gold plate, rugs, and paintings crowd its showcases and walls.

A United States Army sergeant in Meshed volunteered to work on our car. He turned out to be one of the best mechanics who ever touched an automobile. He replaced the carburetor, hopelessly gummed up by Russian gasoline, and installed a new muffler.

Corn on the Cob on the Caspian

We were now equipped to leave for the Caspian Sea. We drove from Meshed through countryside that resembled eastern Oregon, except that the hills are barer. Iranians told us that this was wooded country years ago, thick with oak. But the trees were cut for charcoal, and goats ate the saplings. Today one sees only an occasional canyon where willows and poplars grow.

Plagued by road construction and a punctured gas tank (page 25), we spent two days driving to Bābol Sar on the Caspian. We reached our hotel at 11:30 p. m., grateful for showers and bed.

Bābol Sar has two main attractions: a caviar plant and a beach. The caviar industry flourishes from October to May; this was July and few sturgeon were caught during our visit.

The beach was another matter. We spent hours enjoying the sand, spread a quarter of a mile wide. Our first day there was Friday, the Moslem Sabbath, and families packed the waterfront. Hawkers walked up and down, selling melons and roasting ears. The melons, iced in great tubs, were bought by the hundreds; their rinds soon covered the beach. The ears of corn were turned over charcoal in large iron pans and dipped in a mixture of salt and oil.

Sailboats plied the southern end of the Caspian, anchoring in a yacht basin near here. Men brought their saddle ponies down to the sea for washing and scrubbing. Children ran and splashed on the edges.

Through Pahlavī, Iran's big port on the Caspian, are shipped the caviar and cotton

which the country sells to Russia. In exchange, Persians get manufactured products, including automobiles and steel.

When we arrived, a Russian ship stood in port. It was still unloading. The Russian crew gathered on deck to cheer and jeer as we took photographs. One held his straw hat over his face so that he would not be recorded on a spy's film.

Their cargo was a shipment of Western-type toilets made in Russia. They had unloaded 200 before Mercedes's insistent call turned me back to the car.

It is a six-hour drive over the Elburz Mountains to Tehran, with a good dirt road practically all the way. Not that we didn't have our share of trouble. First the new muffler came loose. It was almost red hot, and when Mercedes tried to take it off, it fell on her left hand and arm, burning her severely. We bandaged her as best we could and went on, only to find our way blocked by a stalled truck. It stood squarely in the middle of the road, out of fuel. Not until I provided some gasoline from one of our reserve jerry cans could the jammed traffic move again.

We practically coasted after that, dropping to the warm, rather barren plains of Tehran. Far in the distance the dome of a mosque pierced upward from mud roofs.

Though Tehran stands at an elevation of nearly 4,000 feet, it is a hot, sticky town in summertime. We stayed in a hotel owned by the Iranian Government in Shemīrān, a suburb nearly 6,000 feet high containing some of Tehran's loveliest homes. Breakfast is served in one's room, lunch in an inside dining room, and dinner on a tiled terrace around a large pool frequented by a lonesome male swan. It was so delightfully cool that we slept 10 hours without waking the first night.

Tehran, City of Beautiful Gardens

Nowhere in the East do I know of a spot with more beautiful walled gardens. Sparkling pools, tall pines, winding paths, roses, geraniums, and hollyhocks abound in designs as intricate as the personalities of the owners.

Tehran is more of a Western than an Eastern town. Mosques and gardens give an imprint of the East, but architecture and broad avenues of modern shops are Western. Even the tap water is pure.

While the station wagon spent several days in the garage, we flew to Shīrāz and Isfahan.

A Tomb in Shiráz Honors the Memory of the Poet Sa'di

*All night I wait for one
whose dawn-like face
Lendeth fresh radiance
to the morning's grace.*

Lines like these earned Sa'di the title "Nightingale of Persia"; they have kept his name alive for centuries.

During a long life—Persian tradition has it that he died in 1291 at the age of 107—the poet made more than a dozen pilgrimages to Mecca and traveled widely in India, Africa, and Asia Minor.

A blue-tiled tower marks Sa'di's tomb, set amid poplars, cypresses, and orange trees.

Bug cleaners raise clouds of dust beside the Zāyandeh River at Isfahan. After beating the carpets, the men wash them in the river.

Galleries for pedestrians lie behind the graceful arches of the Allahverdi Khan bridge.



Shirāz "turns aside the heart of the wanderer from his native land," wrote the poet Sa'di, who lies buried in this city (page 31). And to Hafiz, another Persian poet buried here, it was a "site without peer."

Flying over Shirāz, a traveler is persuaded to agree. The city rests nearly a mile above sea level in a green plain. Streets are wide; turquoise domes and slender minarets stand in splendor.*

Shirāz also has a modern \$6,000,000 hospital, built with funds donated by wealthy, public-spirited Mohamed Nemazee. It was there that we went, as soon as we had eaten lunch, to have Mercedes's burns dressed.

The tomb of Hafiz is a pleasant garden spot, with a marble crypt resting under a canopy supported by stone pillars. Persians customarily bring a volume of Hafiz's poems, kneel at the tomb, then slip their fingers at random into the volume and read the message they find.

One man was there when we arrived. He opened his book and read this passage:

"God counts our tears and knows our misery; Ah, weep not! . . . Take thy Koran and recite Litanies infinite, and weep no more!"

His eyes lit up.

"Good news?" I asked.

"Yes," he replied. "I had lost my job. But now things look better for me."

Kanats Bring Water from the Hills

Northeast of Shirāz stretches a vast plain known as the Marv Dasht. This is irrigated country, growing mostly sugar beets, and here the United States, under Point 4, directs an experimental station. One of the main features was a diesel engine that pumped water from deep wells for irrigation.

But when I talked with Iranian landlords, they told me this system is far more expensive than the *kanat*, or underground tunnel, extensively used in all Iran.

The *kanat* taps underground reservoirs of water in a land where surface streams are scarce and runoff quick and wasteful. Iran has at least 20,000 of them. Each is a series

of wells and connecting tunnels, starting with a mother well high on a slope.

The mother well, dug by hand, may be 100 or more feet deep. Once water is struck, the direction of its flow is estimated and the diggers go downhill a few rods to sink another well. The two are then linked by a tunnel. As more wells are dug and tunnels made, a flowing underground waterway is produced.

The *kanat* may not be efficient by Western standards, but it works, it is relatively cheap to operate, and it irrigates much of Iran. I was to be convinced more than once on this trip that the "outmoded" methods of ancient vintage are often better suited to Asian needs than the modern methods of the West.

Dig Uncovers Darius's Capital

Not far from Shirāz we visited the ruins of Persepolis, fabulously rich in ancient times but now only a collection of mud houses and a modern, rambling one-story hotel. As soon as we had registered, Mary was on her way.

"Not much daylight left," she said. "You go on to the rooms if you like. I'm heading for the dig."

The dig was an archeological excavation uncovering the 2,500-year-old capital of Darius the Great. The palaces stood on a terrace of many acres backed against a mountain and supported on three sides by retaining walls 14 to 50 feet high.† Here is the Gate of Xerxes, Darius's son, decorated with figures 17 feet high. They have been badly mutilated by time and defaced by tourists, who have carved their names here over the centuries. Here too are the ruins of the columned Apadana, or audience hall, and the royal treasury.

Flying on to Isfahan, a city of more than 250,000 people, was for me a reunion with old friends. For Mercedes and Mary it provided an introduction to a fabulous city.

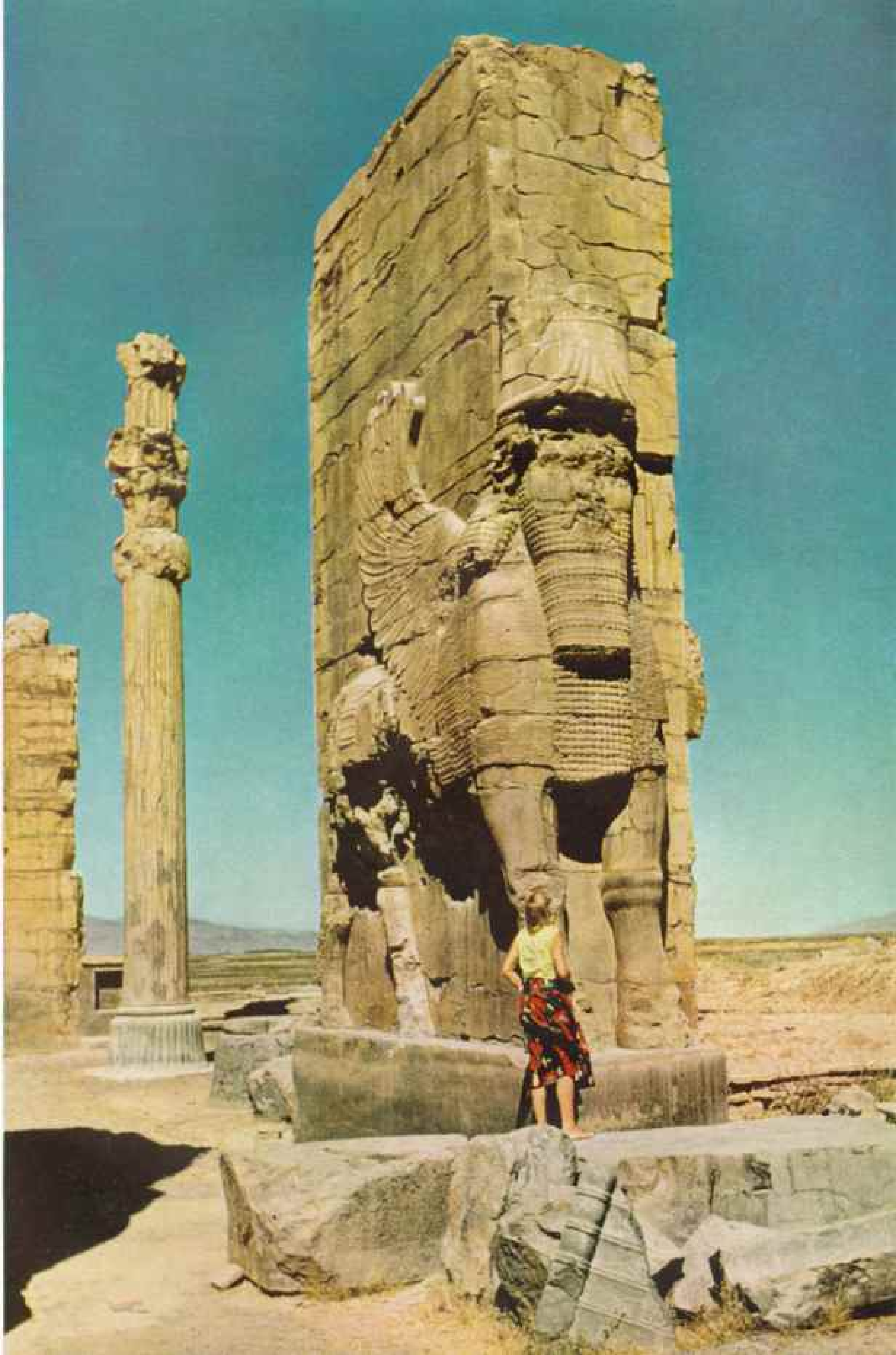
(Continued on page 41)

* See "Old and New in Persia," by the Baroness Ravensdale, NATIONAL GEOGRAPHIC MAGAZINE, September, 1939.

† See "Exploring the Secrets of Persepolis," by Charles Breasted, NATIONAL GEOGRAPHIC MAGAZINE, October, 1933.

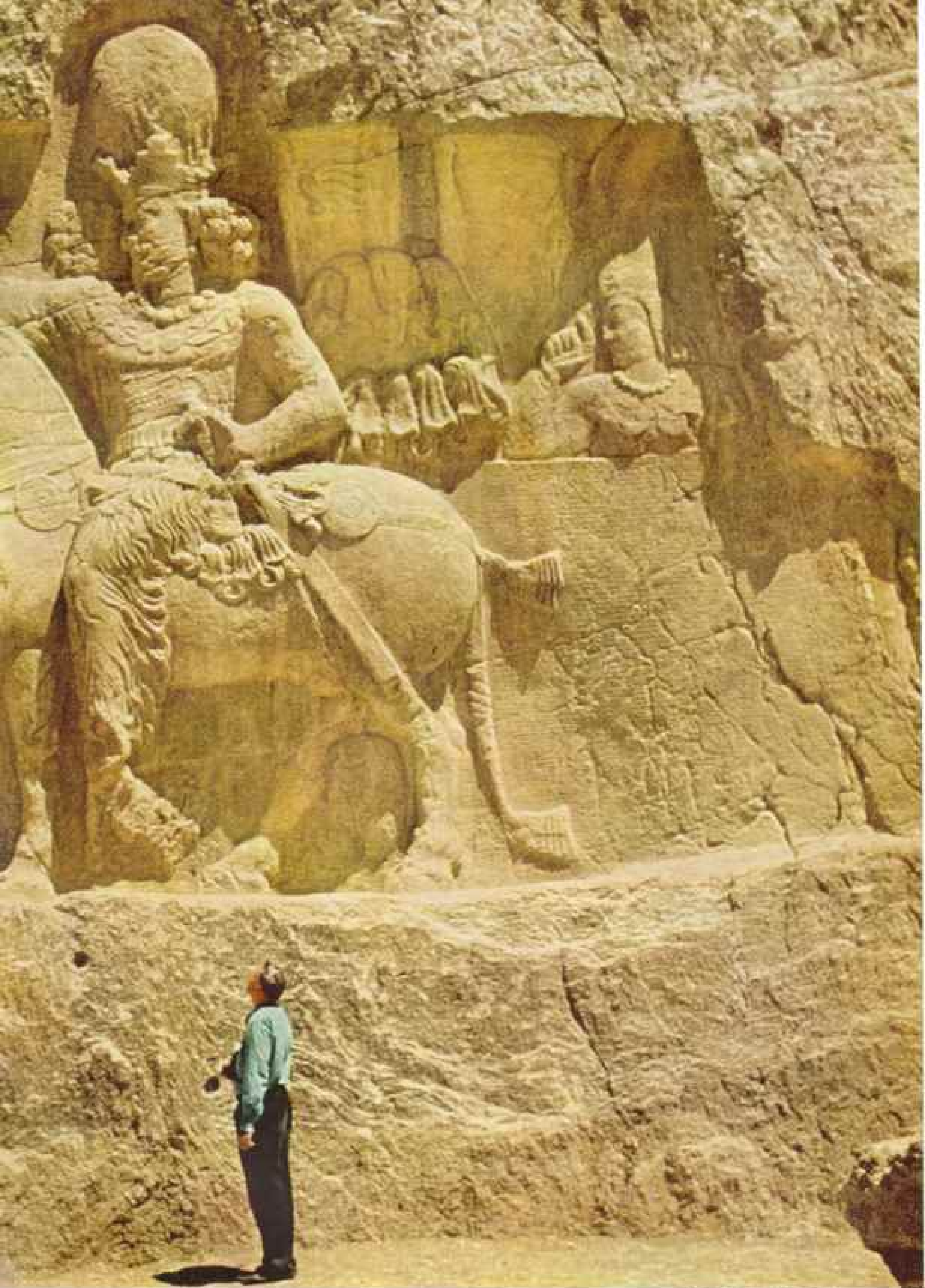
Winged Man-bull Stands Guard over the Desert Ruins of Persepolis

Royal seat of the Achaemenian kings, Persepolis was a Persian treasure city 2,500 years ago. Here stood the palace of Darius, the throne room of Artaxerxes, the pillared Apadana of Xerxes. When Alexander of Macedon conquered the capital, he carried away 4,500 tons of gold and silver, loaded on the backs of 5,000 camels and 20,000 mules. Then the carousing conqueror burned the palaces in reprisal for the destruction of Athens by the Persians.



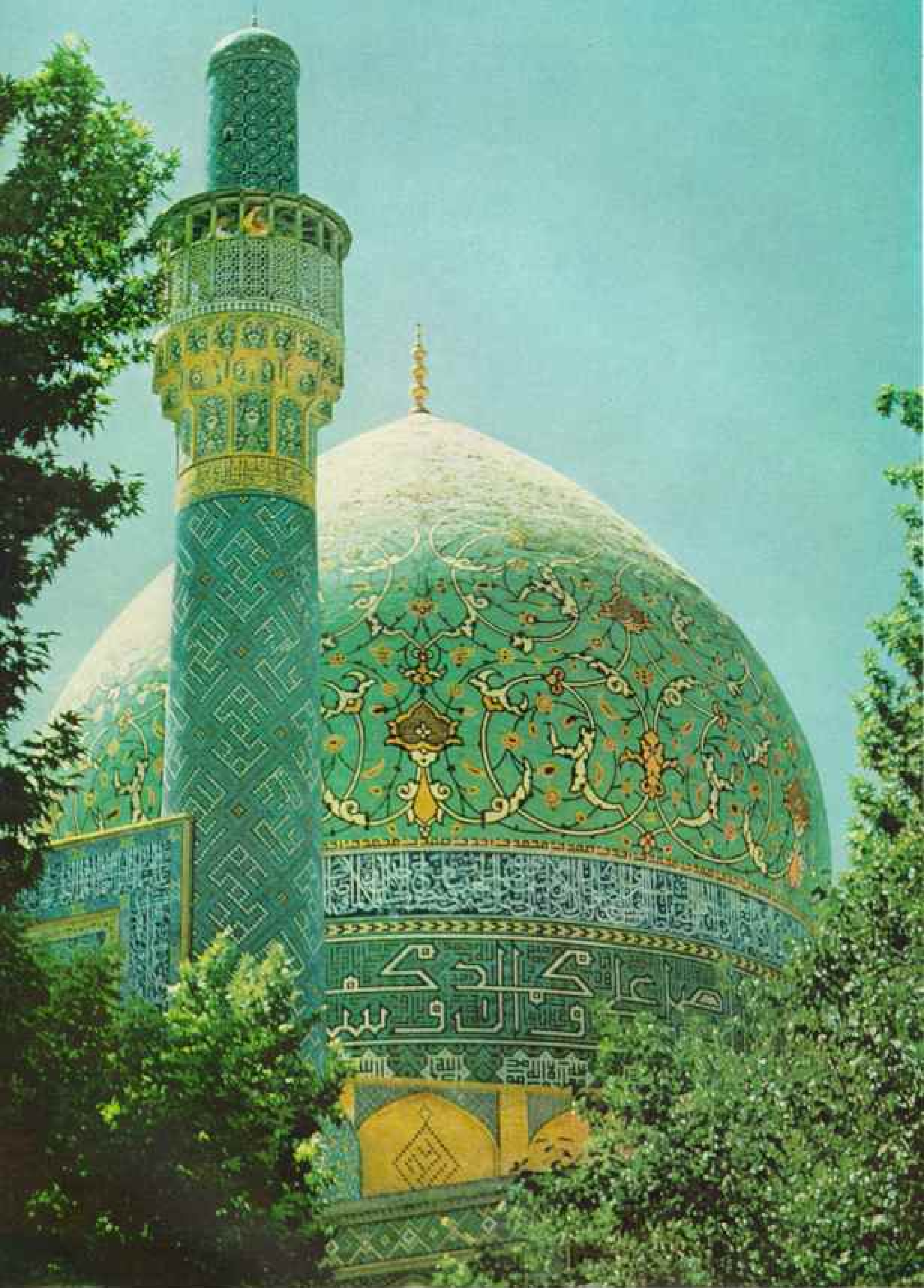


Rock Carvings of Persian Victories Panel the Cliffside Tombs of Achaemenian Kings



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Near Persepolis. Here the Roman Emperor Valerian Kneels at the Feet of Shapur I



© National Geographic Society

The Author Surveys Isfahan from a Minaret at the School of the Mother of the Shah

A Child Rugmaker Works Her Fingers as Fast as Spindles

Cross-legged on a board, this seven-year-old labors from dawn to dusk in the Isfahan bazaar. The largest rugs may take 9 child-years to finish.

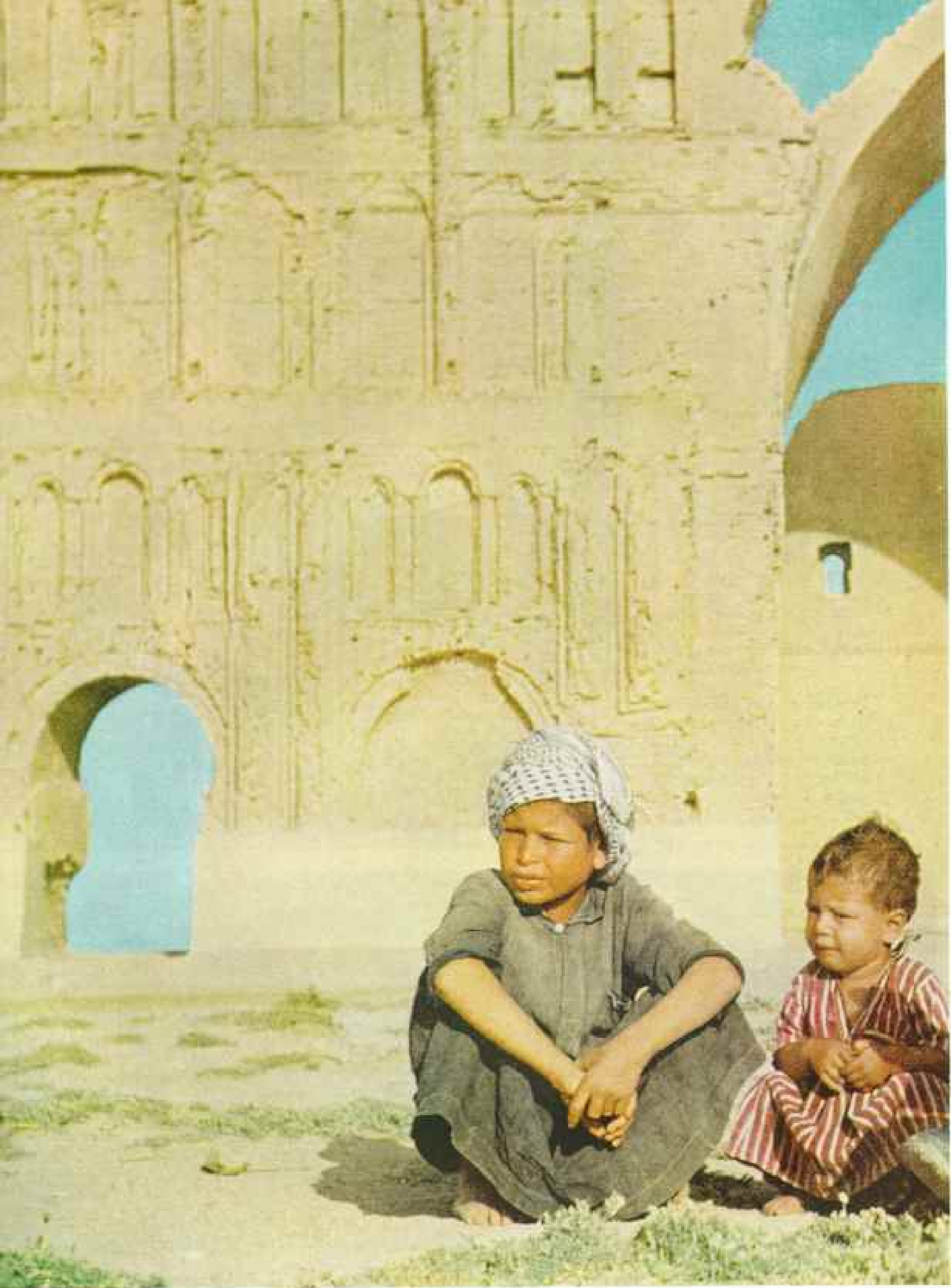
Isfahan rugs, though not the best in Iran, are of high quality. Girls of 5 to 16 do most of the weaving, tying the tiny knots with incredible speed.

Shafts of light from windows in high, vaulted ceilings guide craftsmen of varied origins—Persians, Armenians, Jews, and men of many tribes. Artisans create delicate gold and silver jewelry; barefooted woodworkers hold boards with their toes; blacksmiths shoe horses; merchants sit behind burlap sacks open to show their wares: spices, sugar, dried fruit, sweets, and tobacco.

"No other Asian market place," says the author, "matches the color and atmosphere of the Isfahan bazaar."

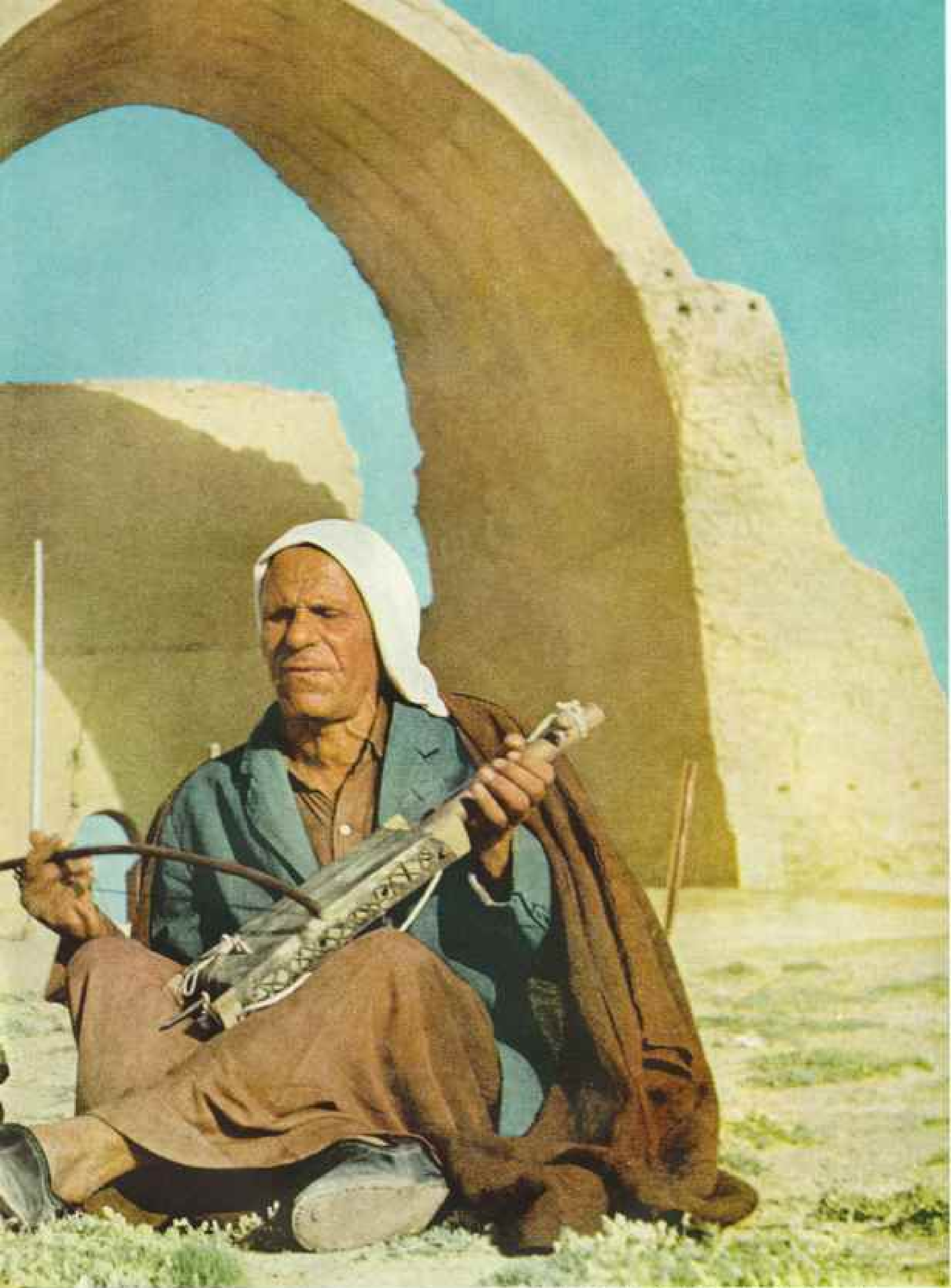
Designs of old Persia still glow in Isfahan. Using a hand-carved block, this textile printer transfers the inked pattern to a nearly completed square of cloth.





**A Blind Beggar Plays Melancholy Strains
Beside the Mighty Arch of Ctesiphon**

When the ancient Persians held sway over the Near East, Ctesiphon served as their winter capital. Arab legions plundered the city A. D. 637. Today only a



Kodachrome by Gerald Greenlee © National Geographic Society

few thick walls and a huge vaulted ceiling still stand. The arch, world's longest span of unreinforced brick, soars 121 feet above a floor once carpeted from

wall to wall with an 80-by-90-foot rug. Each time the Douglasses visited the ruins, day or night, this sightless musician serenaded them with his primitive viol.



Veiled Women Stroll in Baghdad Garden

Mercedes Douglas (left) and Mary Watkins bought these all-concealing chaderis in Afghanistan, but had no opportunity to model them until they reached the Iraqi capital.

© National Geographic Society

Unlike Tehran, Isfahan has little mark of the West. There are streets of shops, but the main bazaar is covered with vaulted roofs. Every house, no matter how small, has a walled garden, and every garden has a rose. The city has a collection of mosques and shrines it would take weeks to explore (p. 36).

The magnificent Friday Mosque dates from the 11th century. The Royal Square boasts the palace of Shah Abbas, the Mosque of the Shah, and the Mosque of Sheikh Lutfullah, with the most delicate and colorful tilework in all Asia. Its dome has a soft green-yellow hue; at dusk it fairly glows.

Musicians Salute the Setting Sun

But the one spot in Isfahan that we never tired of visiting was the bazaar (page 37). Atop its main entrance rises the Nakkar Khaneh—the Drum House. From it musicians play at sunset, “drumming down the sun.” Under the vaulted roofs of the bazaar itself tiny windows let in dust-flecked shafts of light. Streets just wide enough for animal transport trailed off at angles, leading to courtyards that served as freight depots for the unloading of camels and donkeys.

Coppersmiths and brassworkers labored so noisily that we could not hear one another talk. In quieter spots merchants sat behind burlap sacks opened to show spices and dried fruits. Blindfolded camels plodded in circles, turning cottonseed oil presses.

Apart from the sounds are the odors. We of the West have shut up all our odors in tin cans; the East has preserved them for the nostrils. Spices, tobacco, sweets, camel dung,



donkeys, and people all fill the bazaar with a pungent odor. This smell comes back in memory more frequently than the sights themselves.

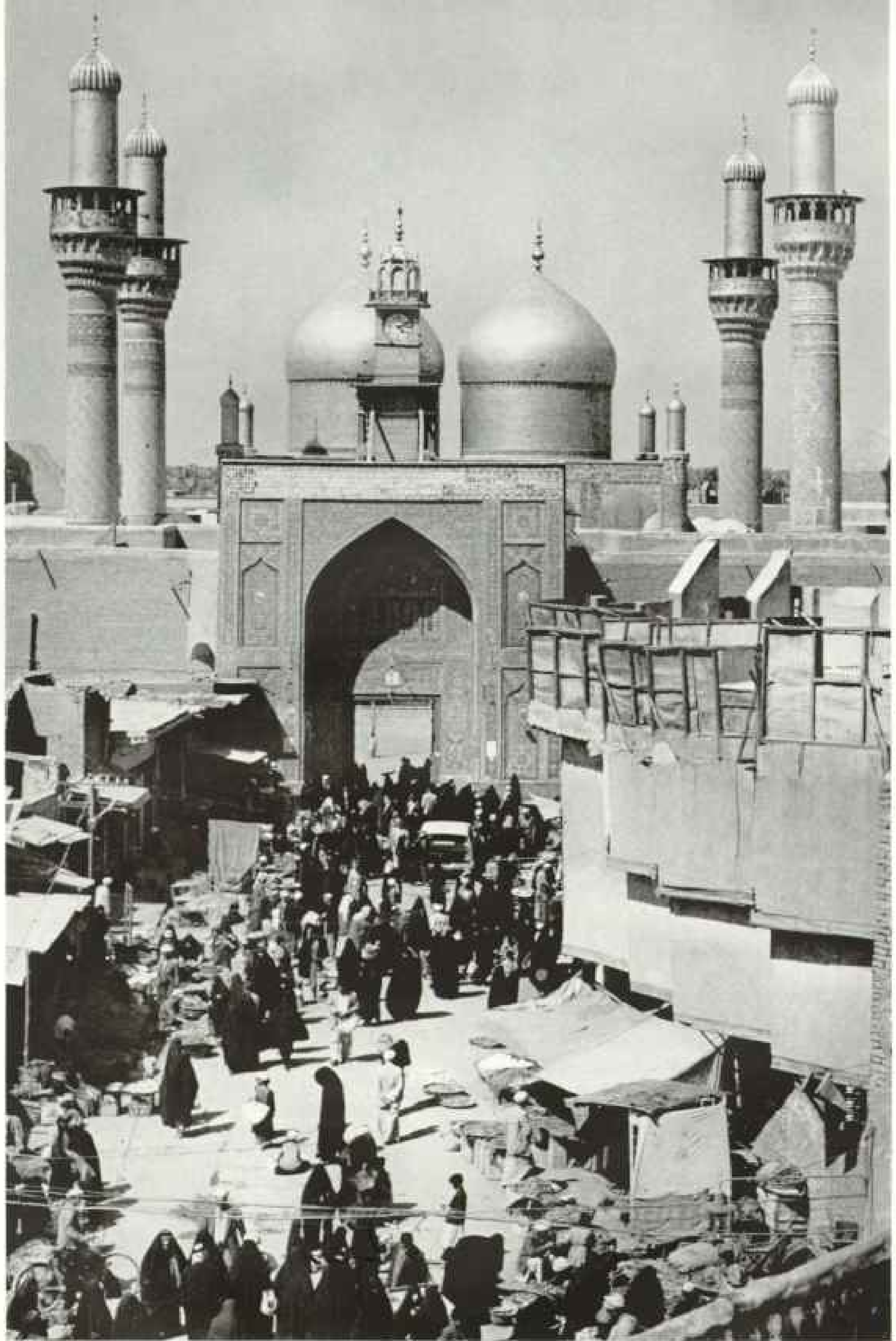
We stopped at a rug factory in a corner of the bazaar. One or two women supervised the looms, but the work was done chiefly by young girls from 5 to 16.

The looms were vertical. The girls sat on boards, working upward from the bottom edge of the rug. Their fingers moved as fast as spindles, and their faces were pressed to the loom as they tied the tiny knots with lightning speed. Malnutrition, disease, and darkness take their toll; a girl who starts at 5 years of age is often blind when she reaches 21.

After visiting old friends and meeting new ones in Isfahan, we flew back to Tehran and visited the Shah at his summer palace in Shemirān (page 27). His role is to guide Iran in a period of transition, to safeguard it from Communist infiltration. It is a difficult task. Iran and Russia have a common 1,300-mile border far removed from outside help.*

The Shah talked of his state visit to the U.S.S.R. in 1956.

* See “Journey into Troubled Iran,” by George W. Long, NATIONAL GEOGRAPHIC MAGAZINE, October, 1951.



42 Above a Crowded Bazaar Rise the Golden Domes of Kadhimain, Moslem Shrine near Baghdad.

"When Khrushchev started to reprimand me for joining the Baghdad Pact," the Shah told me, "I interrupted to say that I did so only as a safeguard against Russian aggression."

We talked of his sale of royal lands to villagers and the building on them of modern communities. These sales involve only a fraction of Iran's lands, but the Shah hopes to set an example for other landlords.

Chilled sherbet was brought in as our talk turned to the United States, to places that we both liked—particularly California—and to mutual friends.

The time came to go. He held my hand in a friendly clasp, and turned to Mercedes to pay me the finest compliment an American can expect abroad. I felt a blush as he said, "You are one of the few foreigners who understand us."

Looking Glass Deflects Evil Eye

The Shah is a gracious host. But so is his modest countryman, the tenant farmer named Ali whom I met a few days later on the road to Hamadan.

We had left Tehran in our now smoothly running car, heading toward Iraq. Mercedes was driving when we came to so striking a picture that I asked her to stop. An unveiled Persian woman, dressed in gay colors, was driving her cattle upon a threshing floor. Near her was an old man, perhaps 70. He was tall and spare and had a long, oval head with remarkably patrician features.

"May I take your wife's photograph?" I asked.

"Bali, ball," he said without hesitation.

When I had finished, he asked me to sit down. We sought the shade of a stack of straw.

The old man's name was Ali. He farms the same tract that was cultivated by his father before him. He has even inherited some of his debts, loans made by the father and grandfather of his own landlord.

There is no doctor in Ali's village, nor is there a first-aid center. No medicines are available, not even aspirin. The people resort to sorcery and old wives' cures. Ali's wife wears an agate to fend off evil. She puts olive oil on wounds or sores; she treats diarrhea by binding charred peachstones on the navel; she uses garlic to drive off cholera, mulberry leaves to combat carbuncles, and oleander to keep fleas away.

There is a yellow herb called rue which

has medicinal value. Ali's wife wears a sprig of it for good luck; she also burns it so that the smoke may ward off evil.

The blood of a sheep may be spread across the road leading to the village to keep out a plague. Or a piece of a looking glass may be put there to deflect the evil eye.

Yet Ali, like most Iranians, was hospitable. By stopping here, I had become his guest. He reached into the straw and pulled out a jug of water.

"It is cold and you are thirsty," he said, handing me the vessel.

On our way to the Iraqi border we drove through a barren expanse of canyons and defiles. This is the northern fringe of Luristan, the ancient home of the Lurs, one of Persia's four major tribal groups. They once had wealthy leaders and a highly organized tribal government, but that day is past. They are today an unorganized, illiterate, and miserable people. One can travel all rural Luristan and find no schools for girls and only a few for boys. Even the latter stop at the fourth grade. One hears the expression "as poor as a Lur."

We saw many Lurs as we drove along. Each wore a large, loose turban of black-and-white cloth. I talked with probably a dozen of them. Their faces always lit up when I said I had been with their people on an earlier trip. There is pride in tribe and ancestry, and one who befriends a Lur makes friends with an entire community.*

Great Dikes Protect Baghdad

Our Iranian sojourn was nearing an end when we crossed the Zagros Mountains and descended into the heavy warmth of the Tigris and Euphrates plain.

Our major stop for customs when we crossed the Iraqi border was Khānaqīn, a small town with shady streets. Then the road dropped into land heavily eroded from overgrazing and fast runoff. Villages were scarce. Time and again we crossed a railroad track, the line to Baghdad from Khānaqīn. Then came the vast, flat plain, and the thermometer edged toward 120°.

Approaching Baghdad, we passed the great dikes erected to save the city from flood. Then, touring the city, we crossed the river on the Queen Aliyah Bridge. By the water's

*See "Mountain Tribes of Iran and Iraq," by Harold Lamb, NATIONAL GEOGRAPHIC MAGAZINE, March, 1946.



Aproned for action, Mercedes Douglas gives the battered station wagon a final inspection before taking a welcome respite in Baghdad. The American Embassy copies Washington's White House. Air conditioners are a must in the Iraqi capital's sweltering summers.

edge men were preparing fires to cook fish. They grinned and held up strings of their live catch for us to see. This was the ancient Tigris River, down to whose mouth Alexander the Great had sailed not long before his death in 323 B. C.

I recalled the old man in the Street of the Storytellers. We had walked in Alexander's footsteps many times between the Indus and the Tigris, and still had miles of travel ahead of us on this long automobile journey. We pulled up to the air-conditioned American

Embassy, built as a replica of our White House in Washington. Our arrival was like a homecoming. Even the thick dust on the baggage did not seem to matter; servants with cloths and brushes were busy cleaning us up. We were almost unloaded when Mary announced:

"Don't look now, but the right rear tire is down again."

Mercedes grinned.

"I'll fix it," she said.

It's wonderful what the prospect of a bath and air conditioning can do for a woman.

A highway of history, Britain's longest river shows many faces to travelers using foot power, canoe, punt, and cabin cruiser

The Thames

MIRRORS ENGLAND'S VARIED LIFE

BY WILLARD PRICE

With Illustrations by National Geographic Photographer Robert F. Sisson

UNDER a big ash tree lay a stony spring a few inches deep. It seemed perfectly dry. I knelt beside it, brushed away the pebbles at the bottom, and pressed my finger against the earth. There was a thin film of water on the tip of my finger.

"That," I said to my wife Mary, "is the Thames." British Government maps mark this point as the official source of Britain's longest river.

I rose and wiped the Thames off on my slacks.

Nothing in the upper reaches suggests that this is one of the most important rivers in the world. It rises in a buttercup-spangled meadow in the dreaming Cotswold Hills and flows to the wild North Sea. The source is not even as impressive as it was 19 centuries ago, when legionaries from a near-by Roman camp visited the spring and filled their ewers with its water (page 49).

First Bridge Only a 4-foot Culvert

Celebrating the beginning of our Thames journey, we had a gypsy breakfast under the great ash. Then we took off on our voyage down the river—afloat!

There was as yet no channel, but the meadow sloped gently toward the center. Following the low places, we came to a bridge, a culvert some four feet in diameter arched with stone under an ancient Roman road (page 55). What a contrast between this first Thames bridge and the last, mighty Tower Bridge at London, 231 feet high, affording passage for seagoing freighters!

From under the tiny bridge we emerged into another quiet pasture. The path of the stream was now more or less clearly marked as we walked down the dry bed. High above a skylark circled, spilling a cascade of melody. There was no other sound, and no one to be seen. The velvety hills stretched away to the horizon.

And yet all this region once hummed with activity. Only three miles to the northeast stood the second city of Roman Britain. Corinium, now called Cirencester, covered 240 acres to London's 330 (page 51). It is interesting that Britain's two greatest cities lay in the Thames Valley, one toward each end.

But the Thames has always been the backbone of England. It was in the lush lands along the river that prehistoric man found the most favorable conditions—abundant water, fertile soil, plenty of game. And for invaders the Thames served as a ready-made road to the heart of England.

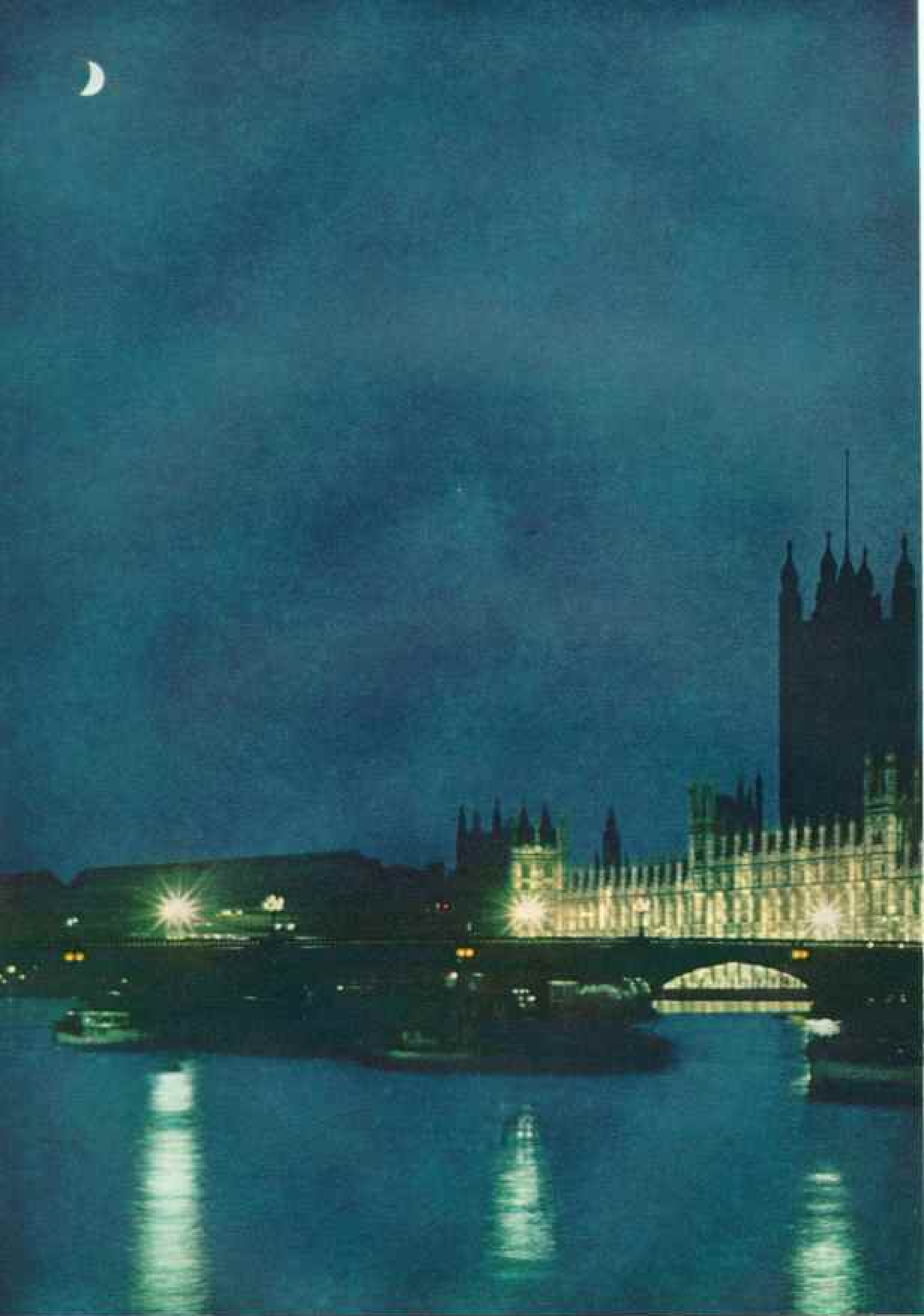
Sheep Brought Wealth to Cotswolds

Britain was considered a great prize. Julius Caesar was the first noted Roman to visit here, followed in the next century by the Emperor Claudius, who also came leading troops. Corinium was founded soon after the latter invasion, A.D. 43.

The Saxons succeeded the Romans as conquerors of the Thames Valley. After the pillage of the Anglo-Saxon invasion and centuries of petty wars, came William the Conqueror. In the Middle Ages, sheep growers discovered that the Cotswold Hills were ideal pasture. The wool trade financed the building of lovely villages and beautiful churches. The villages and churches still stand, but the wool trade is gone, and the Cotswold country has relapsed into a sort of perpetual Indian summer of charm and contentment.

The Author: In 18 books and uncounted magazine articles, Willard Price has described his travels in some 75 lands. National Geographic readers have accompanied him on three other adventures afloat: by felucca down the Nile, by junk through Japan's Inland Sea, and down the Grand Canal of China.

At 71, when most men are content to rest at home, Mr. Price still answers the siren call of far places. After reading proofs of this article, he left his California home once again—this time for Africa.





Photographed by National Geographic Photographer Robert F. Blanton © N.G.B.

The Thames channel, which served as our path, was now a good 10 feet wide and a lush garden from bank to bank. We came upon the first surface water of the river, two stagnant pools fringed with a green mat of algae, through which frogs poked their noses. Presently we were walking along beside a continuous ribbon of standing water.

"Look!" exclaimed Mary. "It's moving!"

The grasses in the stream bed were bending toward London. The "stripling Thames" had begun its 215-mile journey to the sea.*

After the stream took to flowing, the water seemed to wash its face and become bright and sparkling. Minnows appeared, then several larger fish, then many. A snake slid out of the grass; chaffinches, rooks, and swallows answered the lure of running water. The going was easier now. With shoes removed, we simply waded down the shallow stream.

The banks were a botanist's delight. The teasel lifted its bristling head; this wiry tuft once was used to raise a nap on woolen cloth. Loosestrife and fritillary showed how different two purples can be. And there was comfrey, gathered by countryfolk to make cough medicine and to clot wounds.

Riverbanks Yield Natural Dyes

And here grow dyes of superior quality for those who have the patience to extract them. The yellow iris yields a blue, the teasel a yellow, the water lily a brown, the meadow-sweet a black, centaury and agrimony a yellow, and from the roots of lady's bedstraw one may get a brilliant Turkey red.

The seventh bridge over the Thames led into a barnyard. Here the farmer showed us his old mill, run by Thames water. Once it served all the countryside; now it grinds only for the family.

"It was here when I was a boy," said the farmer. "Must have been grinding corn grain for over a hundred years."

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Landmarks of Literary England," by Leo A. Borah, September, 1955; "A Stroll to London," by Isabel Wylie Hutchison, August, 1950; "The British Way," by Sir Evelyn Wrench, April, 1949; and "Time and Tide on the Thames," by Frederick Simpich, February, 1939.

I looked about for corn. Then I remembered that to the majority of Englishmen "corn" means wheat. What Americans call corn the English call maize or Indian corn, and they know little about it, for it grows poorly in England.

The farmer had a big place—350 acres, two-thirds of it in pasture, the rest in grain. He had 200 head of cattle. His two sons, in their twenties, ran the place.

"They're full of modern ideas," the father said. "Look in this shed." The building was full of complicated farm machinery.

We were to find the same sort of thing throughout England. English farms are among the most highly mechanized in the world.

Motorized Farmhand Fetches the Cows

One of the sons came rumbling up on a motorcycle.

"Where are you going?" asked his father.

"To get the cows," the young man replied.

I remembered my own cow-getting days. I went afoot, and barefoot at that. I stared unbelievably at the motorcycle cowboy.

"I've been wondering," I said, "how you keep the cows from getting out of the pasture. We used to have rail fences, and they would sometimes even break through those. But you have only hedges. Any determined cow could wriggle her way through a hedge."

The young farmer smiled. "Come down and I'll show you."

We followed him down the Thames-side path to a pasture gate. He opened the gate and showed us an electrically charged wire half concealed in the hedge.

"It runs around the whole pasture," he said. "The cattle soon learn to keep away from it."

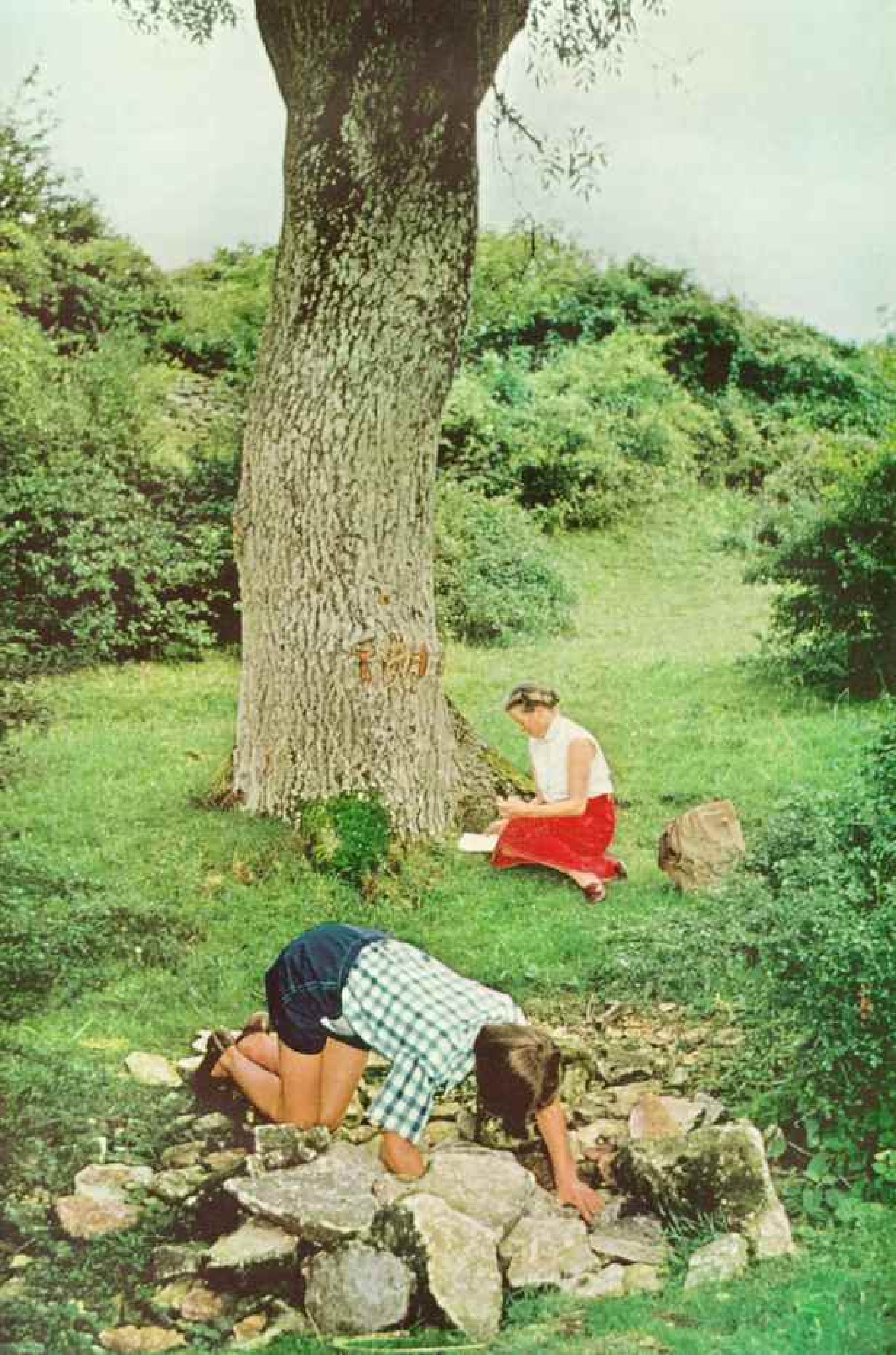
It was a big pasture, with the cattle at the far end, and it would have been a job for a barefoot boy to get them out. But in an amazingly short time the motorized cowhand had them splashing through the ford ahead of him.

"Do you milk them yourself?" I asked as he chugged by.

"Automatic," he called back. "No more of that hand stuff."

The Thames Stirs Faintly to Life at an Ancient Spring in the Cotswolds

Nineteen centuries ago thirsty Roman legionaries paused here to drink. Old engravings picture the spring gushing like a fountain. Today a near-by pumping station so lowers the water table that the traditional source of the Thames River usually shows only a damp spot beneath the stones. The ash tree bears carved initials "TH," for Thames Head.



The Thames plunged into a picturesque wood that arched over the river, admitting only long arrows of sunlight. The stream ran two or three inches deep, and the bottom was a level spread of small pebbles. The water, transparent as air, looked like a coat of clear varnish over a tessellated pavement.

But the pavement didn't feel as romantic as it looked. We dried and shod our sore feet and walked along the right bank.

A thunderstorm threatened, and we found refuge with a kindly farmer who insisted that we stay all night. Typical of the well-informed English countryman, he knew his Thames.

Thames Once Joined the Rhine

"We've dug up many interesting things hereabouts," he said. "I like to think of the Thames as it was long ago. Of course, you know that England wasn't always an island. Winston Churchill reminds us of that in his *History of the English-speaking Peoples*, but the scientists knew it long before. England at one time was attached to the Continent. Part of the North Sea was a great plain. The Thames joined the Rhine and ran out into this plain—hard to imagine, isn't it?—and together they flowed into the sea.

"This valley has been the home of great beasts. Remains of the giant mammoth, musk ox, cave bear, hyena, great elk, lion, bison, rhinoceros, hippopotamus, and elephant have been found here."

The thunder growled and roared, and it was easy to believe that prehistoric beasts were besieging the farmhouse. But the morning dawned clear and bright, and we met nothing more fearsome than a weasel as we walked on to Cricklade.

Just outside the town the Thames is joined by a river that has churned up no end of controversy. As lusty a stream as the Thames itself, the Churn reaches farther into the hills. Many persons contend, and with some reason, that it should be called the Thames, and that the stream originating at Thames Head should be considered a tributary. The true source, they say, is Seven Springs, a morning's walk from Cheltenham. For the springs give birth to the Churn.

After a night in Cricklade we journeyed in a hired car up the road of generals, kings, and emperors to spend a few days in the Cotswolds and see Seven Springs. In a rocky hollow we found the bubbling waters emerging from a

hillside; on a stone has been engraved in Latin the words, "Here, O Father Thames, is Thy Sevenfold Source."

We circled through the Cotswold villages of the Thames watershed. Bibury (page 58) has been called "the loveliest village in England," but so has Broadway, and we could not decide between them.*

Some days later we were back in Cricklade to pick up a canoe that had been delivered by lorry from a boathouse downriver. We slipped the canoe into the ankle-deep Thames; it sat placidly on the bottom. This seemed to amuse an ancient Crickladian bystander.

"You'll have to carry that thing more than it'll carry you," he chortled.

We proved him wrong. We didn't carry it at all, though frequently we had to go overboard to walk it through shallows, haul it through weeds, or let it down gently through stony riffles. It gave us just enough exercise to relieve canoe cramp.

Fast water only finger deep alternated with quiet stretches several feet in depth. The sun was bright, the air warm, the countryside a paradise of perfume and song.

The silence of the gliding canoe allowed us to hear the wind in the grass, the "peek, peek" of the moor hen, the dart of a startled fish, the paddling of a stoat in pursuit of a water rat. We found ourselves speaking in whispers.

Landscape Known in Middle Ages

The incredibly green and pleasant land stretched away to a wooded skyline. It was good to think that here was something unchanged in a changing world. "In such a landscape," John Buchan has written, "you can cheat the centuries, for all that is presented to your ear and eye is what medieval England heard and saw."

We pulled out on the shore to have lunch—vegetable soup heated on a tommy cooker (the British counterpart of Sterno), cheese, biscuits, apples, oranges, and chocolate—mixed with sunshine, solitude, and comfort.

We shot some brisk rapids, then paddled down a long, solitary stretch past a round stone tower at the point where the Thames, the River Coln, and the Thames and Severn Canal join.

The canal was opened in 1799 to link the Thames and Severn Rivers, thus providing a

* See "By Cotswold Lanes to Wold's End," by Melville Bell Grosvenor, NATIONAL GEOGRAPHIC MAGAZINE, May, 1948.



National Geographic Photographer B. Anthony Stewart

Roman Footsteps Once Echoed Across This Mosaic at Cirencester

The design, picturing Silenus (foreground) and Ceres, floored a building in ancient Corinium, second city of Roman Britain. Cirencester in the Cotswolds now occupies the site.

navigable waterway across England from sea to sea. There were many locks on the canal; the last one—or the first, as you choose—stood at this point.

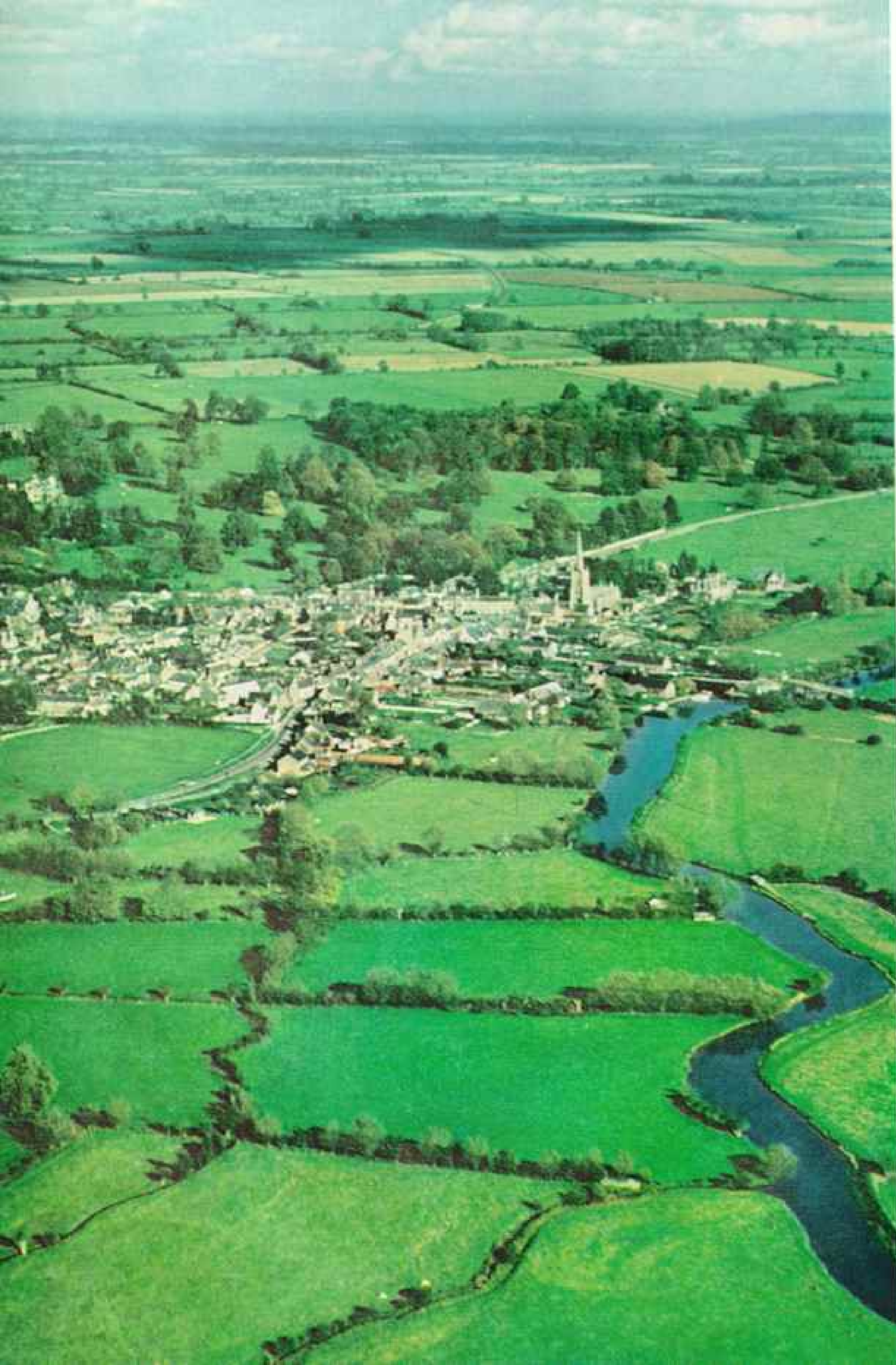
Canal Barges Yielded to Railways

Barges to the number of 150 a day, carrying from 30 to 60 tons each, passed through the canal with grain, cheese, coal, and metals for London; general merchandise, timber, hides, and imported luxuries for Bristol, Worcester, and Liverpool.

Then came the railways, and the canal fell into disuse. Now it is a dry moat overgrown with hawthorn bushes and wild flowers.

From this point the Thames deepens and widens, as befits a thoroughfare for barges. But the barges disappeared with the closing of the canal. While the world has grown steadily busier, the upper Thames has relapsed into medieval peace, a river of pleasure and history.

Ahead of us rose Lechlade with its centuries-old church spire celebrated by Shelley



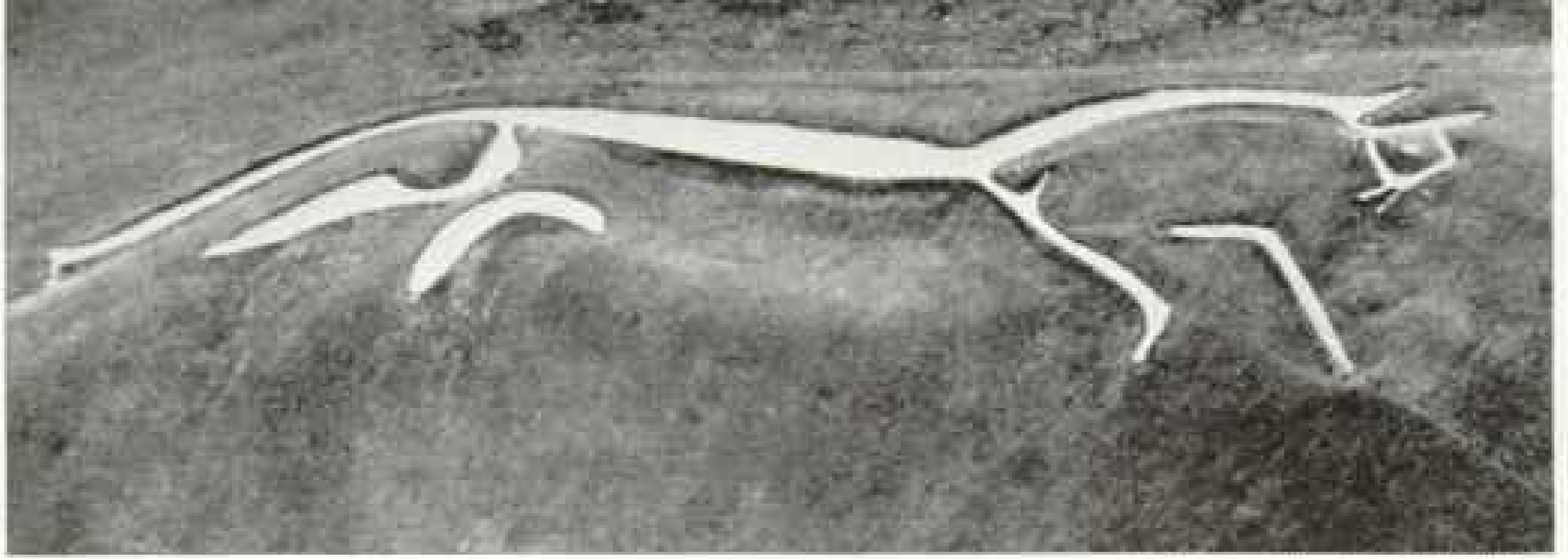


**Serene Meadows Roll
to the River's Edge;
Lechlade Drowns
in the Summer Sun**

Winding across southern England, the Thames flows through a storied valley pervaded by tranquil beauty, haunted by history, and enriched by institutions that symbolize the nation.

Leaving its Cotswold birthplace, the Thames for many miles appears concerned only with "following Gravity in the innocence of its heart," as Robert Louis Stevenson would have it. A bright ribbon bounded by lush meads and shaded by willows, the stream makes a picture of pastoral peace.

Here in Lechlade, on the left bank of the river, time brings changes slowly. A man of the 13th century, returning to the market town, would recognize landmarks he once knew. Most familiar would be the church steeple, that "dim and distant spire" immortalized by Shelley. Tracing the Thames to its source in 1815, the poet found the white-towered church a captive of Silence and Twilight; "Thou too, aerial Pile . . . obeyest in silence their sweet solemn spells . . ."



Uffington Horse (above) and Willard Horse



The White Horse of Uffington Gallops Out of the Past

Prehistoric artists etched the dragon-like monument in the chalk of the Thames Valley. The area came to be known as the Vale of the White Horse. Through the ages succeeding generations kept the 365-foot charger scoured; today it may be seen 15 miles away.

The White Horse of Westbury (left), dating from 1778, replaces an earlier carving that traditionally commemorated King Alfred's victory over the Danes on a near-by battlefield.

(page 52) and a 600-year-old hotel that bears the contradictory name of New Inn. Here we turned in our canoe and hired a punt.

Only in recent centuries has this remarkable craft become the favorite on the upper river. Ancient Britons used a still more extraordinary vessel, the coracle, a lightweight, roundish basket covered with hide.

But the coracle is antisocial, since it will accommodate only one person; the punt will take the whole family and the dog (page 62). They can flop about in it without peril, eat in it, sleep in it, play games in it. It is dangerous only to the person who poles it.

My wife and I had sailed the world's waters in almost every sort of craft, but this was our first experience with an English punt. It was war to the death between a six-foot man and a 14-foot pole. As might have been expected under such odds, the pole won.

My advice to other novices would be this: If your pole sticks in the mud and you must choose between staying with the pole and staying with the boat, stay with the boat.

I recovered from this harrowing

experience in a quaint pub named Trout Inn, built in the 12th century as a nunnery. Here, near Lechlade, we enjoyed the easy cordiality of the taproom and slept in a gigantic canopied four-poster in a low-beamed room whispering with memories and mice.

The river now being deep enough for motor-boats, we had arranged for delivery of such a vessel at this point. The next morning, there it was—a sleek, trim 31-foot cabin cruiser painted a crisp blue and yellow and flying Britain's red ensign at her stern. The tip of the flag divided her name, leaving "Gosh" on one side and "awk" on the other. The first part suggested annoyance and the second part seasickness. It seemed an unfortunate name for a boat.

Then the wind blew aside the flag and we realized that the name was not *Gosh-awk* but *Goshawk*, an excellent name for a boat, for the goshawk—originally goose-hawk—is a bird much used in falconry to bring down game and is famous for its power, speed, and courage.

Just as puzzling as the name had at first been was the black mop of hair that now projected from the wheelhouse. From under the mop came a remarkably gentle voice.

"You are Mr. and Mrs. Price? I'm Herbert."

Herbert, 18-year-old-about-to-turn-19 boat-builder's apprentice, had brought the *Goshawk* upriver and would accompany it down. Quickly we were aboard and examining our floating home. It was actually a five-room flat with sun deck and back porch. Reading from bow to stern: the head, crew's cabin with two berths, wheelhouse, main cabin with two berths, galley, cockpit.

Forty-eight Locks Along the River

We had not finished the first day's run before we realized what a prize we had in Herbert. He could take the wheel when there were pictures to be made or notes to be written—and that was much of the time. Herbert did most of the hopping about that was necessary to get the boat safely through the locks. He pumped the bilge, swabbed the decks, filled the tanks, emptied the pails, dug holes ashore to bury the garbage. No waste may be thrown into the river, for the upper Thames is London's chief water supply.

From Lechlade the river meandered a mile or so through lush meadows to Buscot Lock, one of 48 built along the Thames for the

barge traffic. In summer, Buscot has a keeper of its own; the rest of the year the keeper of near-by St. John's Lock cycles over daily to see if anyone wishes to go through.

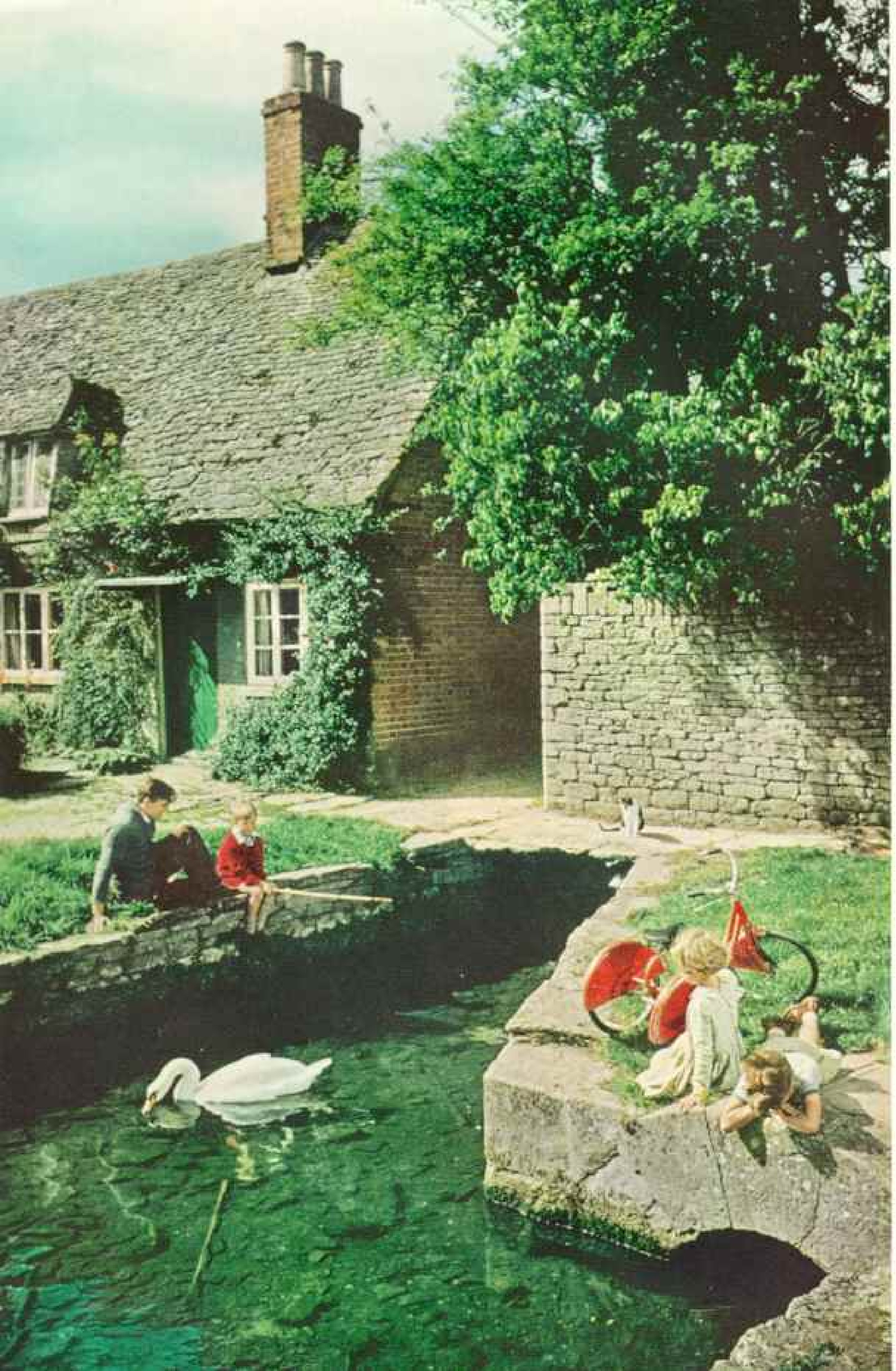
How deep in history is this beautiful land! Dreaming back over the centuries, one suddenly feels a thousand years old—and it is a good feeling.

Downstream we disembarked to walk through Kelmscott Manor, a fine old gabled house once the home of William Morris, that amazing man whose versatility reminds one of Leonardo da Vinci. Morris wrote poetry,

First bridge over the Thames rises a scant four feet with hardly room for the author beneath. The final span, majestic Tower Bridge at London, soars 231 feet and extends 850 feet from shore to shore.

William Price





painted, printed and published beautiful books, made stained-glass windows, drew patterns for textiles, designed tapestries, built furniture, revived handicrafts, translated from Latin and Icelandic, and stimulated social reform.

Here the river was scarcely wider than our boat was long. Cattle grazed near the shore, and swallows dipped and swirled above us. Two big herons rose, trailing long legs. Ducks chattered past.

But the most distinguished birds were the swans, stately white caravels sailing without apparent effort. As the ibis is the bird of the Nile, so is the swan the bird of the Thames. From the point where the stream is so shallow that the bird's webbed paddles scrape the bottom, all the way down to the Port of London, it is hard to go a mile without encountering some of these majestic beauties.

We came upon one sitting on her nest among the rushes at the water's edge. With the air of a queen on her throne she turned a haughty eye upon us as we nosed the boat within five feet of her so I could get a picture.

"Go easy," Herbert advised. "When they get angry, they're bad."

I went easy, but the click of the camera made her hiss and glare, and her mate came steaming over from the other side of the river to defend his home. Mary bribed him with a crust of bread and he, craven soul, left his spouse to take care of herself.

New Bridge Old When Columbus Sailed

The queen in the meantime had decided to ignore us. She ruffled her feathers, stretched herself, and rose, revealing seven large eggs.

Then we saw a remarkable sight. Mother Swan placed her beak under an egg and deftly flipped it over. She went on to turn the other eggs, regard us disdainfully, and settle down to warm the other side.

One night, after a five-lock day, we tied up about midway between Lechlade and Oxford in the shadow of New Bridge. Like New Inn at Lechlade and New College at Oxford, New Bridge is immensely old. Its six pointed arches and projecting stone piers were built in the 13th or 14th century. Already an

antique when Columbus discovered America, New Bridge is quite possibly the oldest on the river.

The wind that had defied our wheel all day died down. As darkness came on, the river looked like black glass reflecting the lighted windows of an inn on the farther shore. The inn is beautifully named. It was once the Sign of the Rose, but politics dictated a change during the Wars of the Roses. Today it proudly reminds visitors of its past as the Rose Revived.

Ferry Runs by Muscle Power

Mary had an argument with the gas stove, which grudgingly agreed to cooperate; the table was set up between the bunks, and Herbert joined us at dinner. The chill May air made everything taste wonderful.

And the chill May air, together with a dense river fog and then heavy frost, made for a very uncomfortable night. The temperature dropped to 28° F. The next morning we telephoned for more blankets.

At Bablock Hythe, a few river-miles nearer Oxford, we saw a ferry still operating as it has for seven centuries. The ferryman stands amidships and grips a cable that runs from shore to shore. Then he simply pulls the boat back and forth across the stream. This is quite a feat, since the craft may be loaded with two or three automobiles and many passengers.

And yet a girl once operated the ferry, and thereby hangs a tale. She was Betty Ridge, the ferryman's daughter. The Ridges were of humble stock, and it was a great thrill to Betty when a viscount took an interest in her. He was young William Flower, second Viscount Ashbrook, a student at Christ Church in Oxford, and he had come for a day's fishing. It was love at first sight. He wooed her, married her, and made her a great lady.

The pages of romance opened again as we looked at the tumbled walls of Godstow Nunnery, just within sight of Oxford's spires, where Fair Rosamond lived and now lies buried. Rosamond had the misfortune to attract the eye of a king. Henry II lured her from the nunnery and, so says a romantic tradition, ensconced her in a secret bower so

Brook-sized Thames Makes a Play Pool for Children at Ashton Keynes

Six miles from its source, the river here emerges from under a flagstone walk. The infant watercourse brings to mind William Morris's lines: "This little stream whose hamlets scarce have names, This far-off, lonely mother of the Thames." Bill the swan begs food in winter by knocking at the door of the 300-year-old Cotswold cottage.

Bibury in the Cotswolds: Everyman's Vision of England

Dormered and stone roofed, Bibury's cottages wear centuries like a blessing. "Surely the loveliest village in England," said William Morris.

This row of 300-year-old homes, preserved jointly by Britain's National Trust and the U.S.-financed Pilgrim Trust, climbs a green cleft in the hill. Bibury's little trout river, the Coln, feeds the Thames near by.

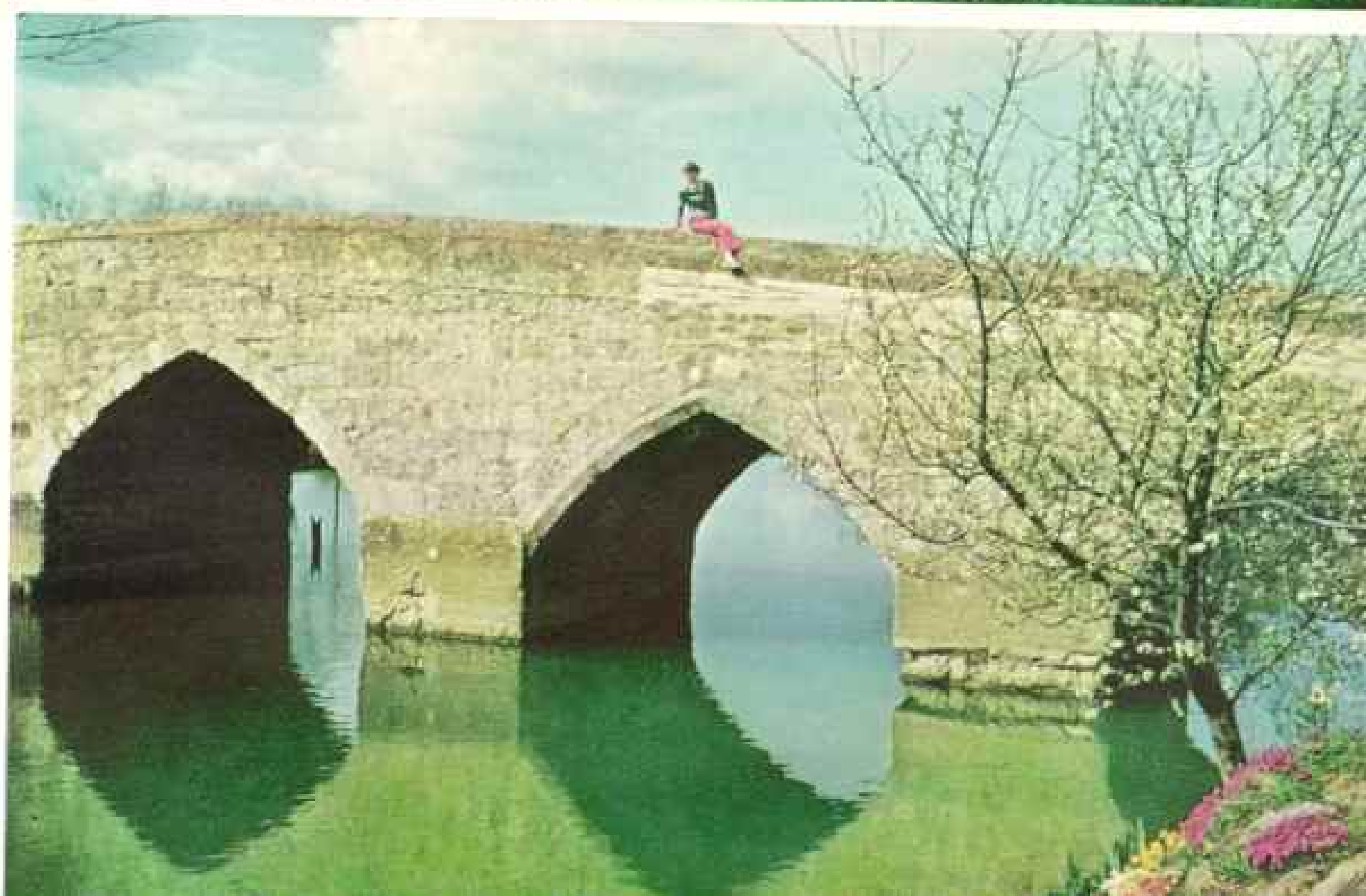
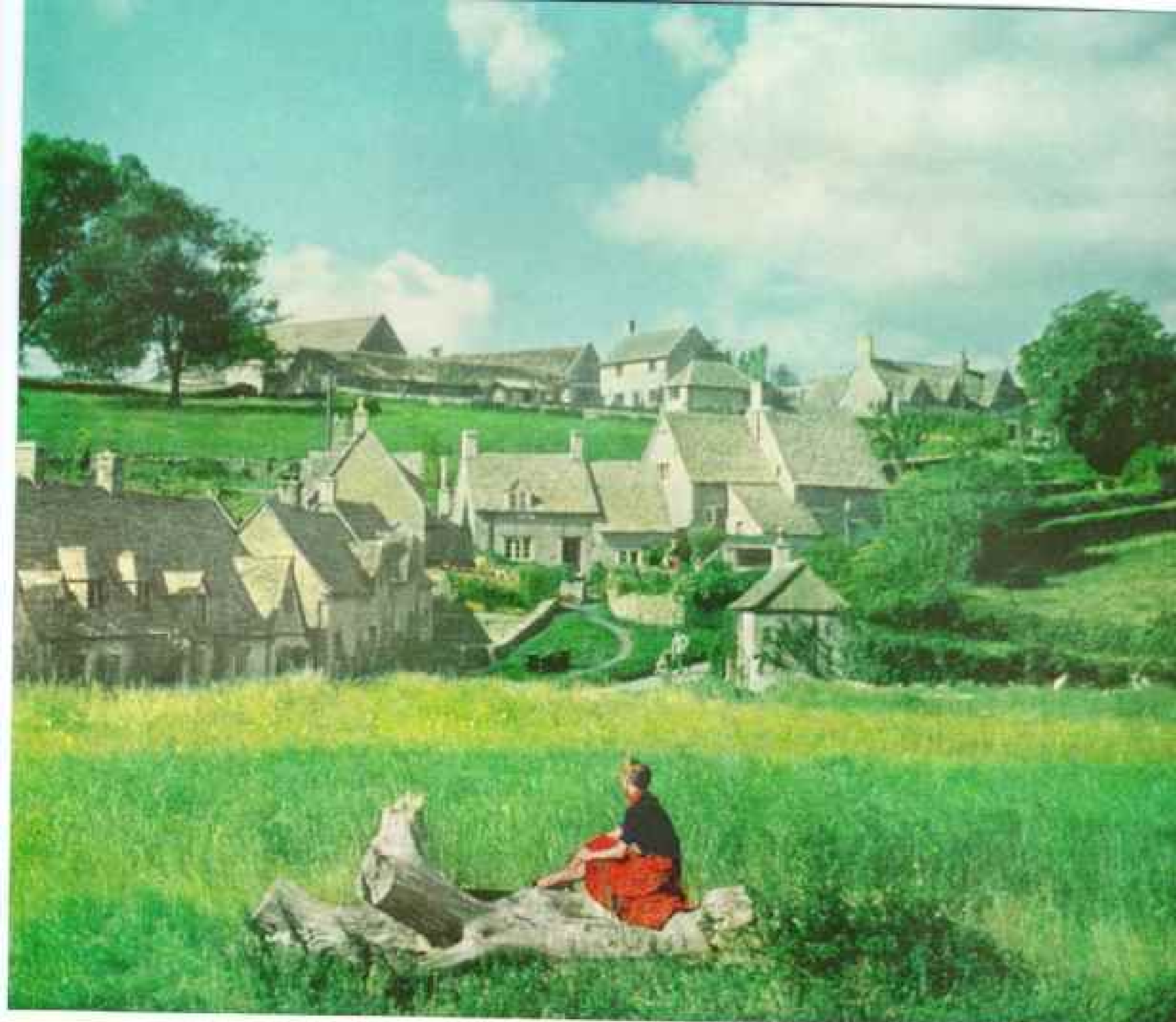
Author and wife lunch along the "stripling Thames," a haunt of Matthew Arnold's Scholar Gipsy. As in the poem, they lie "moor'd to the cool bank in the summer heats, mid wide grass meadows which the sunshine fills. . . ."

New Bridge, one of the oldest spans over the Thames, rose in the 13th or 14th century. Its pointed arches mark the transition from country stream to river.



Illustrations by Willard Price and
(Upper) National Geographic Photo-
grapher Robert F. Seam © N.G.S.







Author Robert Gibbings Feeds a Robin by Hand

Looking like Father Thames himself, Mr. Gibbings sits with Mrs. Price before his 15th-century cottage at Long Wittenham. His book, *Sweet Thames Run Softly*, took its title from Spenser's line "Sweete Themmes! runne softly, till I end my Song." Gibbings's own song ended early this year, when he died at the age of 69.

Wilfred Price

labyrinthine that he could find her only by following a silken thread. But his jealous queen also found the thread, followed it to Rosamond, and contrived her death.

At Godstow Lock I took a ducking. Stepping on the gunwale with the intention of leaving the boat, I left it, but not as planned. A line on the gunwale rolled under my foot, and I found myself with one leg hip deep in the lock. My other foot was still on the boat and my hands on shore, and the gap between was widening. In one hand was a Leica camera.

After one loses a Contax in the Nile, a Leica at Nassau, and a Retina in Japan's Inland Sea, one acquires the habit of thinking of his camera before himself. When Herbert came running along the lockside to help me, I said, "Take the camera." He took the camera, and I dropped into the water.

A lock is not a good place to go bathing. Water rushing out from under the lower gates creates a dangerous undertow. Already I felt as if an octopus were pulling at my legs. The boat's deck was too high to reach and the lock wall was higher. I swam through the churning waters to the upper gates, where the undertow was weaker, and was ignominiously hauled up at the end of a line.

The wetting seemed unimportant when Herbert handed back the camera, dry and safe.

After 30 miles without a town, the river was now, for the first time, smothered between grimy warehouses and factories.

Here, white swans were the only beauty. They refused to be daunted by the black cliffs, belching steam, and growling machinery. Even the crowning horror, the gas works, failed to lessen their majesty and pride.

Spires Rise Like Forest of Stone

So this was Oxford, called by some the most beautiful city in England. All we could see were factory chimneys and coalyards.

But when we disembarked at Folly Bridge and walked up St. Aldate's, the glory of Oxford unfolded before us. Matthew Arnold was right after all about "that sweet City with her dreaming spires." They rose like a forest of fine architecture, each one different, but all beautiful.

We turned into High Street and soon found why it is called "the noblest old street in England." The colleges of Oxford are marvels in stone. One would be quite enough for a city. But Oxford University consists of 28 colleges. That does not mean 28 buildings.

(Continued on page 69)

For Centuries Magdalen's Bells Have Marked the Quiet Hours at Oxford

The university city calls the river Isis, after an old notion that two streams—the Thame and the Isis—wed near downstream Dorchester to produce the Thamisis, or Thames. From the river the 450-year-old bell tower of Magdalen College shows us one of the skyline's many "dreaming spires." On May Day a choir sings a hymn in Latin from the parapet.

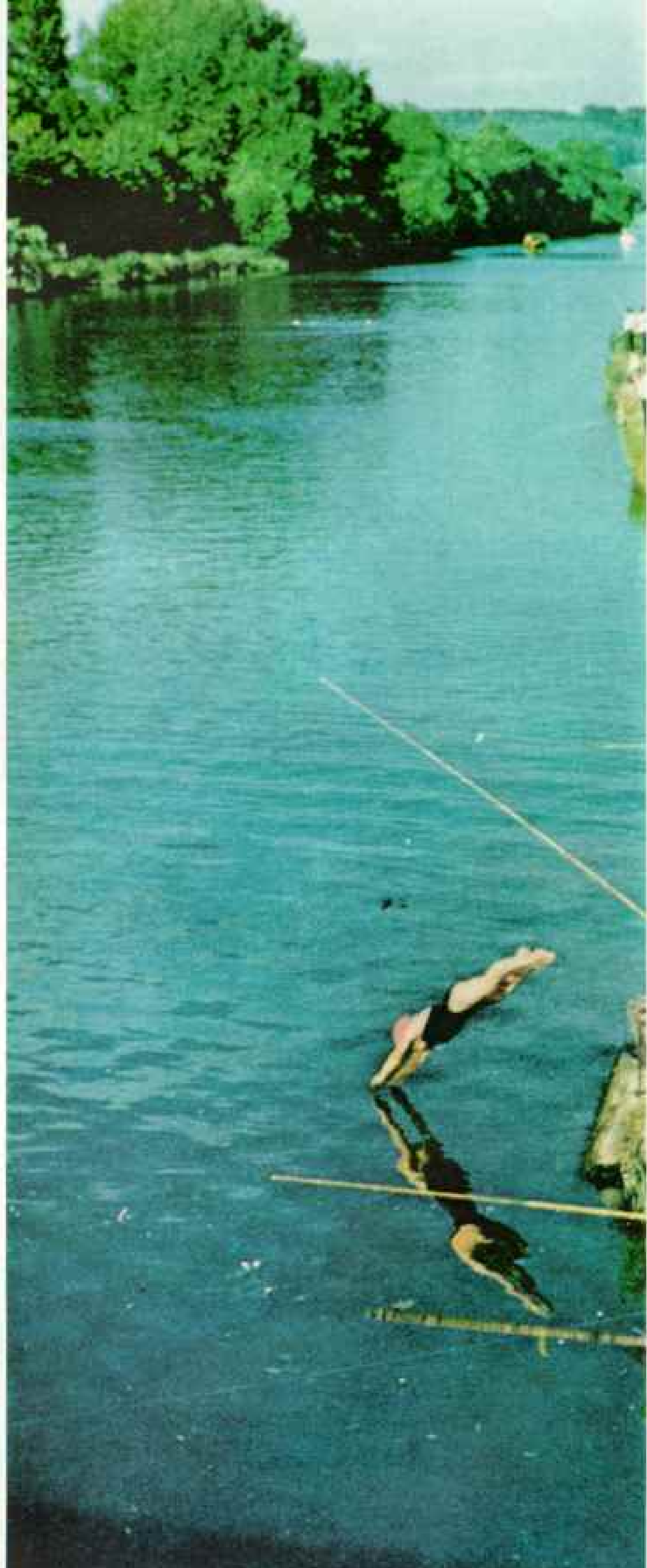


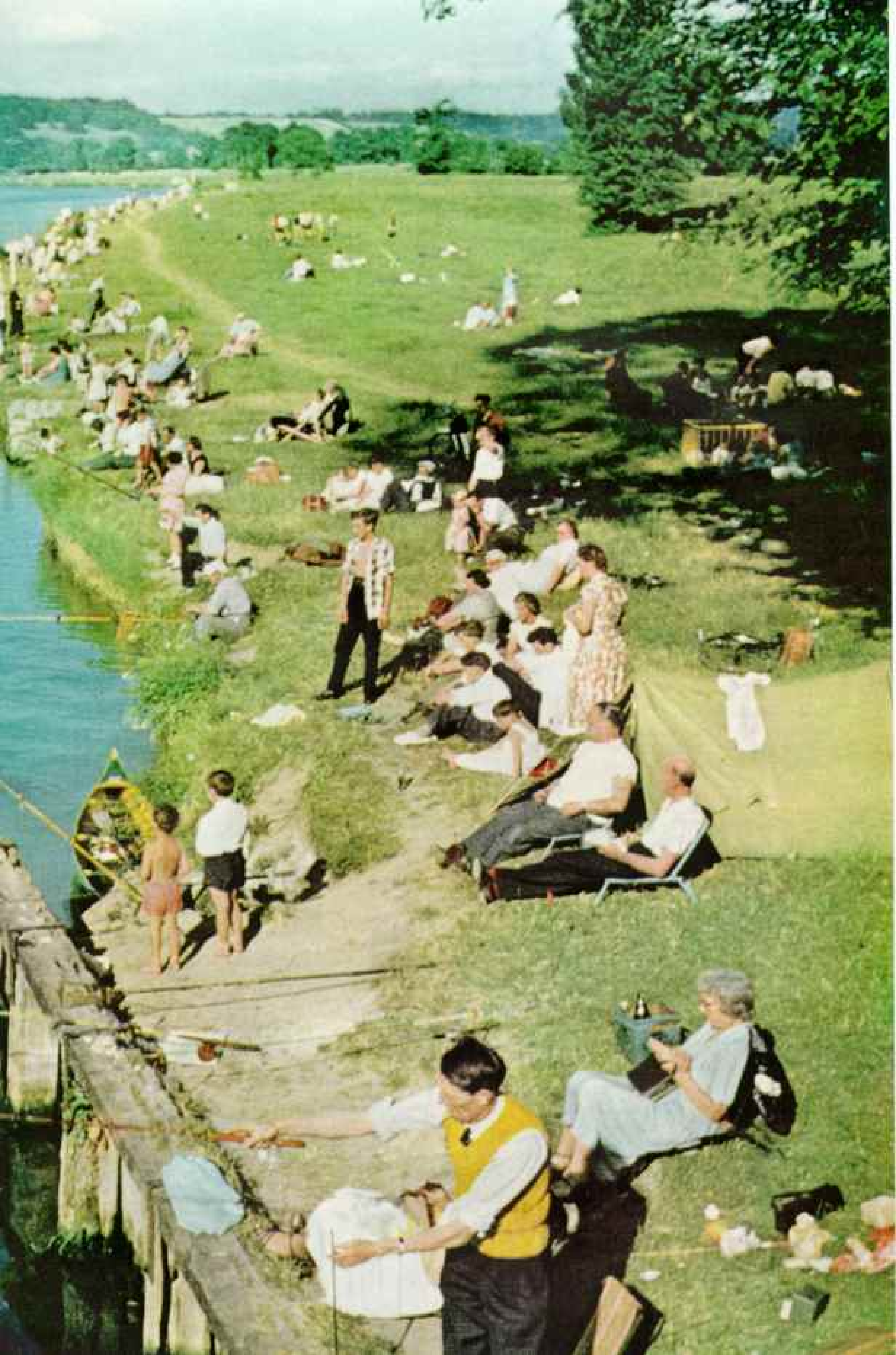
A Holiday Throng Festoons the Bank at Pangbourne

For thousands the Thames is a river of pleasure, an escape from the steel and stone of the cities. Many come only to sit before the healing sight of sun on fresh water, of wind in grime-free trees, of field and hill in motionless pageant.

Others come to camp, to swim, to fish. The Thames Angling Preservation Society annually restocks the river; in one season it supplied half a million fish.

Even the family dog enjoys a day of punting on the Thames. Where the river flows over a firm, gravelly bed, the punter stands on the aft counter and shoves with a 14-foot pole. Here, in deep water, he paddles.





Like a Suburban Street,
the Thames Rolls Past
Fine Homes and Gardens

The long mirror of the river seems liquid history indeed on its passage before castles, manors, and abbeys. At other times its most profound offering takes the form of "little, lost worlds, patches of sweet wilderness."

Here near Henley on Thames the river appears solidly domestic as sidewalks run from its banks to front porches, and boathouses stand by as naturally as garages.

At home afloat, this couple rowed some 250 river miles last year (opposite, below). Canvas unfurled, their camping-skill converts into a snug cabin.

At night when scores of these boats moor near one another on a secluded stretch of the Thames, the warm glow of lights beneath their awnings suggests a village on the water.

Bankside picnic over, attentions diverge. The women look to their knitting; the men, to the passing water parade.

64 Kodachromes by Willard Price
© National Geographic Society







Rowing in Rhythm, Crews Strain for Lead at the Henley Regatta

The Thames-side village held its first races in 1829. Spectators soon proved a problem. Wrote Charles Dickens in his *Dictionary of the Thames*: "The river is so inconveniently crowded with steam launches, house boats, skiffs, gigs, punts, dingees, canoes... that the racing boats have sometimes the greatest difficulty..."

Now an international classic, the Henley ranks as the world's top competition for amateur oarsmen. Here the umpire's boat follows two four-oar shells. Temple Island (background) marks the start of the 155-mile upstream course.

A kayak threads Sonning Lock near Reading.

Prize-winning gardens make Sonning a highlight of any Thames journey.

Rephotographed by Willard Price and (right) National Geographic Photographer Robert F. Sloan © N.G.S.







GOSHAWK
THE CA



A Thames Swan, Who Makes His Living Dining Out, Gently Takes an Offering of Bread

Each college comprises many fine structures, and the visitor's astonishment grows when he realizes that this vast concourse of noble institutions is provided for the education of a comparatively few students.

In the United States a faculty the size of Oxford University's might serve 35,000. But Oxford has only 8,200 students in residence. For the objective here is not mass education but the training of individuals.

Students come from many lands to Oxford—32 of them each year from the United States—thanks to the Rhodes scholarships. These grants, from the estate of South Africa's empire builder, offer outstanding students two or three years at Balliol, Magdalen, Trinity, Jesus, Worcester, or the other men's colleges.

To see Winston Churchill's birthplace, we journeyed north a few miles to Blenheim Palace. It proved to be as colossal as the man, as large as several great hotels rolled

into one. The palace is surrounded by a vast walled park including a lake a mile or more long, acres of formal gardens, wild woodlands and pasture, waterfalls and a cascade, and bronze and marble statues springing up at improbable places.

Returning a few days later to Oxford, we bought a huge white cake with red rosebuds and pink angels and 19 candles. We took it to our waiting boat below Folly Bridge. Herbert could hardly believe his eyes when it was borne blazing into the cabin at dinner time to the chant of "Happy Birthday."

Our sympathy for him because he could not spend his birthday with his family was perhaps misplaced. He had been having the time of his life in Oxford. The birthday dinner had to be curtailed a bit so he could make a seven o'clock cinema. He set off with a piece of birthday cake and an angel in his hand.

The lasher at Sandford Lock, an hour be-

Boats of All Sizes with Sailors of All Ages Jam Sunbury Lock

During Victorian times some of the Thames locks were resorts of high fashion, often visited by royalty. Beruffled ladies went afloat hatted, gloved, and shielded by gay parasols. Their beaus, in straw boaters and blazers, struggled gallantly with oar and sail.

Today some of the color has disappeared, but none of the crowds. Since nearly all the 48 locks are hand operated, boats frequently have to wait. Here, as the *Goshawk* approaches Hampton Court Palace, Mary Price draws the tender close.



Beating to Windward, Dinghies Cut Close to an Imperturbable Fisherman, Who



Kodachromes by National Geographic Photographer Robert E. Dixon © N.G.S.

Personifies the Englishman's Ability to Live as an Individual in the Midst of a Crowd

yond Oxford, is a good place to drown yourself. A lasher, well named, is a pool of thrashing, foaming water just after it has tumbled over a weir.

The drop at Sandford is one of the greatest on the river, nearly nine feet. The tumbling tons of water create whirlpools and strong undercurrents.

Daredevils Defy Whirlpools

A monument stands on the bank as a reminder of the drowning of two Oxford students. The plinth is used as a diving platform by fearless young men who want to see whether the pool really *is* dangerous.

Above the weir a large sign warns of danger. But that did not help the boating party whose engine had failed just at the critical moment. As we came up, we saw their boat being sucked past the danger sign toward the weir.

The occupants of the boat seemed to be in a state of paralysis. The man and two women were staring at the white edge of the river where it disappeared over the weir.

Herbert flung them a line, but they did not

seem to know what to do with it. It slipped off into the water. He threw it again, calling to them to hang onto it.

"Put it over a cleat," he called.

Quite evidently, they didn't know what a cleat was. "Like this," we shouted, indicating a cleat on our boat. They were close to the weir before the line was fast and they could be pulled out of danger.

"How far are you going?" we called.

"We're going straight back to the boat-house," said the man. "We've had enough."

Pale-faced Londoners pour out by the thousands to the Thames of a weekend and trust themselves to craft of every sort without previous experience. The river is fairly safe for such experimentation; yet every year it takes its toll of lives.

As distressing as the engine that won't start is the engine that won't stop. We came upon a motorboat wildly racing round and round, dodging other craft only by inches.

"The accelerator's jammed!" yelled the driver. "I can't stop her!"

Everyone screamed advice, but no one advised him to stop his boat by crashing into a



A Kayaker Fights Against Capsizing in White Water

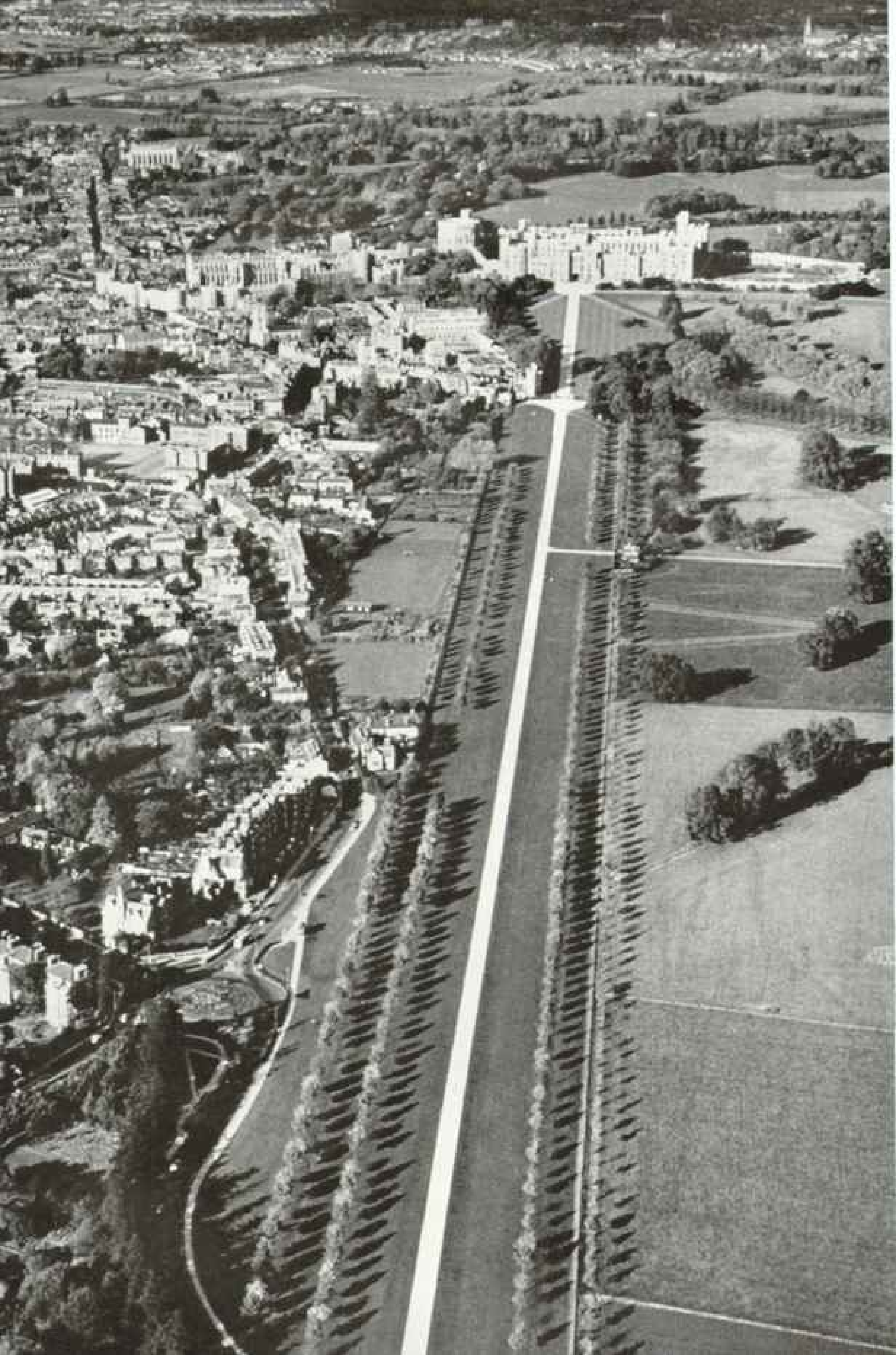
On weekends members of the Chalfont Park Canoe Club meet at Hambleden Lock, near Henley, where an instructor teaches safety in rough water. Opening weir gates, students shoot manfully into the rushing currents.

Here the instructor (far left) shouts directions as a novice tries to turn his boat. One blade of a double-ended paddle presses against the surface of the water to keep the craft upright.

Over he goes in a second try! Excitement grips his wife on the bridge abutment.

Relieve! Current upends the kayak and a head returns to air.







Queen Elizabeth and Prince Philip Parade in the Robes of Chivalry

More than 600 years ago at Windsor Castle, Edward III founded the Most Noble Order of the Garter "for the adorning and encouraging of military Virtue, with honours, rewards, and glory," according to the 16th-century historian William Camden. Today the order is England's oldest and most illustrious. Here Queen and Prince march in solemn procession after an investiture ceremony for two knights. The Garter Collar and Star adorn Elizabeth's blue velvet mantle.

The Long Walk opens a majestic vista to Windsor Castle, one of the Queen's residences. Charles II laid out the three-mile drive, linking the castle's Upper Ward with the Great Park, long a royal hunting preserve. He flanked the walk with 1,650 elms; diseased, they were recently replaced by horse chestnut and plane trees. The Home Park, much of it cultivated (right), sweeps past the castle to the wood-fringed Thames. Eton College and its monumental chapel mark the landscape at upper left.

stone wall, which is what he did. The boat sank in a dozen feet of water.

Reading is the first important town of the Thames after Oxford. A sensation put Reading in the news during February of 1956. A monster was photographed swimming up the river. The newspapers ran stories about it, speculating that it might be a *Dimetrodon*, a reptile that roamed the earth 190,000,000 years ago. Then an inquisitive reporter discovered that the Thing was propelled by a young man in a rubber boat concealed behind a big dorsal fin. The "monster" had been fabricated by two Reading University students.

We timed our arrival at Henley on Thames to coincide with the beginning of the famous Royal Regatta (page 66). For four days we watched shells from all over England and abroad race a little more than a mile from Temple Island to the finish line near Henley Bridge. The three chief trophies went over-



**A Little Fleet of White Swans
Enchants Visitors at Windsor**

William the Conqueror chose Windsor as his residence and reared on the spot the most important in a ring of fortresses surrounding London, his capital. Seat



Kodachrome by Willard Price © National Geographic Society

of royalty ever since, Windsor and its castle attract boatloads of sightseers. Here, in Shakespeare's *The Merry Wives of Windsor*, Falstaff was dumped into

the Thames during an amorous misadventure. "I had been drown'd but that the shore was shelvy and shallow," cried the luckless lover.

seas, the Diamond Sculls to Australia, the Thames Challenge Cup to Princeton, and the Grand Challenge Cup to Cornell. The half a million spectators, most of them of course British, were as warm in their applause of these winners as if they had been British too.

We had seen Windsor Castle before, but had never been so thrilled by it as when, rounding a turn in the river, we saw its fabulous walls and towers mirrored in the still surface of the Thames. Set on a hill with the river forming a natural moat, the castle sends up rank on rank of "towers and battlements . . . bosomed high in tufted trees" (pages 74 and 80).

No wonder Windsor is considered the most regal building in the world. Kings and queens of England since William the Conqueror have made it their residence, and it is still one of the homes of the reigning monarch. Across the river from Windsor lies Eton, largest and most exclusive of all English public schools.

If one were asked to name the most important document in the history of human freedom, he would probably name the Magna Carta, the treaty upon which was founded English political and personal liberty. It was at Runnymede, on the south bank of the Thames beyond Windsor, that English barons forced King John to affix his seal to that great charter in mid-June of 1215.

Royal Ghost Fails to Appear

At Hampton Court (page 82), largest and finest palace in England, we walked through a few dozen of the thousand or so rooms, and looked in vain for the ghost of Catherine Howard, fifth wife of Henry VIII, who is said to run shrieking still through the Haunted Gallery.

At Kingston on Thames we saw our first tugs, all boats above this point having been pleasure craft. This was the first sign that we were about to enter a quite different Thames, a river not of green splendor and postcard villages but of industry and great ships.

"Where are you going?" the lockkeeper at Teddington challenged us.

"To Southend."

"But Bushnell never allows his boats to go downriver. Too dangerous."

I produced the owner's letter authorizing us to sail the *Goshawk* below Teddington, if we took a pilot. Shaking his head, the lockkeeper let us through.

Now we were in the tidal Thames. Teddington is the last full lock on the river. Above this point the water is fresh. Below, it is brackish. Above, the level remains more or less the same except in flood. Below, the river restlessly rises and falls twice a day as the ocean tides make themselves felt 70 miles upstream. Just beyond the lock a stone marks the division between the upper Thames, controlled by the Thames Conservancy, and the lower Thames, supervised by the Port of London Authority.

London Glows in Floodlit Splendor

Caution dictates that an experienced pilot be aboard every boat in the crowded lower reaches. This had been arranged, and Denis Hoolahan, licensed waterman, was waiting for us at the boathouse by the weir. He came on at once, and we sped downriver.

Denis was a pleasant and competent Irishman who began by asking for a cup of tea. This was the first of hundreds of cups he consumed on the way to the mouth of the Thames. Just as the engines ran on petrol, Denis ran on tea.

Passing through London at night was one of the great experiences of my life (page 46). Floodlighting has greatly enhanced the beauty of the city, and nowhere are the lighted buildings seen to greater advantage than in the black mirror of the Thames. Every illumination is doubled and at the same time given a wavering ethereal unreality.

Even the Battersea Power Station was a thing of beauty, its chimneys reaching up like giant arms, with their enormous smudges of smoke transformed into golden draperies against the black sky.

The gleaming white stone and bold statues of the Tate Gallery showed little sign that the

Royal Princess Sets Off for a Thames Run from Westminster Pier

Before the 1800's, England's roads were fit for little except horseback travel. In those days the Thames was truly a national highway. Queen Elizabeth I made innumerable "progresses" by water from one riverside palace to another. Handel composed his "Water Music" for such a journey by George I. Pepys's diary reveals him often on the Thames, en route to fashionable resorts. Some 40,000 watermen run taxiboats between Windsor and Gravesend.

Today few passenger vessels remain except sightseeing launches like *Royal Princess*.





famous building was severely damaged by air raids in 1941. The great clock dial of Westminster Palace, from which Big Ben counts the hours, glowed like an enormous moon. A light at the top signified that the House of Commons was in night session.

Most gorgeous was the façade of the stately London County Hall, illuminated in four colors. Festoons of light completed the picture, which gained contrast from the blackness underneath the bridges as we passed through.

Cleopatra's Needle, an ancient obelisk brought from Egypt with its twin which stands in New York's Central Park, was silhouetted in black against the two-color floodlit face of the skyscraping Shell-Mex building.

We passed under historic London Bridge and faced the grim old Tower of London. But now it looked more fairylike than grim under its whitewash of light, and we preferred to think of it as a palace for kings rather than as a prison and death house.

Like a climax to all this splendor, Tower Bridge soared into the air, the tips of its two Gothic towers lost in the mist, its twin bascules opened like a pair of gigantic jaws to allow the passage of a ship. We tied up below the bridge.*

Thames Brings the World to London

The next morning, as we dodged through the frantic traffic of the Pool of London, made more dangerous by morning fog, we understood why a licensed waterman was needed on board. This is perhaps the heaviest river traffic anywhere in the world. London, of course, was built here because the Thames was here; the city grew because the river brought the world to its door (page 86).

Canals led off from the river through locks into the port's great harbor system—the Royal Docks contain the largest area of impounded dock water in the world. Here lay ocean liners and freighters by the score, and great cranes picking off cargo or putting it on.

Here approximately 1,000 ships a week come and go, more than 50,000 a year. Nearly a quarter of a million passengers

arrive or depart during the year. More than 60,000,000 tons of cargo are handled in a year, half again as much as passes through the Port of New York.

In endless warehouses are stored the stuff of history, the treasures of far-off lands which evidence the trade that made England great: marble, mahogany, mother-of-pearl, ivory, tortoise shell, indigo, spices, quicksilver, gums, rubber, silks and perfumes, grain and timber, sugar and tea by the ton, coffee and tobacco and wine, tallow and hides, frozen meat, and dairy produce.

Zero Meridian Divides East and West

We passed from west to east as we sailed by a vertical marker on the sea wall indicating zero meridian. For here is Greenwich, from which point time and longitude are still reckoned. The lights of the city and the increasing smokiness of the atmosphere, though, have forced the observatory to move to new quarters in Herstmonceux Castle in Sussex.

Downriver we looked with interest at Tilbury, with its great docks, for here the first Queen Elizabeth reviewed her tiny army gathered to face the expected invasion of the Spanish Armada. Gravesend, near by, is in a sense Thames-end; it is here that an outgoing ship puts off its river pilot and takes on a pilot for the deepwater channel.

We sailed on, for although Gravesend may be considered the end of the river proper, we wanted to see the Thames improper, the unpredictable estuary, miles wide, sometimes savage under fierce winds, sometimes blinded with fog or chilled to almost arctic temperatures by storms from the North Sea.

It was nearly eight in the evening when we drew into Holehaven Creek (which was to prove no haven) and anchored in a channel barely 200 yards wide between a mud flat and Canvey Island. We lay between two boats that were drying their very fishy nets—with the consequence that we were promptly visited by flies.

* See "In the London of the New Queen," by H. V. Morton, NATIONAL GEOGRAPHIC MAGAZINE, September, 1933.

Towers and Battlements of Windsor Castle Crown a Riverside Summit

This magnificent structure represents 900 years of growth; each century saw succeeding British sovereigns adding towers, walls, chapels, and apartments. Stone from near-by Windsor Forest, used throughout, gives the castle its uniform look of strength and dignity.

Here in the changing of the guard, toylike soldiers march before retiring sentinels. Henry II's Round Tower dominates the horizon on the site of William the Conqueror's wooden keep.



Flowering Gardens Spread Like a Mout
Between Hampton Court and the Thames

The original Hampton Court, built by Cardinal Wolsey, stood as England's most magnificent private residence. Upon Wolsey's fall from power, Henry VIII added new rooms and settled down with a succession



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of brides. Here Jane Seymour gave birth to Edward VI; Mary honeymooned with Philip of Spain; Elizabeth entertained; and James I presided over the conference that resulted in the King James Version of the

Bible. Sir Christopher Wren added wings at right for William and Mary—making Hampton Court England's largest palace—and redesigned the grounds, including Henry VIII's Pond Garden (foreground).

Canvey Island is redeemed marshland. Dutch engineers in the 17th century built here a dike to encompass the island. This is only part of a great diking system, added to through the years to protect farmland from the treacherous Thames. Even these precautions were not enough to avoid disaster in 1953 when a spring tide, pushed up the estuary by a gale, flooded towns and villages, burst the sea wall, and devastated Canvey Island. Dozens of people drowned, trapped in their homes.

A storm came up and gave us a bad night; we braced ourselves in our bunks to avoid being thrown out. A weird medley of bangs, rattles, smacks, and cracks made the night hideous, and the morning light showed piles

Swan Marker Examines a Trussed Cygnet

All Thames swans belong to the Queen and to two London guilds, the Vintners and the Dyers. Each summer a new generation of birds is taken up from the river and divided in a centuries-old ceremony called "swan-upping." Last year saw 166 cygnets claimed according to the ownership of parent birds.



of crockery and tinware, cans and milk bottles chasing each other over the cabin floor.

The day greeted us with a chill wind and a tossing sea. The *Goshawk* tore at her anchor like a frightened horse. To go on, we needed petrol. Mr. Hoolahan and Herbert rowed away in the dinghy to get it.

Disaster Threatens When Anchor Drags

Some time later I stepped out of the cabin and discovered that our stern was within 20 feet of a lee shore under a strong gale. And the lee shore was not soft—it was the solid stone dike. The anchor was dragging. Ten minutes more, perhaps five, and we would be pounding the rocks.

Could I fend off with the boathook? My strength would be nothing against seven tons of boat and more tons of water. Could I haul in on the anchor chain? Five men couldn't budge the boat against that pressure of wind and sea. My only hope was to start the engines. But engines won't run without petrol. Hoping there might be a little left, I pressed the starter button. There was only a melancholy buzz.

I tried and tried again. My wife reported that we were now ten feet from the rocks. If we struck, first to be smashed would be the twin screws. Then our last chance would be gone, the boat would be broken up, and we would be lucky to clamber up the steep wall without being ground to pulp between boat and dike.

One engine coughed, sputtered, and took hold. I threw the lever into full ahead. The engine stalled. Mary came running forward.

"Only five feet," she said. "What do we do?"

"Be ready to jump," I said.

I tried the engines once more. The port engine refused absolutely. The starboard engine started, stopped, started again. This time it kept going. But one engine wasn't enough. We were still inching toward shore, though more slowly. I saw Hoolahan and Herbert coming in the dinghy. They had seen what was happening and Hoolahan was fairly tearing his arms out at the oars.

I kept coaxing the port engine. Suddenly it responded. The boat pulled away with tantalizing slowness from the murderous stone dike.

The sea became rougher. Herbert lost his breakfast and his two false teeth over the side. His speech became flannelly.

(Continued on page 93)



From *Anas boschas* (above) and *Kolachinos* by National Geographic Photographer Robert F. Heiss © N.G.P.

Scarlet-shirted Queen's men corral fledglings between two of the fleet's six skiffs. Dyers in blue jerseys fly their banner; Vintners wear stripes. In six days of work between London and Henley on Thames, 15 men round up most of the region's 960 swans.

Captors tie the legs of swans behind their backs and clip wings to keep the birds out of high-tension wires. The Queen's cygnets go free, unmarked; the guilds' are nicked on the beak with a penknife. In turn, the birds often inflict their own nicks.





Ships of Every Land Ride the Tidal Thames to London, a Cupboard for the World

"That mysterious forest below London Bridge," Ruskin called the city's labyrinth of pools, reaches, and docks enclosed by miles of warehouses. Here flows in



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immense flood the earth's produce: timber, grain, sugar, wool, meat, wines. Here lies untold treasure: ivory from Africa, shells from the Pacific, spices from

Arabia, porcelains and bronzes from the Far East. Tower Bridge cuts across the Upper Pool by the historic Tower of London (extreme left foreground).





Willard Price (below) and National Geographic Photographer Robert F. Sloan © N.G.S.

A barge armada moves cargo from anchored ships to riverside warehouses. These moored craft in London's Blackwall Reach resemble ranks of wooden shoes.

Masters of an empire of commerce, two port officials check the tonnage of a barge.

An impromptu race between tug and salvage boat sweeps past Wapping. Behind the wharves lies London Docks, import center for wool.





Rebirth scene (above) and Anachronism by National Geographic Photographer Robert F. Blain © N.G.A.

Royal bargemen in red livery trail the Queen to ceremonies aboard the *Cutty Sark*, last of the tea clippers. Greenwich displays the restored vessel.

Ship figureheads adorn *Cutty Sark's* hold. Once the elaborately carved statues led a proud parade of sailing vessels and steamers around the globe.





Brave with Flags, Cutty Sark Sails on the Long Voyage of Memory

Launched in 1869, the clipper was named for the short slip or cutty sark worn by the witch in Burns's "Tam o'Shanter." A "witch of a ship," she astonished the world with speeds of more than 17 knots. From China tea she turned to hauling Australian wool and finally any cargo—coal, oil, scrap iron. *Cutty Sark* limped home a ghost in the 1920's; restoration followed the war.



Ketchikan by Willard Price © National Geographic Society

Russet-sailed Survivor of a Vanishing Fleet of Sailing Barges Plies the Thames

"I'm thick," he complained.

"Sick!" exclaimed the irrepressible Hoolahan. "Oh, no! Come help me fix the engines. That will cure you."

By the next morning the wind had dropped and we were able to get on to Leigh, famous for its cockles and its yacht club, one of the few in the world to use a ship—the *Lady Savile* looks rather like an excursion steamer—as a clubhouse.

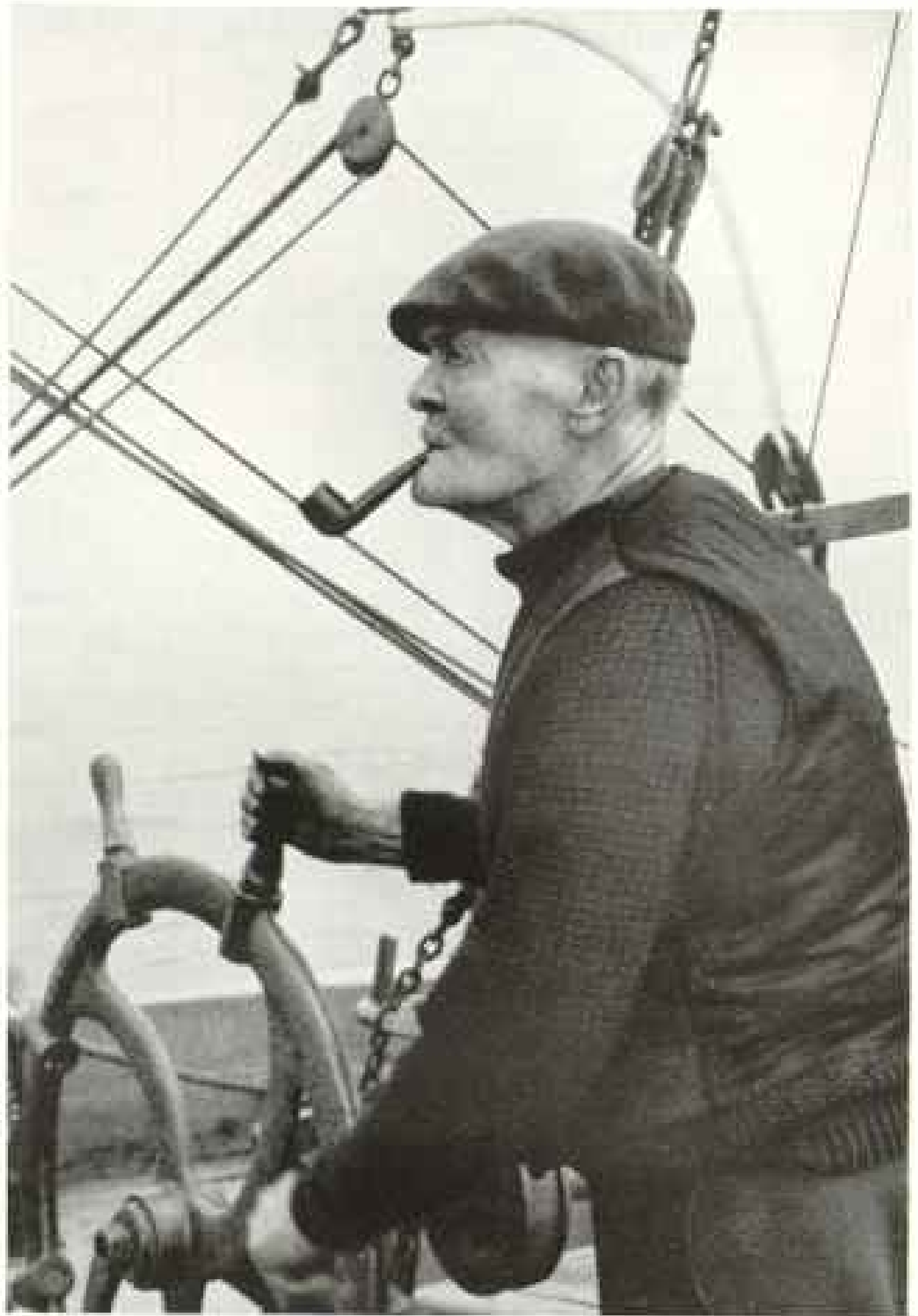
Then to our last port of call, Southend on Sea, where estuary and ocean meet. It was Sunday and trippers from London had inundated the seaside resort. We parted regretfully from Herbert and Denis, who left to sail the *Goshawk* back upriver.

Southend is the British Coney Island. At night the waterfront bursts into millions of colored lights. The pier, one of the longest in the world, even has its own seven-car trains to transport people from shore to pierhead.

At the end the pierhead broadens to become a pile-supported island three stories high, populated with thousands of trippers. Here at the mouth of the Thames they visit shops and shows and concerts and enjoy the bravest illumination in England. They gaze open-mouthed at enormous fire-breathing dragons, a vast luminous mosaic of Queen Elizabeth I and her square-rigged ships, another of the present Elizabeth and her castles and palaces, a replica of the Statue of Liberty to please visiting Americans, a doll's theater, Mother Goose, Miss Muffet, Santa Claus with his reindeer, and many other characters from fact and fiction, all blown up to gigantic proportions and blazing with color and light.

Gaiety on the Somber Thames

There are cafes and bars and booths where you may nibble cockles and whelks and jellied eels. There are games of chance to suit any taste. And there are the people, with green, red, or blue faces, according to the colors that happen to be flashing at the moment, all struggling cheerfully to get past, under or over



A barge skipper feels his way down the foggy Thames. "The captain never gave an order," reports photographer Sison. "He merely offered suggestions, but Heaven help the crewman who didn't jump." The sailing barges, now reduced to six, still carry cargo between the Thames and English coastal ports. The Thames Sailing Barge Club maintains one of the vessels as a feature of London's river.

other people, all laughing and screaming and ignoring the grave old Thames which cannot smother this gaiety with its dark, silent mantle.

There is a place where you can get away from all the uproar, at the far end of the pier projecting darkly into the river. We were a mile and a third from shore and yet far short of the middle of the mighty stream, here some six miles wide.

We stood in the dark and thought of the thousands of ships that pass this point in a year, thought of the fabulous port and the city of cities that owes so much of its greatness to this stream. We thought of all that the river has meant to England and the world.

It was hard to believe that this was the same Thames we had stepped across at Seven Springs and taken up on the tip of a finger at Thames Head.

Tudor London's Square-mile Maze: Capital of the "Eden of Europe"

Cartographer John Speed thus characterized his native land when he published this map shortly after 1600. Today's "City"—the business and financial section—still lies largely within boundaries set by the Roman Wall (1). Fire in 1666 destroyed much of the town, including St. Paul's Cathedral (2) on Ludgate Hill, the Tower of London (3) endured. London Bridge (4) led to inns, taverns, and theaters of Southwark, where Shakespeare worked.

NEW ATLAS MAP LINKS ROMAN
AND ATOMIC TIMES IN THE

British Isles

IF 17th-century cartographer Speed could see the National Geographic Society's new British Isles Map, he would find place names already old in his time mingling with others attuned to today's atomic Age of Discovery.

Emperor Hadrian's Wall, angling across England, contrasts with the new mammoth radiotelescope at Jodrell Bank, south of Manchester. Hastings, where invading William the Conqueror triumphed, looks across the English Channel—and nine centuries—to Omaha and Utah Beaches of World War II. Haunts of King Arthur vie for interest with a dozen towns where men make news in atomic research and power.

These are some of the contrasts on the new map, fourth in The Society's fast-growing Atlas series. With this July issue, at a time when Americans help swell European travel to its yearly flood tide, the 10-color portrait of the United Kingdom and Ireland reaches some 2,225,000 members as a National Geographic supplement.

Member-families following the Atlas Folio hobby will find this a veritable treasure map. Here is the setting for great history and literature, with place names suggesting the oldest in nursery rhymes and the newest in nuclear physics.

One large-scale inset shows modern London—grown from a town Speed measured in "pases"—and much of the Thames, traced from its source in the preceding pages.

An inset of Plymouth shows the location of both the Mayflower Memorial and The Hoe, where legend says Sir Francis Drake



was playing at bowls on a July day in 1588 when word came that the Spanish Armada was approaching. Thereupon Sir Francis finished first his game and then the Armada.

In a sense, the whole map reflects this naval victory by Speed's great contemporary. It charts a realm that moved from that bold moment to become mistress of the seas—mothering a great navy in spacious harbors, casually launching colonists like those on the little *Mayflower*, building argosies of ships, and founding vigorous nations.

Here, on the world's eighth largest island, is the seat of the British Commonwealth, joining nearly one-quarter of our planet's peoples and land. This island and its lesser neighbors are the ancestral home of Scots,



Library of Congress

Irish, Welsh, and English, to whom more than one-third of all United States citizens proudly trace their origins.

Lustrous place names spur imagination and scholarship: Nottingham stands guarding oaken mementos of Robin Hood in Sherwood Forest. Macbeth's Glamis broods over Scottish hills, and Hill of Tara crowns County Meath, where Irish kings once ruled.

Crossed swords mark scenes of great battles, and open squares denote other places of special historical interest, from King Arthur's Castle on the Cornish coast to Balmoral Castle, Aberdeen residence of the present royal family, and Sir Winston Churchill's Chartwell, south of London.

Dotted triangles mark archeological ruins,

and across Northumberland and Cumberland a crenelated line shows the Roman Wall built by Hadrian early in the 2d century to hold back marauding barbarians from the north.

One modest place name looms large for all mankind: Harwell, in Berkshire west of London. Here British scientists, engaged in pacifying and harnessing the hydrogen bomb for power, have produced temperatures greater than those on the surface of stars.

Members may obtain additional copies of all published Atlas Maps (50 cents each, postpaid) and the handsome Atlas Folio to bind them (\$4.55, postpaid) by writing to the National Geographic Society, Dept. M, Washington 6, D. C. All remittances payable in U. S. funds. For prices of large wall maps and other National Geographic publications, write for free catalogue.

Bustles, boots, and Franklin stoves—plus the transplanted laboratory of a great inventor—re-create the world of grandfather's day in Henry Ford's unique museum.

THE PAST IS PRESENT IN

Greenfield Village

BY BEVERLEY M. BOWIE

Assistant Editor, National Geographic Magazine

FOR an afternoon, at least, time had taken a vacation.

In the suavely upholstered interior of a 1902 Waverly electric brougham I drove sedately past the paddock of a Cotswold cottage. Two stableboys leaned on the gate and stared; an old horse pricked up its ears and whinnied. At the door of a 17th-century forge the smith slowly wiped his hands on his leather apron and blinked at us in the warm sunshine.

Sounds eloquent of another era disturbed the autumn air. From the meadow below arose the frantic squeal of a steam calliope playing "Daisy, Daisy." Rounding the bend of the lagoon to our right, the stern-wheeler *Sauwance* gave two hoarse, high-pitched toots. And above the lengthy procession of Moons, Maxwells, Hupmobiles, Tin Lizzies, and Stutz Bearcats that stretched behind us floated the nostalgic "oogah-oogah!" of a hundred antique horns.

For this was the annual Old Car Festival held each September at Greenfield Village. Here, on some 200 acres near Dearborn, Michigan, Mr. Henry Ford (1863-1947) re-created a big slice of American history, from a 1634 Cape Cod windmill to an 1886 Detroit power plant; from the weather-beaten shacks of southern slaves to his own neat, flower-bordered homestead. These 90-odd buildings, 51 of them transplanted originals and the rest authentic reproductions, Mr. Ford linked with



19th-century America springs to life again

his gigantic museum near by: a vast 14-acre display of the Nation's developing industry and art (color map, pages 104-5).

The great bell of Martha-Mary Chapel was softly ringing one o'clock when, after the last of 250 entrants had chugged through the village, the contests began on the green. Cork-screwing between rows of balloons pegged to the grass, high-slung cars wove elegant figure eights, racing against time and explosions as daintily as spry dowagers dancing a gavotte. Drivers competed to see who could go the slowest without stalling or shifting gears.



National Geographic Photographer Willard B. Carter

in the 200-acre museum on the outskirts of Dearborn, Michigan

Autos of only one or two cylinders engaged in spirited "drag" trials.

Far into the sunlit afternoon the antique sports went on, as blue and red and yellow ribbons drifted from the judges' hands like maple leaves. A silver Rolls-Royce purred past me, and from the tonneau a gentleman in top hat and opera cape bowed benignly. I nodded farewell, elbowed my way through the crowd, and strolled along some of the village's nearly deserted side streets.

The gentle thump of a steam engine at the Loranger gristmill told me that Ralph Shackle-

ton was ready to grind some corn meal. I looked into his shop and found him lifting a few bags into position. Greeting me calmly, he finished his preparations and then sat back in a Windsor chair padded with flour sacks and folded his hands. The steel-framed glasses on his long Scots nose had slipped a little; over the rims he squinted at me and said:

"You know, I wish Mr. Ford had been here today. He would have gotten a kick out of all those old cars, and the kids gawking at them, and the village really coming to life. He loved this place."





Motorists in Dusters and Goggles Pilot a Steamer Down the Green

Henry Ford, a tireless collector of antiques, found he owned so many things that he could scarcely get a look at them. The idea grew on him of displaying his treasures; he wanted to give future generations a tangible picture of the life their ancestors led, especially the men of America's Industrial Revolution.

Accordingly, he erected Greenfield Village. In some 90 buildings, more than half of them transplanted originals—from blacksmith shop to gristmill, from shoeshop to tintype studio—he housed his wealth of Americana and opened it to the public.

To Greenfield each year come some 250 horseless carriages from all over the country. For two autumn days they chug about the extensive grounds, basking in the admiration of old-car buffs, competing in tests of driving skill, and providing a brightly burnished history of automotive progress.

This 1903 Stanley Steamer can hiss along at 40 miles an hour. A gasoline flame fires its boiler; the car cruises 40 miles on two gallons of fuel and 20 gallons of water.

The slender tower of Martha-Mary Chapel—a memorial to the mothers of Mr. and Mrs. Ford—dominates the north end of the Village Green.

Grand champion receives bowl and buss from a flapper-costumed official for his 1923 Stutz Bearcat, best of the 1917-1925 class.



Kodachrome (left) and Ammochrome by National Geographic Photographer Neal P. Davis © N.G.S.

The only sounds to break the warm, dusty silence now were the clack of the twirling buhrstones, a subdued hiss of steam from the boiler. The corn kernels in the glass-paned hopper, undermined, shifted uneasily and fell slowly down between the shearing stones.

"Used to see him nearly every day. He'd stay across the street at his homestead; same bed he'd slept in as a boy. Show up at chapel in the morning to hear the youngsters sing, walk back across the green, stop at the Sir John Bennett jewelry shop to watch Gog and Magog strike the hour on the big clock overhead, and then drop in on my mill to see what I was up to. A friendly man, Mr. Ford. Nicest I ever knew."

Shop Powered by 120-year-old Engine

Mr. Ford's next stop, of a morning, was usually the village print shop and bookbindery. I put my head in to see if Ed Litigot, the proprietor, was on the premises. He was. With a swatch of cheesecloth he was wiping invisible specks from the gleaming, toylke 120-year-old Stillman Allen engine which ran the shop's whirring belts.

"I'm still a bit nervous, I guess," grinned Ed. "Mr. Ford was very particular about dust. Never came by but what he'd run his hand over this machine and then look at his fingers. He wasn't mean; it's just that he had a passion for steam engines—you can see 'em all over the village—and this one was his pet.

"But he liked people and learning even better. Always made me shut the presses off when he came in, so's we could have some peace while we passed the time of day. . . . The 'old man' was in here the day he died. Went out of that door and never came back."

Ed sighed and kicked the pedestal of one of his presses. "I remember, too, the day he rambled in, long time ago it was, and said, 'Ed, where should I put my house?'

"I said, 'Why not across the street? Looks like a nice spot to me.'

"And he said, 'Yes, I think so, too. I want to be near my tinkers.'"

It was characteristic, certainly, of Mr. Ford

to want to be near men who made things—"tinkers" like himself, restless until they understood how something worked and how it could be made to work better. At one time he had as many as 20 craftsmen working away in the village, not merely a printer and a miller, but also several smiths, a weaver, a glass blower, a tintyper, a shoemaker, a silversmith, a silkworm farmer, and a sawyer. Today the skilled artisans working at their specialties include as well a pewterer, a potter, a cabinetmaker, and a candlemaker. Enough authentic tools and equipment have been assembled to equip 50 different trades.

A self-made historian of these crafts, Mr. Ford began early to collect examples of both their implements and their output. As the antiques trickled in from all parts of the country, they began to fill and then flood the old tractor factory Mr. Ford had set aside as a storage spot.

"Better find some place to put these things," urged his architect, Edward J. Cutler. "Another few months and we won't have any space left to sit down in."

Mr. Ford said nothing. But in a little while he took Cutler aside and said: "All right. Start looking for a site. Might as well put these things in a place where they'll look right, and where other people, too, can see what America used to be like."

A Village of Historical Buildings

Some days later Mr. Ford and Mr. Cutler went out to survey the village's present location. As Mr. Cutler recalled to me one afternoon, "It was just an old field, mostly flat and crossed by a dirt road. But Mr. Ford was already re-creating it in his mind's eye. 'We'll put a church on this little knoll, and the town hall over there, and the school along the edge of the green. . . .'"

It was a prodigious undertaking. Merely to manufacture an outdoor stage set on this scale would have been difficult enough, but to compose it of unique historical buildings lifted bodily from the far corners of the United States and even abroad—that was something to give a man pause.

Tin Lizzie's Earliest Ancestor Could Travel 20 Miles an Hour

In this brick shed, which stood behind Henry Ford's Detroit home at 58 Bagley Avenue, the inventor in 1896 put together his experimental two-cylinder car. He used bicycle wheels, carriage cushions, old pipe, and anything else handy. Like many another home workshop tinkerer, Mr. Ford found his completed masterpiece too big to get out the door; with an ax he enlarged the opening. Later the bricks were reset to create this wider exit.

In Greenfield the reconstructed shed sits again by an avenue named Bagley.



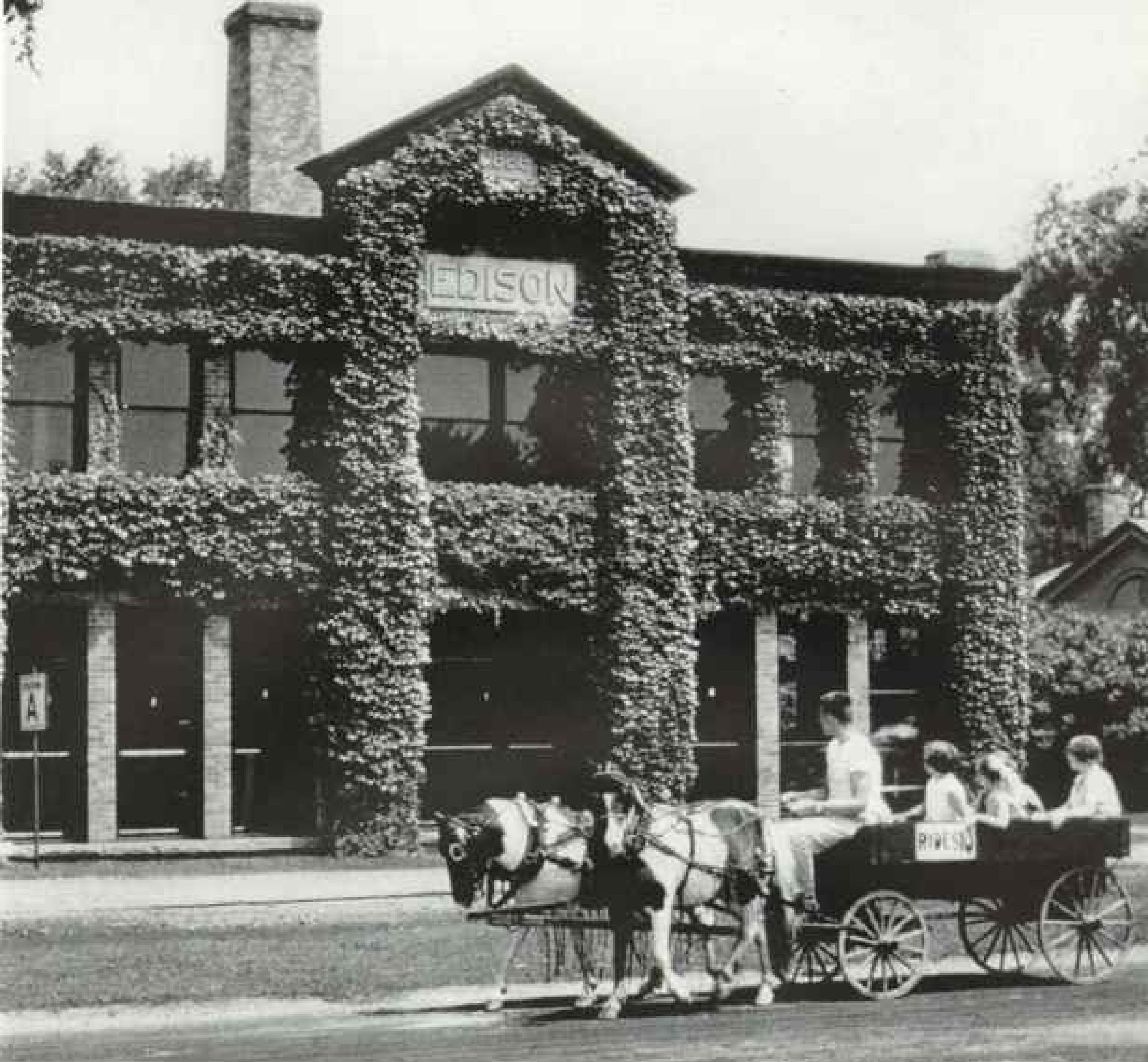
As a Young Engineer in This Detroit Plant, Ford Began a Lifelong Friendship with Edison

For \$45 a month, young Henry tended the dynamos of the Edison Illuminating Company's Detroit station, here reproduced in partial replica. At night he tinkered with gasoline engines. When he told Edison of his auto designs, the "wizard of Menlo Park" exclaimed, "Young man, that's the thing. You have it!"

Years later, Ford expressed his gratitude by importing to Greenfield Village Edison's laboratory and outbuildings, complete to broken test tubes on the dump. He even imported the dirt on which the offices stood: seven carloads of New Jersey soil. When the last Leyden jar, the last wet-cell battery was in place in 1929, Mr. Ford persuaded Edison to re-enact the moment at which he had first sent a current glowing in a vacuum bulb 50 years before. Overcome by emotion, the inventor accepted the honor in the names of all who had helped him in his research.



A boardinghouse table at Menlo Park, New Jersey, was the first to bask in the glow of Mr. Edison's incandescent bulbs. It belonged to Mrs. Sarah Jordan, who gave food and lodging to Edison's bachelor assistants for \$5 a week. When Edison perfected his electric light, he tested it by hooking wires from his laboratory to Mrs. Jordan's dining room. Mr. Ford transplanted the modest home to Greenfield Village in 1928. Furnishings are late Victorian, with Cable glass and English pottery.



National Geographic Photographer Svail P. Durbi

But not Mr. Ford. His conception of the venture continually outpaced its realization, and obstacles did not impress him. In Cutler's words:

"He would come into our office some morning with a brand new idea and say, 'Get me something on paper about that. I'll be back at two.' Well, we'd have to hump ourselves. Maybe the thing couldn't be done. But we would have to *show* him it couldn't, and not just say so. He couldn't stand being told something was impossible. He'd been told that too often before."

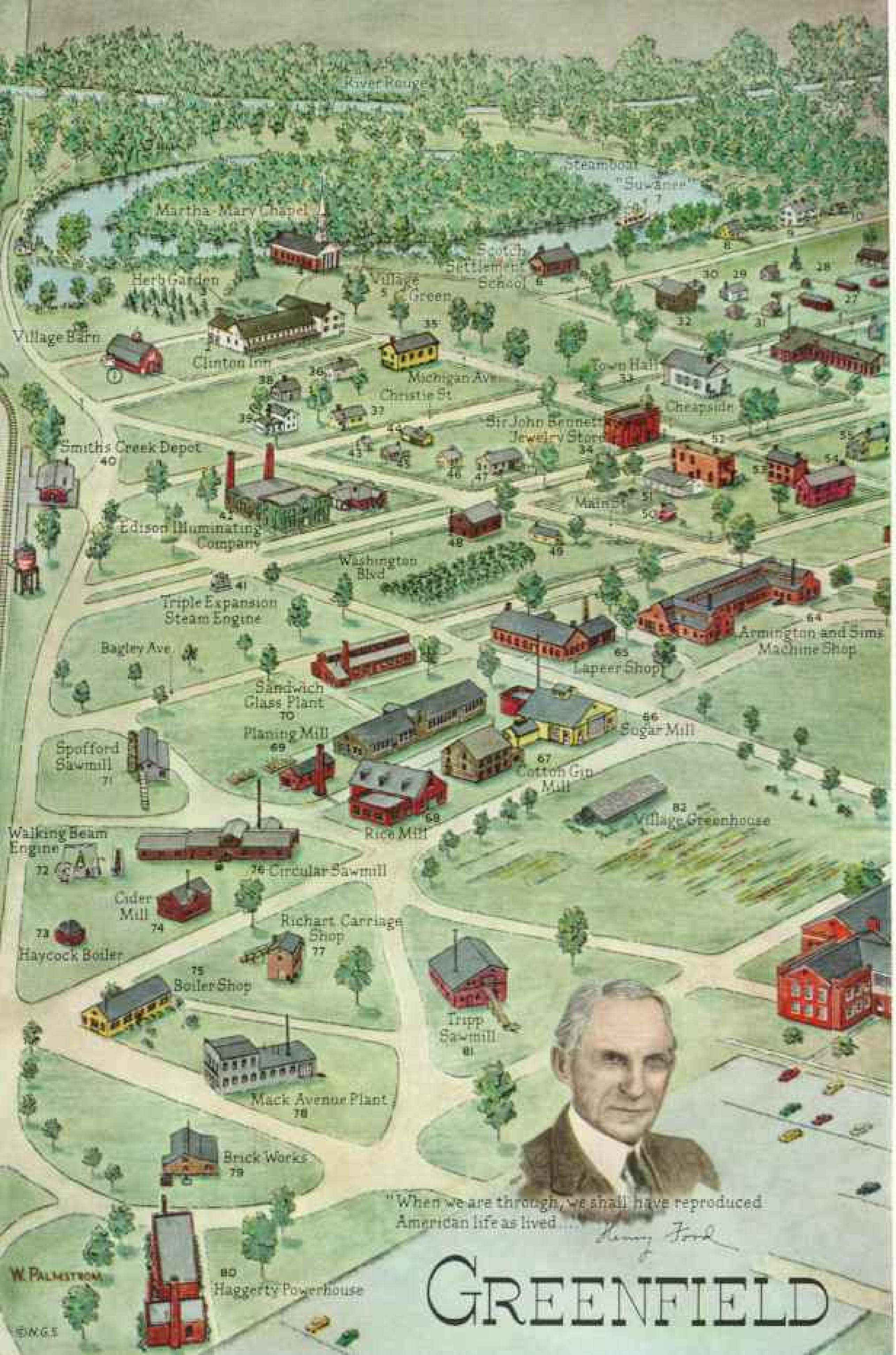
Smithy Imported Complete with Dirt

Perhaps the most ambitious single project was the importation from Chedworth, England, of the Rose Cottage, its stable and dovecote, plus a near-by forge, at a cost of more than a million dollars (page 110). Mr. Ford was not

content to acquire just the buildings. In transplanting the smithy, he also moved every last item of equipment that the original owners—the Stanley family—retained after 300 years of ironwork: the limestone forges, the sledges and fullers, the bellows, the nail blocks. He even imported the hard-packed soil which had made up the floor of the old shop.

With the barn came a flock of English sheep; their descendants still wander about the village. The English mourning doves proved less hardy. They liked their familiar dovecote, but they were quite unused to coping with such aerial thugs as the hawks of Michigan.

To pluck up an Old World grange in this manner and waft it across the sea to a suburb of Detroit may seem a shockingly abrupt operation, fatal to the character and charm of the patient. Yet it is astonishing how tran-



River Rouge

Steamboat
"Suwanee"

Martha-Mary Chapel

Herb Garden

Village Green

Scotch Settlement School

Village Barn

Clinton Inn

Michigan Ave
Christie St

Town Hall

Cheapside

Smiths Creek Depot

Edison Illuminating Company

Sir John Bennett Jewelry Store

Main St

Triple Expansion Steam Engine

Washington Blvd

Armington and Sims Machine Shop

Bagley Ave

Sandwich Glass Plant

Lapeer Shop

Spofford Sawmill

Planing Mill

Sugar Mill

Walking Beam Engine

Rice Mill

Village Greenhouse

Circular Sawmill

Cider Mill

Richard Carrriage Shop

Haycock Boiler

Boiler Shop

Tripp Sawmill

Mack Avenue Plant

Brick Works

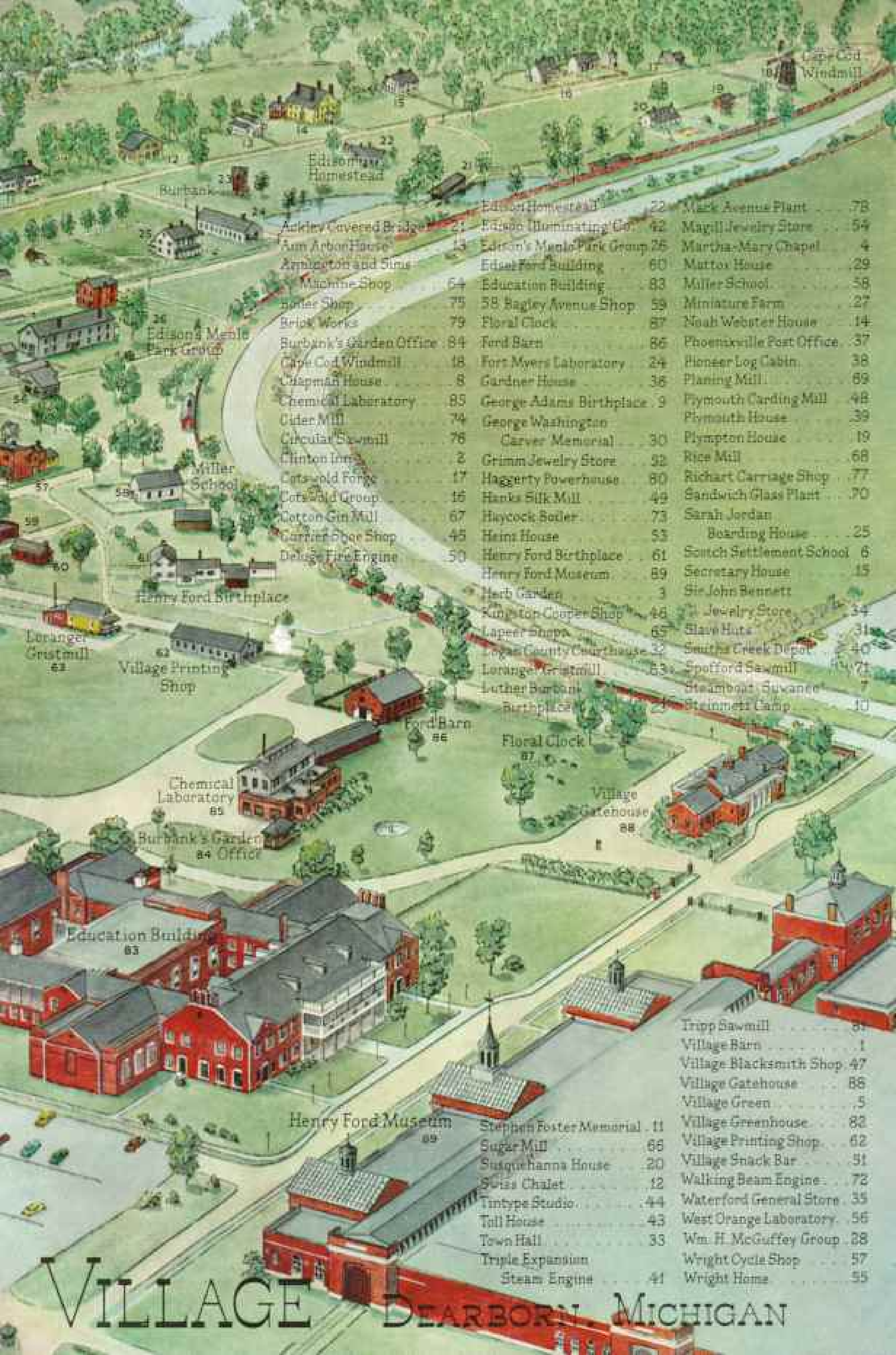
"When we are through, we shall have reproduced American life as lived."
Henry Ford

GREENFIELD

W. PALMSTROM

Haggerty Powerhouse

EWG.T



Ashtley Covered Bridge	21	Edison Homestead	22	Mark Avenue Plant	78
Aun Arbon House	13	Edison Illuminating Co.	62	Magill Jewelry Store	54
Armistead and Sims		Edison's Menlo Park Group	25	Martha-Mary Chapel	4
Machine Shop	64	Edsel Ford Building	60	Martox House	29
Printer Shop	75	Education Building	83	Miller School	58
Brick Works	79	58 Bagley Avenue Shop	59	Miniature Farm	27
Burbank's Garden Office	84	Floral Clock	87	Noah Webster House	14
Cape Cod Windmill	18	Ford Barn	86	Phoenixville Post Office	37
Chapman House	8	Fort Myers Laboratory	24	Pioneer Log Cabin	38
Chemical Laboratory	85	Gardner House	36	Planing Mill	69
Cider Mill	74	George Adams Birthplace	9	Plymouth Carding Mill	48
Circular Sawmill	76	George Washington		Plymouth House	39
Clinton Inn	2	Carver Memorial	30	Plympton House	19
Cottswold Forge	17	Grimm Jewelry Store	92	Rice Mill	68
Cottswold Group	16	Haggerty Powerhouse	80	Richard Carriage Shop	77
Cotton Gin Mill	67	Hanks Silk Mill	49	Sandwich Glass Plant	70
Garnier Shoe Shop	45	Haycock Boiler	73	Sarah Jordan	
Dodge Fire Engine	50	Heins House	53	Boarding House	25
		Henry Ford Birthplace	61	Scott Settlement School	6
		Henry Ford Museum	89	Secretary House	15
		Herb Garden	3	Sir John Bennett	
		Kingston-Cooper Shop	46	Jewelry Store	34
		Lapeer Shops	65	Slave Huts	31
		Lodge County Courthouse	32	Smiths Creek Depot	40
		Lorange Gristmill	63	Spofford Sawmill	71
		Luther Burbank		Steamboat Duwamish	7
		Birthplace	21	Steinmetz Camp	10
		Floral Clock	87		
		Village Gatehouse	88		
		Chemical Laboratory	85		
		Burbank's Garden	84		
		Office			
		Education Building	63		
		Henry Ford Museum	89		
		Stephan Foster Memorial	11		
		Sugar Mill	66		
		Susquehanna House	20		
		Swiss Chalet	12		
		Tintype Studio	44		
		Tail House	43		
		Town Hall	33		
		Triple Expansion			
		Steam Engine	41		
		Tripp Sawmill	81		
		Village Barn	1		
		Village Blacksmith Shop	47		
		Village Gatehouse	88		
		Village Green	5		
		Village Greenhouse	82		
		Village Printing Shop	62		
		Village Snack Bar	51		
		Walking Beam Engine	72		
		Waterford General Store	35		
		West Orange Laboratory	56		
		Wm. H. McGuffey Group	28		
		Wright Cycle Shop	57		
		Wright Home	55		

VILLAGE DEARBORN MICHIGAN



National Geographic Photographer Neal P. Davis

The Air Age Was Born in the Back Room of This Bicycle Shop

Here Wilbur and Orville Wright in spare hours built the motor and many parts for the plane they flew successfully near Kitty Hawk, North Carolina. A wind tunnel they improvised for aerodynamic tests, reproduced by Mr. Ford, may be seen in the shop's cluttered back room. The shop was moved from Dayton, Ohio, in 1938.

Cooperating enthusiastically with the photographer, tintyper Irwin Clark wobbled into focus on this 1887 high-wheeled "ordinary"; then he took a disastrous header, breaking his arm. Life is slower and somewhat safer in Mr. Clark's tintype studio (page 125).

quilly acclimated the Rose Cottage now seems.

Yellow butterflies danced above its old-fashioned dooryard garden the day I first visited it. Ivy rustled at the door, and from behind the stone stairs a cricket chirped contentedly. Something may have been lost in the moving of this cottage. But it was not peace.

Brothers Moved with Their House

Transporting the old windmill from Cape Cod was no easy feat, either. Stoutly braced against the wind, its superstructure was as tight as a drum. "To get the heavy grindstones out, we had to build a skidway up to

the second floor," Mr. Cutler told me. "I felt like a Pharaoh fooling with a pyramid."

When it came to fetching the wide-verandaed Susquehanna House from the site it had occupied along the Patuxent River since 1652, Mr. Ford's passion for completeness led him to bring also two brothers who had lived in it long ago. Christopher Rousby, once King's Collector of Customs in Maryland, was murdered by a disgruntled taxpayer; now he lies next to his brother John beneath the lawn of his magically transplanted home.

Other assignments, which looked equally formidable, sometimes proved quite simple. To move the Ackley Covered Bridge from

Wheeling Creek, Pennsylvania, Mr. Cutler's men just waited until the stream froze, dropped the bridge down onto the ice, and dismembered it in perfect safety.

Mr. Ford was interested in more than beauty. He wanted to preserve a historical cross section of America, and he had no desire to prettify it. His reproductions of the Edison Illuminating Company plant (page 103) and the Armington and Sims Machine Shop could scarcely be mistaken for the "frozen music" of a master builder. In the one, however, Mr. Ford picked up his first job as an engineer. Here he used his spare hours to tinker with a gas-powered auto. And during this period Ford met the man with whom he was to enjoy decades of friendship tinged with hero worship: Thomas Alva Edison. In the other were built the engines that Edison ordered for his first commercial lighting plant—the Pearl Street Station in New York City.

Mr. Ford never gave his heart away lightly. But once committed in his admiration for a man, he would spare no expense or pains to do him honor. When he decided to memorialize Edison's scientific achievements, he did not stop with a mere power plant and a machine shop. To the best of his ability, he re-created Menlo Park in Greenfield Village.

Menlo Park, New Jersey, was the site of Edison's first laboratory. Working around the clock, the "wizard of Menlo" and his "insomnia squad" of brilliant technicians had perfected a multitude of extraordinary inventions, from the phonograph to the incandescent light. But by 1928, when Mr. Ford thought to acquire the building, it had been well looted and "cannibalized" and had fallen into sad disrepair. He bought it from a chicken farmer—and had to buy as well half a dozen other houses in the vicinity to collect all the missing parts and equipment.

Lock, Stock, Barrel—and Even a Stump

Mr. Ford's industrious men brought back not only the laboratory but near-by shrubs and trees—and seven carloads of New Jersey earth with which to give the old building a familiar foundation. Rarely has dirt been purchased at so high a price: because someone forgot to treat the soil chemically before transporting it out of the State, \$1,400 in fines were levied, and the Department of Agriculture had its agents prowling about the village for weeks to trap any Japanese beetles that might have hitchhiked to Michigan in this way.

Shelf after shelf of Edison's bottles and jars, retorts and test tubes were ferreted out. Workmen also imported and reinstated on the northeast side of the laboratory an old dump studded with broken bits of discarded glass, scraps of iron, splinters of wood. They even picked up the stump of a big hickory tree that once stood next to the laboratory.

Boardinghouse Brought from Menlo Park

The ramifications spread out to include a shed in which the night watchman scraped lampblack from the chimneys of Edison's kerosene lights for the inventor's carbon transmitters; a wooden shack for glass blowing; a carpenter's work shed; an office and library; a machine shop—and, down the street, Mrs. Sarah Jordan's boardinghouse (pages 102 and 122), where several of Edison's workmen lodged. Thanks to some wires strung over from the machine shop, this pleasant establishment became the world's first Edison-lighted house.

Mr. Ford couldn't procure the building in which Edison was born; he had to content himself with the Canadian homestead of the inventor's grandparents. But he salvaged the laboratory at Fort Myers in Florida that witnessed many of Edison's experiments on extracting rubber from plants. And he indulged himself happily in purchasing Michigan's Smiths Creek Depot.

Thereby hangs a typical tale. Upon the 50th anniversary in 1929 of Edison's development of the electric bulb—"Light's Golden Jubilee"—Mr. Ford, President Hoover, and Edison rode together behind a wood-burning locomotive along the boundary of Greenfield Village. With them rode a glittering throng of dignitaries that included Orville Wright, Will Rogers, and Gilbert Grosvenor, then Editor of the NATIONAL GEOGRAPHIC MAGAZINE.

On just such a Grand Trunk train the young Edison had sold fruit and candy and newspapers (page 116), and nearly burned up the baggage car with his unauthorized chemical experiments. Now, however, as the engine puffed to a halt before Smiths Creek Depot, the President of the United States respectfully assisted the venerable but still mischievous genius to alight—at the same platform onto which an indignant conductor had booted him 67 years before.

Mr. Ford relished the irony. He relished even more the quip with which Edison greeted the re-creation of his Menlo Park laboratory.



Proudly Mr. Ford showed him around the meticulously duplicated scene.

"Well," he said finally, "what do you think of it?"

Edison shook his head. "Henry, it's 99.9 percent perfect."

"What! There's something wrong?"

"Yes. We never kept the old place this clean."

Editorial Ribbed Wizard of Menlo

Displayed in a showcase on the first floor, among other memorabilia, is a clipping from a *New York Times* editorial of November 13, 1879. Edison no doubt enjoyed it more from the perspective of 1929 than he had at the time it was published, when the editors took note of his labors upon the electric light bulb in these helpful words:

"Would it not be as well, though, to invent some mode of abolishing night altogether? A dozen artificial moons would answer the purpose: an Artificial Moon Company, with a capital of \$100,000,000, would be a novelty; and the exhibition could be postponed from time to time to suit those emergencies which are prone to arise in realizing grand conceptions."

For a guide through Mr. Ford's Menlo Park, I had the next best shepherd to Edison himself: Frank Davis, curator of the museum's department of communications. Ordinarily, when a chap starts explaining a bit of machinery to me, a fine glaze settles over my eyeballs, and it takes a very loud noise indeed to rouse me. But Davis was different. His frosty blue eyes alight with restless zeal, he re-enacted for me one invention after another, moving from apparatus to apparatus along the quiet laboratory and holding my attention with no trouble at all.

At last, slumping for a moment onto the pipe-organ bench at the end of the room, he paused and said:

"We're talking, you know, about a man who never patented his biggest invention. I don't mean his electric light, or his telephone trans-

mitter, or his stock ticker, or his phonograph. I mean his invention of organized research. He was really in the business, you might say, of producing ideas. He wasn't interested in cooking up a process, founding an industry on it, and getting rich. What he wanted was to turn his Menlo Park team loose on one problem after another. Solutions bored him—problems intrigued him.

"Everything he worked on was designed to make life safer or simpler or happier. I guess that's why he and Mr. Ford hit it off so well."

While Edison occupied a unique place in Mr. Ford's esteem, other scientists had their niches, too. As a memorial to George Washington Carver, the gentle but resolute Negro chemist who found so many odd things to do with peanuts, pecans, and sweet potatoes, he built near the green a typical slave cabin of timbers sent by Ford dealers from every State in the Union. The cabin was based on Carver's memories of his long-vanished birthplace. As an old man, Carver—who was born in slavery—once came to Greenfield and camped out in the cabin for several days, rambling about the village with Mr. Ford and chatting of the America they had seen change, as it were, under their feet.

Charles Steinmetz, the hunchbacked Merlin of General Electric research, was another friend. In a small gray shack overlooking a creek in upstate New York, he used to study the nature of lightning. Years after Steinmetz's death in 1923, Mr. Ford moved that summer camp to the village—where it has since been struck three times by lightning!

Wright Brothers: Out to Lunch

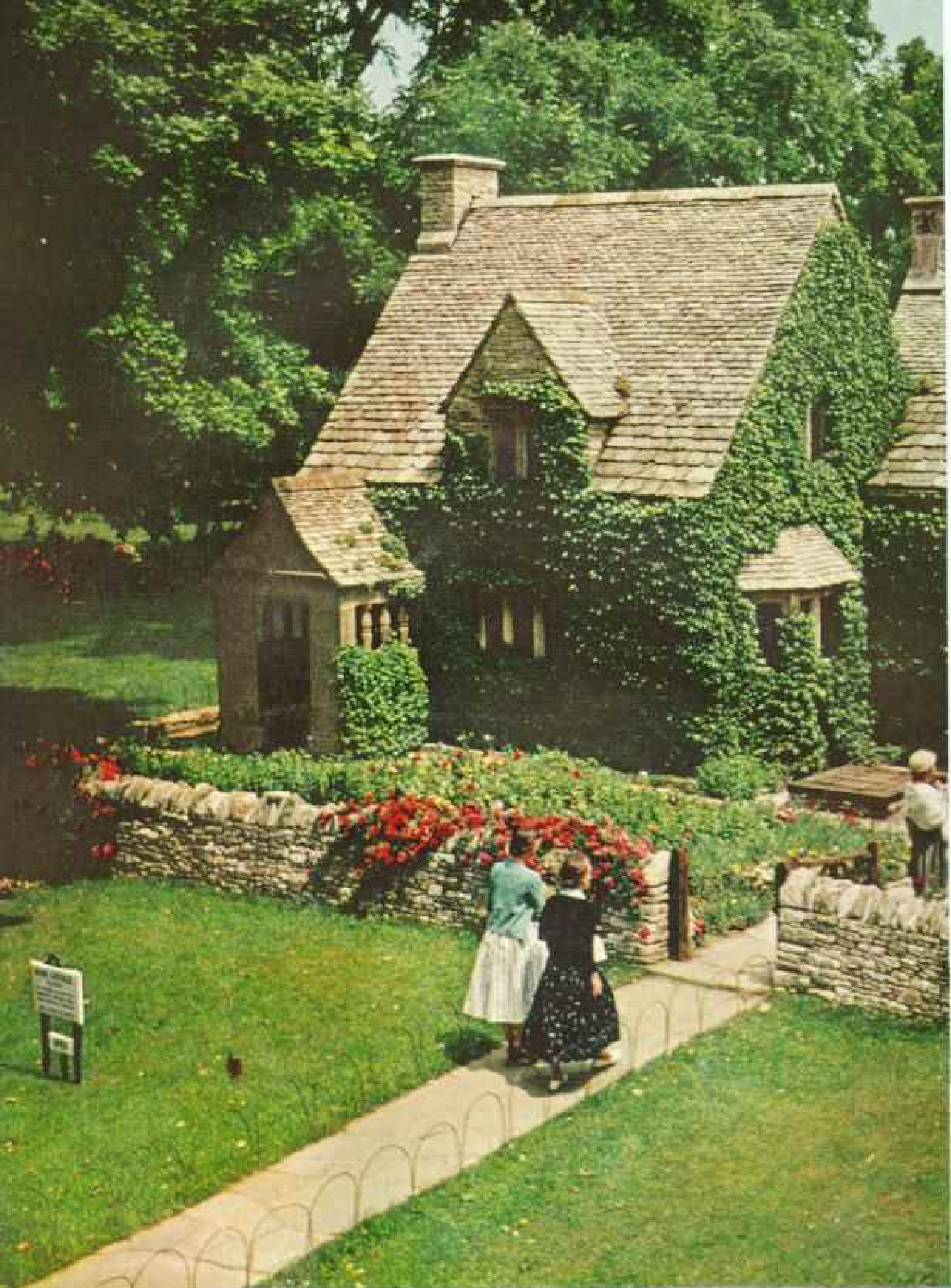
It was certainly predictable that the Wright brothers, those eminently practical pioneers of flight, should also enter Mr. Ford's industrial Valhalla. The bicycle shop that Wilbur and Orville ran in Dayton, Ohio, now stands on Cheapside Street in the village, across from the Magill jewelry shop (page 106).

The bikes are still there in the front room, but in back I found the really exciting items,

Gog and Magog, Imported from London, Strike the Quarter-hour

From boyhood Henry Ford loved to repair clocks and watches. As a man, still fascinated by timepieces, he amassed a collection of more than 3,000, now shown in Greenfield. One group is housed in the Sir John Bennett jewelry store, a 19th-century London landmark.

Legend identifies Gog and Magog as giants captured by Brutus, founder of the British capital. The original clock-striking figures, which stood in the Guildhall, were destroyed in the Great Fire of 1666. Their replacements were blitzed during World War II; new giants were set up in 1953. Sir John had Greenfield's copies made more than a century ago.



Rose Cottage Began Life on Rolling Downs
in England's Cotswold Hills

Dismantled, with each stone and slate and timber
numbered, this 17th-century sheepherder's farmstead
rattled from its native Chedworth to the port of Lon-



Killarney by National Geographic Photographer Willard R. Culver © N.G.S.

don aboard 67 freight cars. Architects reassembled it in Greenfield Village; gardeners soon made it at home with a mantle of ivy and a riot of English blooms

and herbs. To Mr. Ford, the serene beauty of the cottage spoke volumes about the ancestry of the American colonial home and rural culture.

casually left about as if the brothers had just gone out for lunch in the middle of some experiment in aerodynamics. On a sawhorse rests a primitive 6-foot wooden wind tunnel, and over on a workbench, near a heap of worn-out bicycle tires, lies an airfoil rib in cross section.

Here and there are deployed many of the original tools and machines the stubborn dreamers used to make their first plane. No question about their authenticity: Orville Wright himself helped Mr. Ford track them down and assemble them in this unpretentious memorial to a historic exploit.*

In a cabinet I saw a copy of a letter Wilbur had written the Smithsonian Institution in 1899, asking for some of their scientific papers and explaining why he wanted them. The phrasing, I thought, was wonderfully cool, confident, and matter-of-fact:

"Dear Sirs: I have been interested in the problem of mechanical and human flight ever since as a boy I constructed a number of bats of various sizes after the style of Cayley's and Penaud's machines. My observations since have only convinced me more firmly that human flight is possible and practicable. It is only a question of knowledge and skill just as in all acrobatic feats."

Tintyper Uses Four Cameras in One

I spent nearly a fortnight at Dearborn, rambling about and poking my head into odd corners of the village and museum. There was always something doing. I missed the wandering ballad singer who, in the summer, is likely to pop up with his guitar on the *Sweetie's* deck (page 127) or on the shady green. But I enjoyed looking in on the potter, smiling to himself over his twirling wheel; the glass blower bent before his torch like a votary before the sacred fire, drawing raspberry-hot tubes across the flame; and the rather philosophic tintyper.

Correctly attired in frock coat and top hat, I sat for my portrait one afternoon in Mr. Irwin Clark's studio (page 125). Disappearing under a velvet hood after stern orders for

me to look at the tin birdie, Mr. Clark fiddled with his wet plates. The camera's four lenses stared at me like the muzzle of a Bofors anti-aircraft gun. Somewhat muffled, Mr. Clark's voice rolled on.

"This tintyping is more of an art than a science. Can't use light meters—the emulsion's so slow it hasn't any rating at all. The chemicals in it seem to work one way on one day and entirely differently the next. That's why I cover myself by taking four shots at once, with varying exposures."

"Snapshot" Lasts for 22 Seconds

Rigid, growing more sternly Victorian by the second, I held the pose. Ten seconds, 15, 20, 22. Mr. Clark emerged.

"A horrible form of photography, really. A step backward in quality from the ambrotype and the daguerreotype. But people in the 1880's wanted something cheap and quick, and this was it. Drop by later, and I'll have your pictures all mounted."

I thanked him and made my way over to the Owl Night Lunch Wagon for a revitalizing Coke. From there I drifted next door into the Waterford General Store, Elias A. Brown, Propr. (page 96). Here I could browse among bustles, bowlers, boots, and fancy cravats, heft a good wooden rake or pitchfork, look at the latest in corn-cob pipes, buy a few jawbreakers and some rock candy, and admire the great two-wheeled grinder for Arbuckle's Ariosa Coffee.

My favorite among the store's elegant advertisements was a large poster for Kirk's Flake White Soap. It depicted a grimy tramp penning a testimonial that read:

"I used your soap two years ago and have not used any other since."

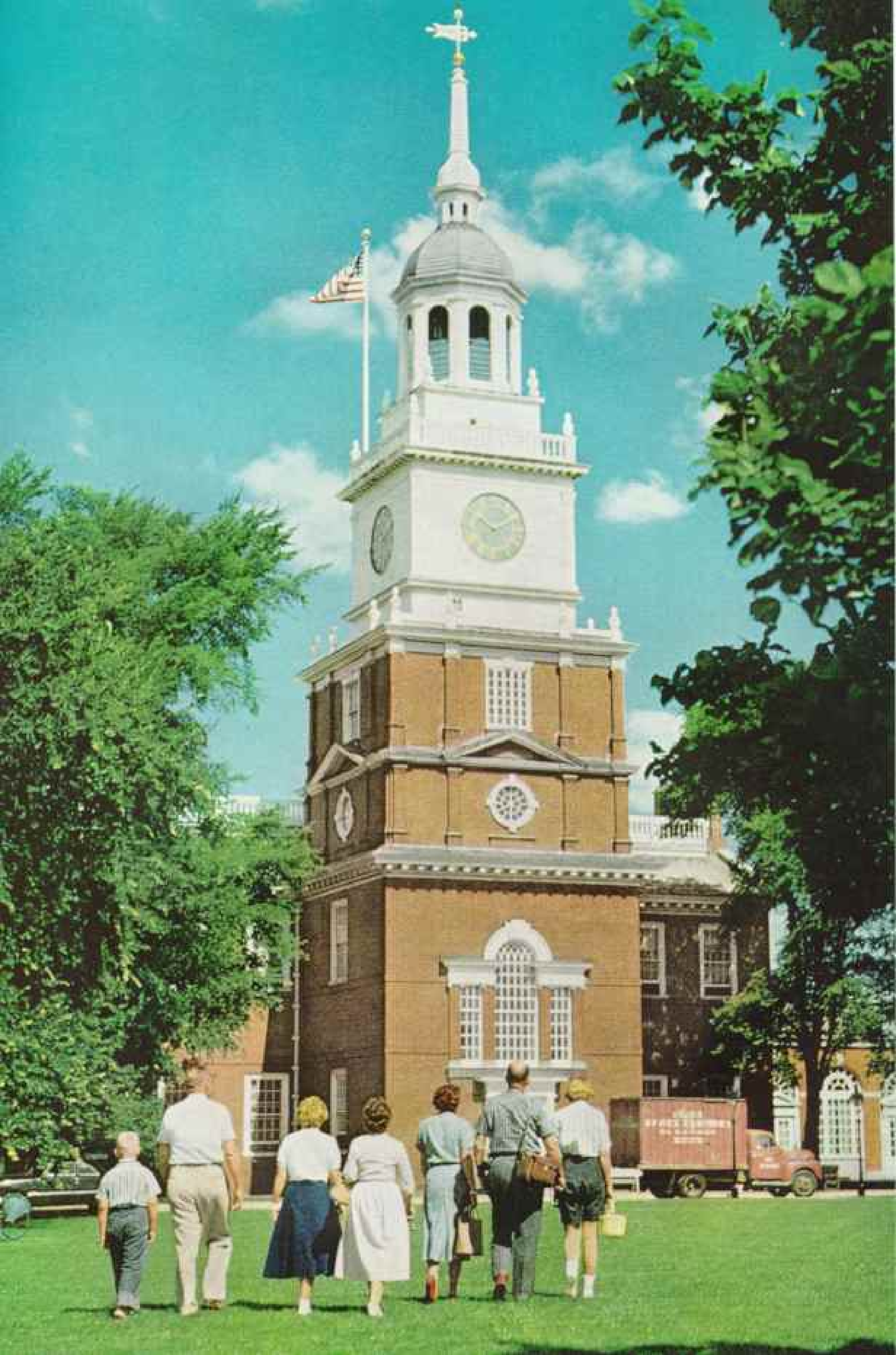
Usually, toward the end of any day spent in the village, I would return to the Ford Museum for an hour or two of leisurely exploring. I recommend the procedure. This

(Continued on page 121)

* See "Fifty Years of Flight," 31 historic photographs, NATIONAL GEOGRAPHIC MAGAZINE, December, 1953.

Independence Hall Beckons Visitors to the Ford Museum

No builder's plan survives of Philadelphia's historic meetinghouse, where American Revolutionary leaders voted to break with Great Britain. So Mr. Ford, determined to reproduce the hall accurately to the last nail hole, dispatched engineers and draftsmen to survey it inch by inch. When they discovered a window out of line or a column off center and corrected the errors, Mr. Ford sternly decreed, "Put the mistakes back in." Behind this tower now extend the vast display rooms of the museum—14 acres of prize-packed floor space covering fine arts, household arts, agriculture, manufacturing, power, and transportation.





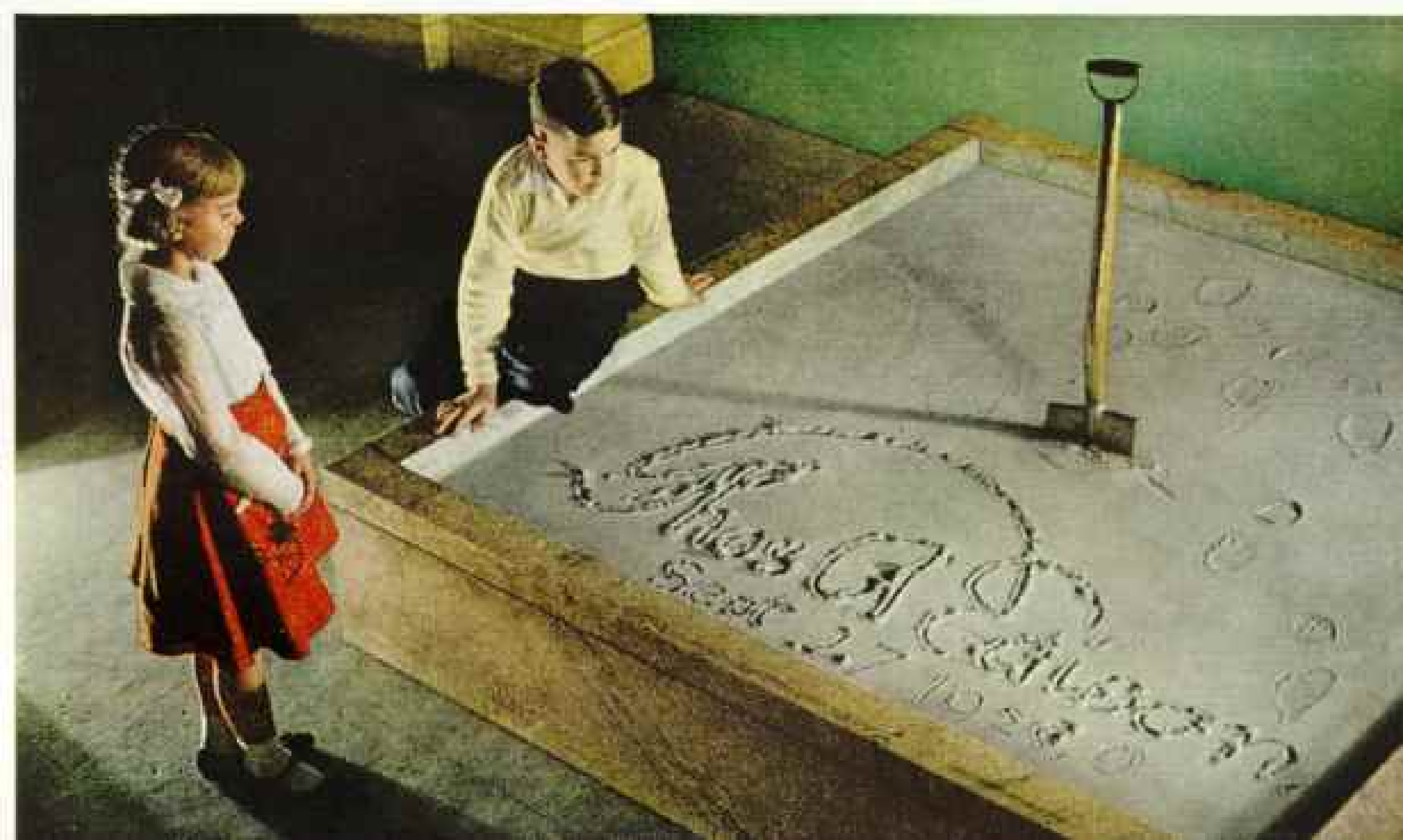
Crystal Chandeliers Cast Their Gleam on a Rare Collection

Though the Ford Museum annually attracts nearly half a million visitors, its extraordinary assemblage of antique furniture, ceramics, and silverware has only recently become recognized as one of the Nation's finest. Here connoisseurs can trace the development of American furnishings from Pilgrim chests to Victorian rockers. In this gallery visitors admire the patina on a Hepplewhite dining table of 1785-1800.

Bloodstained rocking chair in which President Lincoln was shot while attending Ford's Theater now sits in the Logan County Courthouse. In this simple clap-board building, brought to Greenfield Village from Illinois, young Lincoln practiced law.

Footprints of genius, left by Thomas A. Edison in September, 1928, mark this "cornerstone" of the Ford Museum. Shovel wielded by Edison belonged to plant geneticist Luther Burbank; its use symbolized the union of science and agriculture.

Reproduction by National Geographic
Photographer Willard R. Carter © N.G.S.





Tom Edison Worked as a Newsboy on the 19th-century Train Reproduced Here. The Conductor



Kodachrome by National Geographic Photographer Neil P. Davis © N.G.S.

Boxed the Youngster's Ears for Setting a Baggage Car Afire. His Deafness Resulted





Window-shopping the Past, Visitors See the Finery Their Ancestors Bought

For five blocks along the Ford Museum's main floor, visitors can browse among goods of yesterday, from hurdy-gurdies to whaling guns, bonnets to bridles. During the winter, craftsmen pursue their trades in five of the "street's" 22 shops, shaping pewter, molding candles, making tintypes (page 125), blowing glass, and repairing furniture. In summer they move to shops in the village.

Snappy sports car of 1904, a one-cylinder water-cooled Cadillac, gets a reminiscent going over. Washboardlike contraption hanging from the runabout's hood is an early form of radiator. Baby, in more modern conveyance, cares not at all.

Corner drugstore of the 1880's offered no banana splits, quick lunch, or rock-'n'-roll records, but it could dispense a painkiller sure to stop that toothache, or at least give you something else to think about.

Kodachromes by National Geographic Photographers Willard R. Culbert (top) and Neal P. Davis (N.G.S.)





Gargantuan collection of American art and industry ranges from a 600-ton locomotive to a light bulb the size of a grain of wheat. No one can hope to take it all in on one visit, and recklessly to attempt it is to risk a severe case of mental indigestion plus fallen arches.

One's first rash impression of the museum's exhibit-packed main floor—a teakwood lake as big as six football fields—is that Mr. Ford must simply have decided to gather together the World and What Is In It. But this is an illusion.

Ford Preferred Engines to Castles

Chief Curator Minor Thomas put me straight on the matter. "Mr. Ford knew what he was doing from the beginning. While other American millionaires were buying castles, Mr. Ford was prowling around on the lookout for prizes like Newcomen's 18th-century steam engine—things he felt were the cornerstones of our civilization. He was interested in the men who revolutionized our way of life, not in some lord sitting up in a moldy stone tower.

"What's more, Mr. Ford had an amazingly precise notion of the step-by-step evolution of a given branch of technology—the printing press, for example, or the telephone. He was deeply concerned about whatever original, germinal idea had started a particular train of inventions, but he was just as interested in tracing minutely its development in the hands of successive generations."

Of the seven major exhibits in the mechanical arts—agriculture, crafts, industrial machinery, steam and electric power, communications, illumination, and transportation—the last is understandably the most popular among the hordes of children who stream through the museum each year. Here is drawn up just about every conceivable contrivance that man has ever devised for moving his lazy frame from one place to another.

King Tutankhamun's state chariot is a copy of the one he used around 1350 B.C., but most of the other assorted vehicles are originals—a clumsy Russian three-yoked telega, an Irish

jaunting car, a "booby hut" sleigh and an "Adam and Eve" wagon from New Hampshire, a French sedan chair, and a whole parade of rockaways, phaetons, landaus, cabriolets, surreys, broughams, barouches, and buggies.

A horse-drawn streetcar pauses in the shadow of a 125-foot Chesapeake & Ohio locomotive, and on the engine's other flank is drawn up the charming DeWitt Clinton. The Clinton, rebuilt from surviving parts, pulled the third train in the United States and the first in New York State. It boasts three pumpkin coaches straight out of Cinderella: the entire train extends only from the C & O monster's cowcatcher to its cab.

Naturally enough, the evolution of the auto is not neglected. But the museum provides no mere procession of Ford models. In a well-rounded collection of some 175 cars visitors can see a coal-burning Roper Steam Carriage of 1865; a Benz "Velocipede" of 1892 with one-cylinder, 1½ horsepower motor; and an 1894 two-cylinder Daimler, distinguished by its hot-tube ignition and its belt-and-pulley transmission.

To Stop, Shut Off the Steam

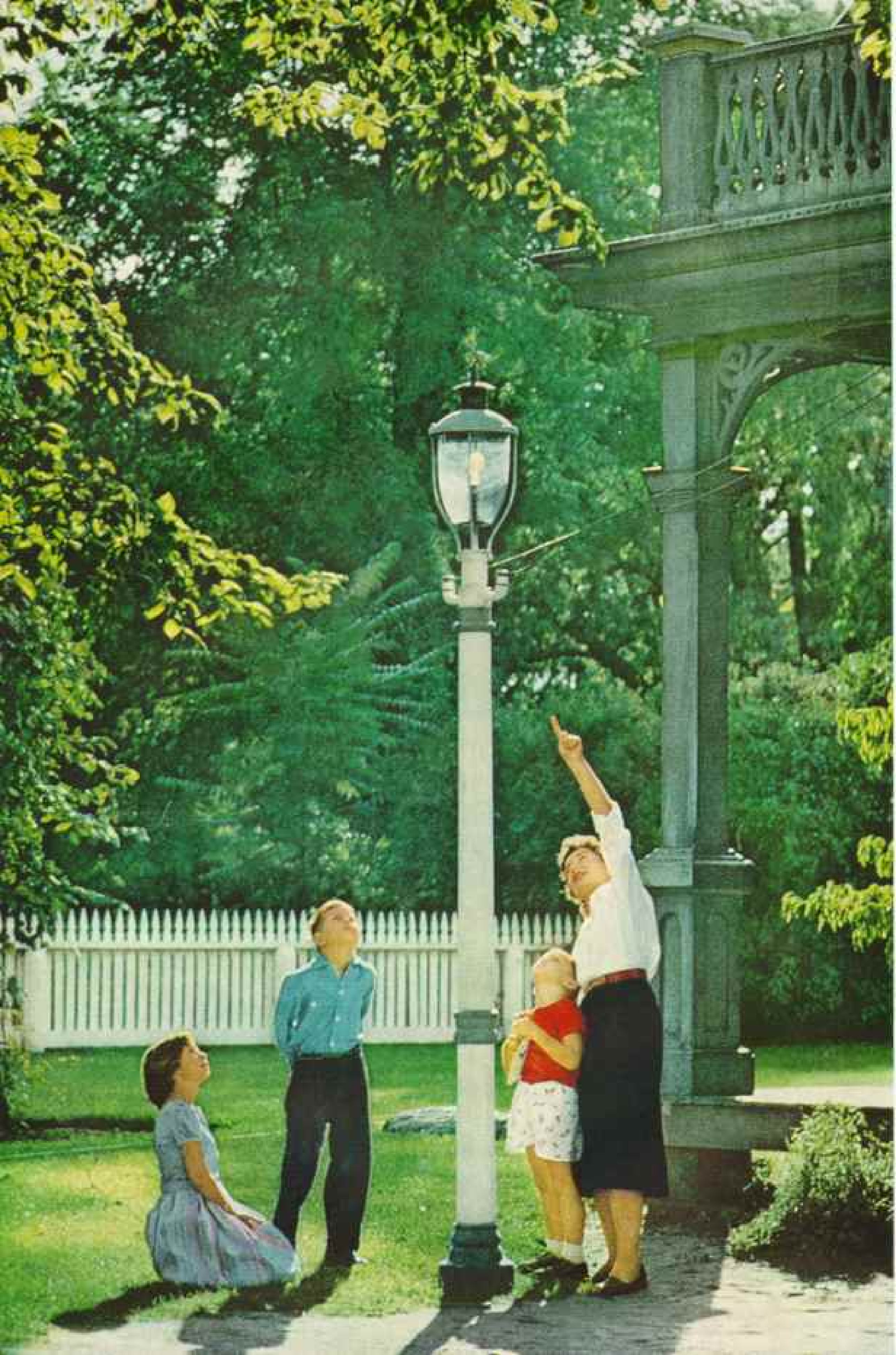
Every type of engine is represented; one wouldn't be surprised to lift the hood of one of these vintage cars and find its power being generated by squirrels in revolving drums. Some of the autos steer by a tiller, others by levers and cranks. Many of them have no reverse gear, and several have no brakes. Shutting off the steam brought things to an abrupt halt.

For those who do not believe the horseless carriage is here to stay and who are putting their money on the bicycle, the museum has some items of interest. For pure carrying capacity, I would choose the Oriten. It has only two wheels, but it seats 10 sturdy pedalers in between. All out, on a flat road, they can cover a mile in 1 minute 20 seconds.

For water travel you may prefer the catamaran. The museum has one, rigged and ready to cast off. *Amaryllis* carries a stout

Greenfield's President Fondles a Century-old Target Rifle

William Clay Ford, one of the inventor's three grandsons, heads the museum and village. Here he sits in John F. Brown's pine-paneled shop, modeled after a store of the early 1800's in Haverhill, Massachusetts. A wild-fowler's long-barreled shotgun hangs uppermost on the wall. On the counter lie, from left, a brass-decorated percussion rifle, a Whittier revolving carbine, a breech-loading flintlock made at the Harpers Ferry armory, and a carbine with detachable stock. The Marston pistol selects one of three barrels by a dial on the frame. Beside it rests a duplicate of the Philadelphia Deringer with which Lincoln was assassinated.



bridge between two 32-foot pontoons. In its prime, it could make 19 or 20 knots in a fair wind.

Strung from the rafters and parked along the floor are planes that embody lofty moments in the history of flight. There is a monoplane like the one in which Blériot flew the English Channel in 1909; one of a group of gliders brought from Germany to introduce the sport in America; the first planes (Admiral Byrd's) to cross the North and South Poles; the Junkers *Bremen* which made the first westward crossing of the North Atlantic; the first diesel-powered airplane.

And so much else. Fire engines. Agricultural tools and machines by the score. Spinning wheels and butter churns. Steam engines. Guns and pistols. Every manner of lamp, candle, and light, meaningfully marshaled in the order of their development.

Old Inventions Portend the Future

Are these innumerable objects only an inventory of the past—or do they have some significance for the future? Chief Curator Thomas is one who believes his exhibits are very much alive, that they contain unexpected lessons for those who can decipher them.

"There's something here for everybody; it's a dozen museums in one. Listen—if our only object was to pay homage to Eli Whitney or Edison or Watt, a bronze plaque would do perfectly well. We have their machines here because people can learn something from them."

"And do they?"

"I'll give you an example. A professor of engineering had his class working on problems of helicopter design, and he brought them to the museum. He didn't show them a helicopter, though we have one. He showed them a mechanical flail on an old harvester.

"His students thought he was crazy. But when they began to analyze the eccentric, very complex motion through space of that flail, with its changing angularity, they learned more about 'copter blades in half a day than their books could tell them in weeks. And

they picked up, to boot, a thundering high respect for the man who invented that harvester."

Power turbines, mimeograph machines, lathes, and presses may baffle many ordinary visitors. But the museum's Street of Shops will bewitch almost anyone (page 119). Here, for five blocks skirting the main floor, stretch 22 establishments of typical 19th-century American craftsmen, from a toymaker to a tinsmith, from an East India merchant to a milliner. Low-eaved shingled roofs shade graceful bay windows chockablock with fine wares or opening enticingly upon displays-in-depth. Cigar-store Indians stand solemnly on guard at the street corners.

Samuel Atwood's violin shop features not only fiddles, mandolins, guitars, and harps, and the tools with which they were so painstakingly made, but also an early version of the long-playing record: a spinet-sized music box which will play 30 minutes of Italian opera at a crack!

Across the street from David Cutler's pewter shop I encountered a special exhibition of American folk art. It was obvious that Mr. Ford must have started gathering these creations of self-taught artists at a time when other museums and private collectors in this country scarcely knew they existed.

With some of these folk items, as with Mr. Ford himself, it is sometimes hard to tell whether one is dealing with naivete or with the utmost in sophistication. The decoy of a sickle-billed curlew which some anonymous American carved around 1860, for example, is pared down and refined to the very essence of the bird, in a manner the most urbane of modern sculptors might envy.

Furniture Traces History of Taste

It shouldn't be supposed, however, that Mr. Ford's tastes ran solely to simplicity—to weather vanes and samplers, shop signs and primitive portraits. In one spacious gallery after another are ranged the fruits of a lifetime's careful collating of the decorative arts.

As with industrial technology, Mr. Ford was

Edison's Gift of Abundant Light Came First to Menlo Park

During the fall of 1879, men from Edison's workshop in the New Jersey town strung wires to converted gas lamps along Christie Street and to Mrs. Jordan's boardinghouse (page 107). Then, on New Year's Eve, the "wizard" threw a switch, and a crowd of more than 3,000 saw a street and residence illuminated by the glow of Edison's lamps. For the inventor's practical bent, Mr. Ford felt something akin to reverence. Many a professor, he would say, would lecture on electricity to his students and then walk home in the dark; Edison put electricity to work. This lamp stands before the reconstructed Edison laboratory.



Youngsters Learn How Pioneers Mass-produced Their Candles

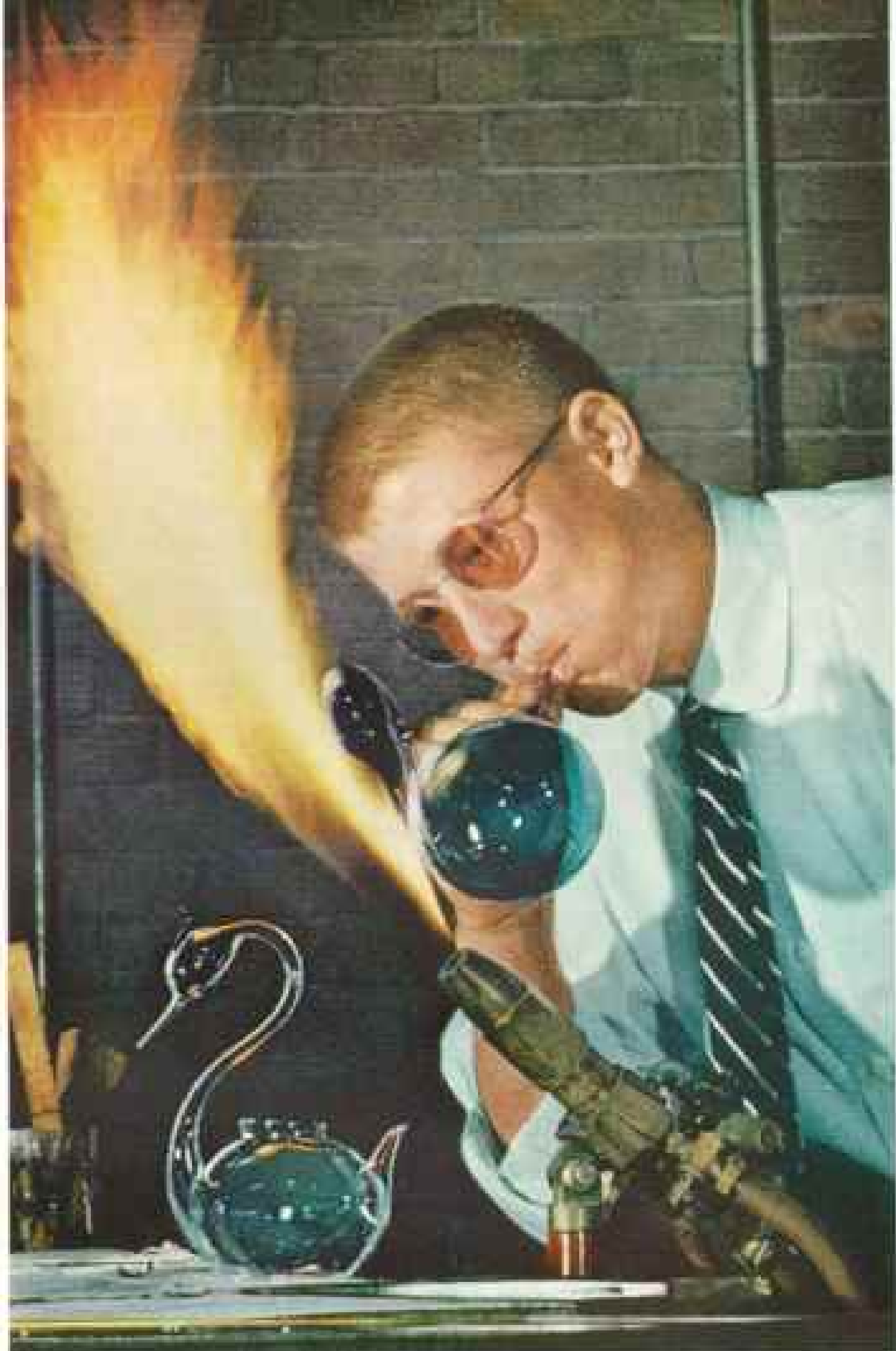
Twenty-three craftsmen currently practicing their skills in the village help bring to life the forerunners of American technology. Candles molded at the 1653 Susquehanna House are sold to visitors over the counter of the Waterford General Store.

With a modern gas flame John Beers demonstrates an age-old art: glass blowing. Like Greenfield's other craftsmen, Beers must be not only master in his field but a showman capable of working long hours in front of throngs insistently curious about his technique.

Watching the birdie is easy with the victim braced in a stern neck vise. Here George Bird, the museum's assistant curator of arts and crafts, poses rigidly during an eight-second exposure. Others who have sat for the village tintyper: Gene Tunney, Walt Disney, Gen. James Doolittle.

*Kohutimes for National Geographic Photographer
Neal P. Davis © N.G.S.*

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concerned to trace the origins of American culture and to illustrate its subsequent flowering, stage by stage. He assembled more than 1,500 pieces of furniture, examples not merely excellent in their cabinetry, but each comprising a necessary historical link.

To flesh out this esthetic skeleton, he acquired as well a host of supplementary treasures: silver and glass, clocks and watches, pottery and pewter, rugs and textiles. With this wealth of props to maneuver, the museum staff has been able to dress a series of harmonious and striking sets, dramatizing significant changes in the Nation's taste. The visitor wanders from set to set, as if through a mansion furnished by successive generations of affluent connoisseurs.

Revere Silver Highlights Collection

Jerry Gibson of the fine arts division is especially proud of the museum's silver. "American silversmiths, like American cabinetmakers, were just as talented as their contemporaries in England," Jerry assured me. "But they had in addition a very pleasing bent toward simplicity. Look at this."

He beckoned me over to where a silver-paneled drinking bowl stood on a glass case. "Here's America's oldest unaltered racing trophy. Jesse Kip made it, back in 1699. A colt owned by one Squire Van Dorn won it in a mile race down the Kings Highway, at Middletown, New Jersey."

Along ceiling-high shelves flanking the museum's main corridor, row upon row of other choice silver gleamed against a background painted in demure colonial colors. Mugs, tankards, and jugs predominated.

"It was an age potent in potting," Jerry remarked dryly. "Take a look at this handsome coffeepot. It's by Paul Revere—one of 10 works of his that we have. The fact that we have any has come as quite a surprise to collectors in the East. I think that goes for our whole collection, as a matter of fact; museums all over the world are just beginning to realize what a stupendous hoard of fine things Mr. Ford brought together."

Yet the executive director of this year-round show is far from content. When Dr.

Donald Shelley speaks of his present layout, it's with pride. But when he turns to its future, his eyes really light up.

"What we have here, you know, is an enormous three-dimensional library of American economic and industrial development—a library, moreover, whose resources are virtually unknown to the country's scholars. We mean to spread the word around.

"We've been trying lectures, slides, film strips, and movies. Further, our staff is already producing two TV shows every week. At the museum itself we've pioneered in the use of tape-recorded 'voice repeaters' which, at the punch of a button, tell the story of a particular exhibit or invention (we have more than 50 in operation). But we're also training guides who can take both the casual tourist and the lynx-eyed specialist around and satisfy the intellectual appetites of each."

Shelley paused and smiled. "We won't forget the kids. It would be difficult, in any event; the way they swarm here sometimes makes us think the rest of the United States must look depopulated. We've set aside a section of our Education Building as an overnight dormitory, and we're helping Wayne University to acquaint prospective public school teachers with the kind of educational experience we can offer their classes."

Grandsons Carry On Founder's Interest

Removing his glasses, Shelley waved them in the direction of a portrait of Mr. Ford that hung behind his desk. "You've seen enough of this place to become aware of what a deep personal interest Henry had in the museum and village. Well, that interest still lives—through his grandsons.

"Nobody can claim they don't have plenty of other responsibilities. But Henry II, Benson, and William Clay Ford all continue to serve as trustees.

"Why? Well, I think they believe just as firmly as their grandfather did that—in his words—'When we are through we shall have reproduced American life as lived; and that, I think, is the best way of preserving at least a part of our history and tradition.'

"And that's worth doing."

Stern-wheeler Plies the Quiet Waters of a Man-made Suwannee

On a hill overlooking the river—actually an artificial lagoon—sits the Stephen Foster Memorial House, dedicated to the composer who wrote "Swanee River." In late spring and summer, pilgrims to Greenfield Village embark on this smoke-spouting craft for a brief, nostalgic voyage, while a minstrel sings some of Foster's best-loved songs.



SUWANEE

THE SUWANEE OF SUWANEE RIVER

SUWANEE



Perched above the clouds, a solitary

HOWARD LA FAY

National Geographic Magazine Staff

DEW Line

Sentry of the Far North

BY LATE AUGUST the brief, riotously beautiful northern summer is over. At Point Barrow, Alaska—334 miles inside the Arctic Circle—the thermometer dips toward zero, the wind whistles in from the Arctic Ocean, and flurries of wet snow whip across the sky.

On such a cold, gray August day last year I stood outside Point Barrow's only store talking to an old Arctic hand—Alexander Malcolm Smith.

Now a vigorous 96, Sandy Smith emigrated from Scotland at the age of 18 and has been trekking the northland ever since. During the 1897 gold stampede he dog-sledged 1,500



Woolrich Electric Co. for U. S. Air Force

outpost crowns a wind-scoured plateau on Baffin Island, DEW Line's eastern anchor

miles from Edmonton to the Klondike. He once took a boat down the Yukon River system, portaged it over the brutal heights of the Brooks Range, and sailed out into the Beaufort Sea. As we talked, Sandy cocked an eye toward an immense plastic dome beyond the village.

"They've changed everything by building that," he said. "The Arctic will never be the same again."

The dome, housing a search radar antenna, loomed above a strange H-shaped building that marked the western nerve center of the Distant Early Warning Line—DEW Line for short. Some 50 similar stations now dot the

frozen Arctic in a 3,000-mile arc from western Alaska to Baffin Island (map, page 137).

In the event of an enemy attack across the polar ice, the DEW Line will flash instant warning to the joint Canadian-U. S. combat operations center at Colorado Springs, Colorado. The time thus gained could spell the difference between national life and death for Canada and the United States.

Traveling at the speed of sound, jet bombers would require more than an hour to fly between the DEW Line and the closest of their probable targets. During this crucial interval, interceptors would take to the air, retaliatory bombing would commence from bases around



the world, and the civilian population would take cover.

But DEW Line is far more than an elaborate defense installation. As Sandy Smith said, it has indeed "changed everything."

Already the DEW Line has brought 215 miles of roads where none existed. It provides reliable communication where no radio had ever functioned effectively. Now, simply by dialing a number, a man at Point Barrow can speak to another on Baffin Island, an entire continent away. DEW Line airstrips furnish a sure artery of Arctic transportation; already two airlines operate schedules linking Canadian stations.

"Auxes" and "I-sites" Fill In Gaps

Each of DEW Line's six sectors covers roughly 500 miles. Administrative and communications center of each is a main station—hangar, garage, and storage facilities huddled around a radome. Some 40 civilians staff a main station, plus a USAF complement charged with evaluating radar findings.

At approximate 100-mile intervals between main sites stand smaller auxiliary stations. About 20 technicians and mechanics man each radome-crowned "aux."

Finally, three-man intermediate stations, called "I-sites," fill in all gaps in the line. These possess no search radar equipment, but transmit a semiradar signal that will bounce off any object that crosses its beam and sound an alarm at the nearest main or aux.

DEW Line radar cannot presently cope with intercontinental ballistic missiles. However, military realists believe that—at least until 1960—manned bombers will remain the chief threat. Meanwhile, researchers are already working on a long-range radar system adapted to the missile age.

While detection of 16,000-mile-per-hour ICBM's will offer a warning margin of mere minutes, even this would permit the Strategic Air Command to swing into action. Ultimately, these precious minutes might also allow antimissile devices to smash hostile projectiles in flight.

The early-warning line was conceived in 1952 by a group of scientists meeting at the

Massachusetts Institute of Technology's Lincoln Laboratory. Reasoning that the Nation was most vulnerable to a transpolar air raid, they recommended a radar alarm net across the Arctic.

Approving the plan, the Defense Department engaged the American Telephone and Telegraph Company to build and operate an experimental radar chain across Alaska's northern coast. AT&T delegated the role of prime contractor to its jack-of-all-trades subsidiary, the Western Electric Company.

While a prototype DEW Line station was building at Streator, Illinois, Bell Telephone Laboratories joined forces with the Lincoln Lab to perfect an absolutely reliable communications network, first requisite of an effective warning line. Because of violent storms and assorted magnetic disturbances, the Arctic had always been a communications no man's land. Static blotted out conventional radio signals as often as not; vital messages occasionally were delayed for days.

The scientists' solution to this problem was the revolutionary Forward Propagation Tropospheric Scatter—a new form of ultra-high-frequency radio. A huge parabolic antenna throws up a concentrated cone of signal, most of which passes out into space. But, much as a powerful searchlight beam will partially reflect off a low cloud, a small proportion deflects downward from the troposphere, to be trapped by another carefully sited parabolic antenna.

"Tropo" has a range up to 400 miles; the signal may then be relayed still farther, and it is immune to virtually all known atmospheric phenomena.

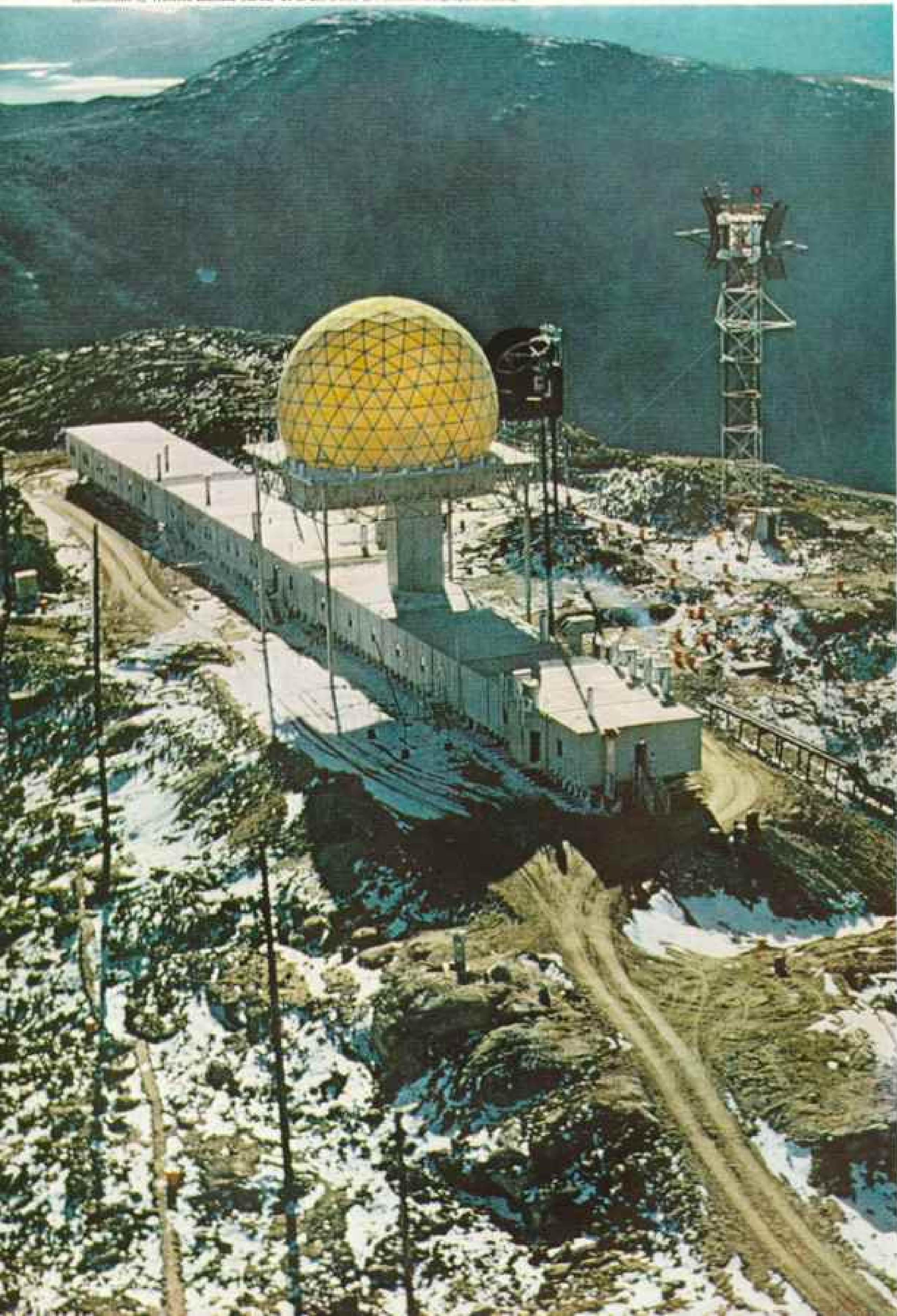
Weather Undoes Man's Work

While scientists were eliminating final bugs from the electronic equipment at Streator, Western Electric mounted its initial engineering assault on the Arctic. Intensive study led to the selection of Barter Island—a dot of land off the northern Alaska coast some 70 miles from the Canadian border—as the nerve center of the experimental line.

Men of the Bell System scoured the coast by air and by land to choose sites for the in-

Stinging Snow, Driven by Gale Winds, Lashes DEW Line Builders

To erect a string of radar stations across the Arctic, workmen invaded an icy wilderness that few but Eskimos had penetrated. Life for DEW Line construction workers was hard and lonely. Isolated by minus-50-degree temperatures and blinding white-outs, they lived in tents, slept in their clothes, battled polar bears that invaded their camps. More than 35 men lost their lives erecting the \$600,000,000 alarm system, which stretches in a 3,000-mile arc from western Alaska to Baffin Island.





Radar Dome, Like a Golf Ball on a Tee, Scans the Northern Sky

Why a distant early warning line? The elaborate electronic fence across the roof of North America may one day spell the difference between life and death for the United States and Canada.

Enemy jets, traveling at the speed of sound, would require more than an hour to fly between the DEW Line and any major North American city. Warned of their approach, the civilian population could seek cover while interceptors took to the air. At the same time, retaliatory bombing could commence from bases around the world.

Conceived in 1952 by scientists meeting at the Massachusetts Institute of Technology, the DEW Line was built by 23,000 U. S. and Canadian construction men directed by the Western Electric Company. Project 572, as it was called during four years of construction, recruited skilled manpower from all divisions of the vast Bell Telephone System.

Here the slanting rays of the Arctic sun burnish a lonely auxiliary station on Baffin Island—one of 30-odd DEW Line sites. Crisscrossed dome of waterproof plastic houses the search radar antenna, heart of the warning system. Prefabricated buildings, end to end like railway cars, sit atop pilings to let wind-driven snow sweep through.

Other antennas—some shaped like drive-in movie screens, some like giant dishes—sprinkle the bleak plateau. Using a new form of ultra-high-frequency radio, they relay messages to the next station beyond the mountains.

dividual stations. Engineers whose only acquaintance with snow had been at the other end of a shovel suddenly found themselves battling white-outs and polar bears.

"On certain overcast days," Superintendent of Operations Robert A. Sidur told me, "there was nothing but a dazzling whiteness enclosing you on all sides. I've fallen flat on my face into snowdrifts without ever seeing them."

When a Western Electric man opened his tent flap one morning, a polar bear lumbered in. Snatching a knife, the man cut his way out the back of the tent just before the bear swiped at him with a powerful paw. At another site a polar bear broke into a building and besieged two workers in an inner room. Fortunately they were imprisoned with a radio transmitter and could send for help.

But the worst tribulation was the wind that lashes the tundra, reaching velocities of 130 miles an hour (page 130).

"Once," Sidur recalled, "I was in a bush plane when we landed against a wind that almost matched our air speed. The plane rolled less than six feet after it touched the ground."

The wind tore tents from their stakes, undid the work of weeks by piling deep snowdrifts across freshly cleared airstrips, and reduced human efficiency to near zero. But, somehow, the work went on.

Barter Island Eskimo Installs TV

Meanwhile, relays of airplanes flew in tons of construction material from the United States. Navy convoys brought in additional supplies. Tractor-drawn sleds—construction men call them "cat trains"—hailed critical gear hundreds of miles across the frozen tundra to the actual building sites.

An enormous surprise to the Western Electric crews was the relative sophistication of the Alaskan Eskimos.

"I still remember," an electronics engineer told me, "how a couple of Eskimos turned out with movie cameras to photograph the first people to fly into Barter Island aboard a C-124."

Wherever possible, Eskimos were hired—at prevailing union wages—for DEW Line construction jobs. With overtime, some skilled workers earned staggering sums.

By mail order, one newly rich Barter Island Eskimo purchased a TV set, a washing machine, and a full-size electric organ, installing them proudly in his packing-crate home. There was only one drawback: the Barter Island Eskimos had no electricity.

Western Electric patterned the first DEW Line structures after those developed by the Air Force for its northernmost stations. Built of prefabricated metal-clad panels, they comprised a long central corridor from which several wings extended at right angles.

Experience soon proved this design totally unsuitable for DEW Line use. The metal sides introduced noise into the electronic circuitry; ceilings tended to leak at the joints. And there was the snow.

Snow and Permafrost Harass Engineers

"North of the Brooks Range, you know," explained a Western Electric engineer, "Alaska can be called a desert. There's only about 26 inches of snow a year—the equivalent of less than five inches of rainfall. But it's hard, granular snow. The treads of a 23-ton tractor bite into it to a depth of less than an inch. And the wind keeps whipping it across the tundra. Eventually, 20-foot drifts bury the buildings. And when the snow is good and hard, it could even crush the metal sides."

The construction men also had to conquer the ever-present permafrost. This layer of perennially frozen ground covers the Arctic to fantastic depths. In summer the top few feet thaw into a liquescent marsh that all but precludes cross-country travel. Wild flowers carpet the tundra, and in certain areas—reminding one of an insanely displaced Dixie—a species of wild cotton nods in the 24-hour daylight.

During World War II the Navy had drilled a producing gas well at Point Barrow. When Western Electric engineers drilled a second well to obtain sufficient gas to heat the entire Point Barrow construction camp, they had to penetrate 970 feet of permafrost!

The nature of the permafrost, as well as the difficulties it presented, varied with its soil components. Where the frozen layer comprised a large proportion of pebbles or rocks, it offered a tricky, but usable, building base.

Daredevil Riggers Spin a Web of Wire at a DEW Line Main Station

Reflector towers, strung with gossamer, relay warnings to listening posts far to the south. These antennas will flash the warning should blips on DEW Line radar screens reveal enemy planes attacking across the Arctic. Though the system cannot now protect against long-range missiles, military and research specialists are confident that it can eventually become an integral part of America's rocket defense.



Mid-Canada and Pinetree Reinforce DEW Line; Radar-equipped Ships and Aircraft Protect the Flanks

Role of the radar fence across Canada's heart is to confirm DEW Line's preliminary alert; Pinetree, in operation since 1955, will provide data on height, speed, and direction of enemy bombers. Information from any link in the 15,000-mile land-sea-air warning chain encircling North America is relayed to centers where electronic computers digest facts and issue combat instructions. Alert, Eureka, Resolute, and their far-northern neighbors (square symbols) are weather stations (See "Weather from the White North," by Andrew H. Brown, NATIONAL GEOGRAPHIC MAGAZINE, April, 1955).

But wherever it consisted only of silt and water, problems multiplied.

Foremen then had to place foundations with exceeding care, since surface disturbance may magnify with time. Once the permafrost's thin, insulating coat of moss is stripped away, the underlying thermal balance alters. Tractor ruts may gradually deepen and widen until they become impassable ravines.

DEW Line builders placed a bed of gravel beneath most stations. This not only insulates the permafrost from the heated buildings, but also keeps it from melting in the Arctic summer.

"We crushed, graded, and rolled almost ten million cubic yards of gravel," remarked C. W. Walker, in charge of construction and siting. "Roads, airstrips, building pads—everything depended on its availability."

Building Units Joined in "Trains"

From experience gained on the experimental line, Western Electric engineers made several key modifications in the blueprints of the future stations. They shifted to wooden panels to eliminate electronic interference and insure waterproof joints. They also devised a modular type of building.

The basic unit, or module, is a cubicle 16 feet wide, 28 feet long, and 10 feet high. Doors are so arranged that units can be fitted end-to-end in a weather-tight "train" (page 132). A main station consists of some 50 modules mounted in two parallel trains joined by an enclosed catwalk. The design proved so sturdy that one station withstood a three-day beating from 130-mile-per-hour winds, suffering only two broken windows.

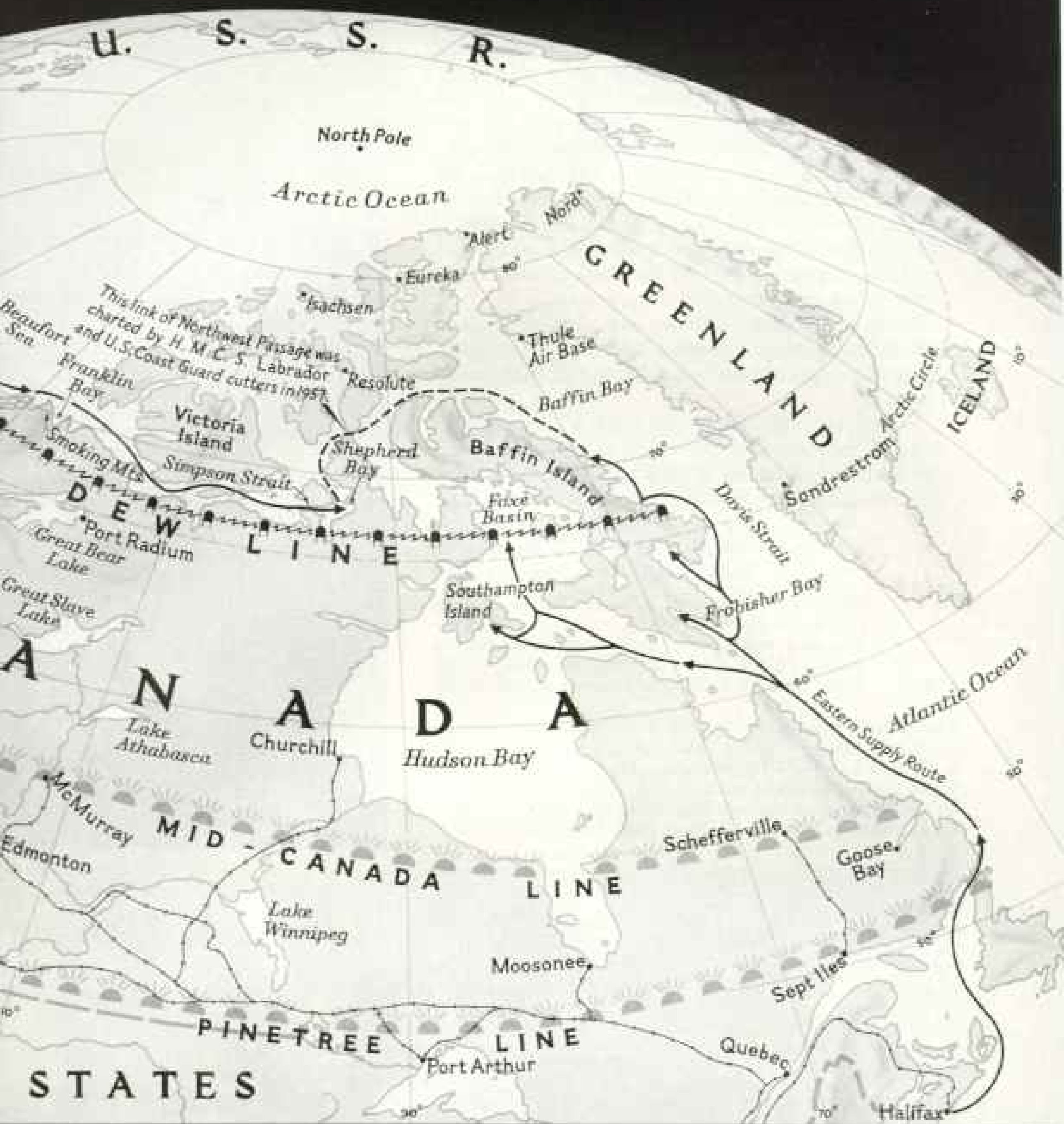
"The first thing we learned is that you can't fight the Arctic and win," Chuck Walker said. "So we decided to roll with the punches. We mounted the module trains on long sills raised above ground to leave a big blow space beneath. We also oriented them with the pre-



vailing winds. As a consequence, we had no trouble with drifting snow. It just whistled under and kept going."

Housing the search radar antenna posed a knotty problem. The heart of the warning system, it had to be protected from the elements at all cost.

The Air Force was then testing a rigid radome for Arctic use. Unable to await the outcome, Western Electric engineers crossed their fingers and, working with the experimental sphere's manufacturer, developed a 361-piece prefabricated version (page 140).



While these improvements were being planned and executed, Western Electric crews manned the experimental line, checking and rechecking the performance of electronic equipment. By the end of 1954, experience in Alaska proved conclusively that an Arctic warning system would work.

Cooperating closely, the United States and Canada decided to extend the line across the remainder of the continent. Once more Western Electric was assigned the job of building it. And the Air Force imposed a time limit: an incredibly short 32 months. Deliv-

ery of the completed operational line was scheduled for July, 1957.

The man whose responsibility it became to accomplish this herculean task was Vernon B. Bagnall, a Bell System communications engineer who had received his Arctic baptism on the experimental line.

"Vern Bagnall," said Chuck Walker, "was the kind of fellow you imagine Caesar or Napoleon to have been. He had tremendous drive and confidence. Yet he used to speak so softly that a Western Electric official—whose hearing is no worse than mine—had to

buy a hearing aid just to hear him in conferences!"

Once the Canadian-American defense board had approved a tentative line across the Arctic, Bagnall's teams swung into action. Flying from one proposed site to another in ski-equipped planes, they fought minus-50-degree temperatures and 100-mile-an-hour winds as they surveyed and laid out the ground. To simplify problems of logistics, the engineers pinpointed each station as close as possible to the coastline. They planted small red flags to mark future buildings, and charted the locations of airstrips, water supply points, and oil storage areas.

Siting was fraught with its own peculiar hazards. For instance, anyone peering too closely through a theodolite might find his eyelid frozen fast to the metal eyepiece.

Slowly, but inexorably—one week at this site, ten days at the next—the surveyors hopscotched across the Arctic, planting the all-important red flags. And their laconic reports poured into project headquarters:

Navy LCM's Spill Supplies on Baffin Island's Ice-choked Shores

Operation Sealift—some 120 ships sailing in twin convoys—delivered mountains of material. DEW Line sites used 46,000 tons of steel, more than enough to build the U.S.S. *Forrestal*, 75,000,000 gallons of fuel, 22,000 tons of food, and 12 acres of bed sheets.

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Globemaster disgorges delicate electronic gear on a DEW Line runway. Winter airlift logged thousands of flights in bitter cold, fog, and snow. More than 60 planes crashed; 26 airmen lost their lives. This Douglas C-124 unloads in minus-47-degree weather after a nonstop run from Dover Air Force Base, Delaware.

U. S. AIR FORCE OFFICIAL





Globe Photos, Pix

"Temperature this a.m. 40 below." . . . "Got lost . . . passed over lots of wolf tracks; no gun along." . . . "Before daylight this morning one of the tents in the other party burned to the ground." . . . "My right ear froze, even under parka." . . . "Can't find trail. Visibility down to just a few feet." . . . "C-47 . . . landed at camp. Right ski broke and ship nosed along snow. Airplane is complete wreck."

The engineers lived in tents, slept in their clothes, ate what and when they could. They worked seven days a week, and in good weather they labored around the clock. Setting foot on terrain that had never felt even the mukluk of an Eskimo became an everyday occurrence.

After the last site had been surveyed and marked, husky ex-Marine James D. Brannian, assistant superintendent of siting engineering, told me simply but fervently, "I'm certainly proud to have been part of it. But frankly, if I had it to do over again, I wouldn't!"

On the heels of the siting crews came

the first wave of construction workers. The usual sequence of events saw a skeleton crew landed by ski-equipped plane. With them came a small tractor. The men would use the tractor to clear a landing strip on the sea ice. Globemasters of the U.S. Tactical Air Command would then bring in more men and heavier equipment; these aerial behemoths made more than 700 landings on ice strips during that fateful spring of 1955.

Heavy Gear Parachutes to Ground

On Baffin Island the terrain was so rugged that the first tractors had to be dropped by parachute. With heavy equipment on the spot, the men would build a permanent airstrip; then came a gravel road from the strip to the site itself.

To expedite construction, Bagnall had split the line into three segments. An American firm contracted to build the Alaskan link, while two Canadian companies worked on the central and eastern sectors. Men and



Geo. Galusa, PH

Radar Dome's 361 Plastic Panels Lock Together Like a Giant Jigsaw Puzzle

140 Skilled crews have raised the 55-foot bubbles in as little as 12 hours. The translucent diamonds, bolted together, permit free passage of radar beams. Assembled dome can withstand winds of 100 miles an hour.

supplies poured into the north on commercial aircraft, while giant Globemasters continued to roar in with heavy cargo. Bush pilots ranged the length of the line, making impossible landings and even more impossible take-offs as they transported men and gear from site to site.

Meanwhile, far to the south, ships were gathering in Atlantic and Pacific ports for a voyage that would make or break the project. Their assignment: to converge on the DEW Line from east and west, delivering 200,000 tons of essential cargo. For a few fleeting weeks in late summer, the northern waters would be navigable. The ships, hulls reinforced against floes, would have to operate on a terrifyingly tight schedule.

Early in July, 57 ships steamed out of Seattle, Washington, and headed north. Their holds were jammed with gear for the western and central sectors. The Navy used every cubic inch of shipping space; LST ballast tanks carried aviation gasoline instead of water.

A month earlier another fleet had sailed from Halifax, Nova Scotia, to complete the gigantic pincers movement. H.M.C.S. *Labrador*, a Canadian icebreaker that in 1954 had become the first deep-draft ship to sail through the Northwest Passage, pioneered the way in the east.

For more than two months prior to joining the convoy, *Labrador*, carrying three helicopters for reconnaissance, had ranged the ill-charted waters of the Foxt Basin, setting up temporary navigational stations. So clogged with ice was the south of the basin that *Labrador's* frogmen had to blast a way through. After surveying the northward route and charting the waters, *Labrador* headed south to rendezvous with the supply convoy.

Supply Fleets Make Midsummer Run

On an overcast August morning the ships left from the rendezvous point at Southampton Island. An American icebreaker, U.S.S. *Edisto*, shared the lead with the *Labrador*. Progress through the jammed ice was tortuously slow. Day by day, weary mile by weary mile; the ships bucked their way north. At night the ice would freeze them in; every morning saw the icebreakers cutting the ships free.

The reports of Capt. O. C. S. Robertson, *Labrador's* commander, tell the story:

"Icebreakers got under way at 0600 with column moving by 0700. Ships repeatedly got stuck and had to be cut out. Stopped to

examine sick man in *Craig* [a freighter]. Stopped for the night at 2200, after which rounded up stragglers. Made 8.9 miles.

"Under way in fog at 0515. Stragglers were rounded up and the ships got under way in small groups and remained under way during night to maintain position against currents of ... 4 knots. Made 8.1 miles."

Buffeted and wounded by the ice, the convoy fought on. As the ships peeled off at their destinations, frogmen scouted the beaching areas (page 143). Tirelessly the divers blew up underwater obstructions so the landing craft could shuttle cargo ashore.

Meanwhile, the western supply ships had steamed through Bering Strait and on into the Beaufort Sea. Like great seagoing cornucopias, they emptied their treasures on gravelly beaches as far east as Shepherd Bay.

Ships Freed by Shifting Wind

On shore the construction workers labored prodigiously all across the line. At a Frobisher Bay supply base steelworkers built a 3,200,000-gallon storage tank in an eye-bugging 10 days to meet an off-loading schedule.

"If you didn't develop a heart attack or an ulcer on that job," Chuck Walker said, "it was a sign that you weren't working hard."

Their task magnificently performed, the ships headed home. As the western convoy approached Point Barrow, the ice pack closed in. It ground against the reinforced hulls, snapped propellers, flooded the engine room of one vessel. For days the fleet stood immobile as the situation steadily worsened. Then, just as the convoy's skipper was on the point of ordering the ships to prepare to winter in the Arctic, the wind shifted, driving the ice pack northward.

Icebreakers in the van, the fleet smashed its way to the open sea. But the toll was heavy. Of the 57 ships in the western convoy, only four escaped serious damage.

In the wake of the sealift, Bagnall's construction teams worked at fever pitch. A total of 7,000 workers flooded the area. They came from Canada, the States, Australia, Asia, and half the nations of Europe. The one thing all seemed to have in common was an abiding interest in the day-to-day temperature.

A Western Electric engineer tells of rigging a tower with a Scottish steelworker one sub-freezing day. Over and over the Scot kept asking him if he knew the temperature. Finally, in exasperation, the engineer managed to locate a thermometer. He and the Scot



U. S. Coast Guard, official

Four Tons of Concrete Blocks Smash the Ice in Simpson Strait

Seeking a safe deepwater route for supply convoys, three United States Coast Guard vessels and a Canadian icebreaker last summer charted a Northwest Passage amid desolate Arctic islands. Here, strung with life lines and armed with axes, men dangle from the prow of the U.S.C.G.S. *Spar*. Blocks are dropped onto the ice to smash a passage through the floes or used as anchors to warp the ship turt when it becomes fast.



Arctic Trail Blazers, Coast Guard Ships Crunch Through Floes

Staris (W38), *Bramble* (W392), and *Spar* (foreground) steamed out of Seattle last July on the annual supply run for far northern bases. The trio, joining the Canadian icebreaker *Labrador*, became the first U. S. ships to thread the Northwest Passage.

Sheathed in rubber suits, Navy frogmen plunged into the icy water to blow up hidden shoals blocking convoy routes. Their daring earned the nickname "madmen."



U. S. Coast Guard, Official (top), and U. S. Navy, Official

chipped away the frost and ice that coated it until finally they could read the scale. It registered 28° below zero.

The Scot's face clouded. "Ah," he said, "ye canna' trust the thing. It's in the sun."

Life on the line was hard, but it was not without its amenities. The food was universally good, and sometimes it was spectacular. W. E. Burke, Western Electric Vice President in charge of the Defense Projects Division, still recalls with astonishment his first Arctic meal, served at Barter Island. The dessert was flaming crepes suzettes.

DEW Line came closest to foundering among the towering mountains and plunging fiords of Baffin Island, the line's eastern anchor (pages 128, 132). Some of the Baffin Island sites are accessible only by air; two of them are in terrain so rugged that only helicopters can reach them; at another the airstrip ends at a 2,000-foot drop.

"Troubles?" says one worker of the Baffin Island effort. "We had nothing but troubles."

Fire Wipes Out the Labor of Months

At some exposed locations the weight of ice, coupled with high winds, toppled 100-foot temporary radio towers almost as soon as they were erected. At a station bordering Davis Strait workers blasted for a solid year to build a short road up a rock incline; two men lost their lives in the process. At a major Baffin Island installation workers watched in chagrin as a \$500,000 fire destroyed the backbreaking labor of months. Nevertheless, the construction crews met the scheduled completion date for every site.

On July 31, 1957, Western Electric turned the completed DEW Line over to the Air Force, which immediately transferred custody to Federal Electric, the service division of the International Telephone and Telegraph Corporation. For almost a year Federal "radicians" — radar-technicians — had been gradually replacing Western Electric personnel at the finished stations.

A brief ceremony at Point Barrow marked the event. Vern Bagnall, however, was not among those present. He had died of a heart attack while work was still in progress.

A veteran polar explorer, Vice Adm. Richard H. Cruzen, USN (Ret.), is DEW Line project chief for Federal Electric. Cruzen was second in command to Rear Adm. Richard E. Byrd during Byrd's 1939-1941 Antarctic expedition. In 1946 he led a task force that established a weather station in northern Greenland. The admiral admits to mild mis-

givings about the DEW Line's transformation of the once-lonely Arctic coast.

"So many people drop in on us up here—mostly prospectors—that it's become a nuisance," he told me. "In the middle of nowhere, we're forced to post 'Keep Out' signs."

Life on the line today continues to be a battle, but its nature has shifted. Boredom and isolation are the chief enemies of the DEW Liners as they wait—through the long night, the restless winds, and the silent, drifting snow—for the ominous blip on a radar screen that could unleash a holocaust.

Their quarters are snug and clean. Each man has his own private room; modern toilet facilities, showers, electric washers, and driers grace every station. The food continues to be good—so good, in fact, that the manual presented to every new employee advises him to bring oversize clothing because "most men gain weight at the DEW Line."

Three doctors and three dentists safeguard the health of the 700 DEW Liners, while six chaplains ride a frozen aerial circuit ministering to their spiritual needs. Bush planes shuttle across the line on a regular schedule, touching down at most sites several times a week. In addition, main stations can provide immediate air service in an emergency.

Every site offers hobby shops, photographic darkrooms, high-fidelity record players, books, and three class-A movies a week.

Yet the most exciting diversion is waiting for the temperature to plummet to 52° below zero and then dashing outside to throw a glass of water into the air. The water crystallizes immediately and floats away as a cloud of ice fog (opposite).

Most DEW Line Men Are Married

The average radician is 29 years old, has undergone specialized training, and has passed a battery of psychological tests to ascertain his fitness for the emotional rigors of 15 months in the Arctic. Oddly enough, three out of every four DEW Liners are married.

Loneliness, accentuated by the sunless gloom of the long winter, lends a dreamlike quality to existence in the north. A young radician at an Alaskan site, who had left a bride in Boston, told me wistfully: "My real life seems like something somebody once told me about."

Hazards have diminished, but they have not disappeared. This past winter savage storms completely isolated a three-man I-site for 50 consecutive days. And a bush plane crashed in a white-out, killing the pilot and



Western Electric Co. Inc. ©. A.P. Photo



Western Electric Co. for U. S. Air Force

Boeing B-47, Patrolling the Northern Frontier, Streaks Above a Gleaming Radome

mechanic. A DEW Liner aboard managed to find a sleeping bag in the wreckage. It was not until 36 hours later that air search parties located him, fractured and frostbitten.

What attracts men to jobs on the line?

"Money," succinctly explains Jack Webber, Federal Electric's personnel manager for the DEW Line. "More than 90 percent of the men have a goal—to pay off a mortgage, to build a nest egg, to start a business."

End of Tour Brings a Bonus

Salaries for radicians start at \$850 a month, and sector superintendents earn \$17,000 a year. Food and shelter are supplied gratis. If a man fulfills his contract he receives a \$1,500 bonus; if he returns for a second tour, he obtains a substantial raise in salary.

Halfway through their Arctic stint, DEW Liners are turned loose for a two week rest and recreation leave. Some men, starved for sunshine and warmth, have flown as far as Hawaii and Mexico to spend their vacations.

By proving that it is possible for man and his most complex machines to live and work in the Far North, the DEW Line has opened the door to exploitation of the region's incalculable subterranean wealth. Locked in by

the permafrost is a treasure trove—coal, oil, copper, uranium, immense hoards of rare metals—that will one day flood the world.*

Geologists have barely scratched the surface. But already Point Barrow's petroleum and natural gas resources are known. Norman Wells, in northern Canada, refines oil produced on the spot, and even supplies diesel fuel to DEW Line sites. From Port Radium, on Great Bear Lake, came uranium used in the first A-bomb. The Smoking Mountains on Franklin Bay—actually a smoldering mass of sulphur and coal—have been burning, according to Eskimo tradition, forever.

Through untold centuries the Arctic slept in frozen solitude, inviolate in its chaste, cruel beauty. But man has now invaded the white wilderness in force: his technology has come to stay.

As one measure of the profound change wrought by the DEW Line, you may now fly completely across the North American Arctic without losing sight of the lights of a human habitation, and rarely being more than 25 miles from an airstrip.

* See "Hunting Uranium Around the World," by Robert D. Nininger, NATIONAL GEOGRAPHIC MAGAZINE, October, 1954.



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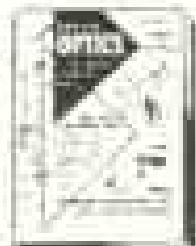
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