VOLUME C NUMBER ONE

THE NATIONAL GEOGRAPHIC MAGAZINE

JULY, 1951

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C.

$5.00 A YEAR 50c THE COPY

VOL. C, No. 1 WASHINGTON JULY, 1951

THE NATIONAL GEOGRAPHIC MAGAZINE

France's Past Lives in Languedoc

By WALTER MEAYERS EDWARDS

With Illustrations from Photographs by the Author

THE SKY was black. Suddenly the fury of a summer rainstorm broke on us as we drove into Vichy. Wind-driven water beat into the car and dripped on our feet. To proceed was impossible.

Through blinding rain we drove up to a garage, but a man peering through the wide double doors waved us away. Sticking my head out into the deluge, I spluttered at him in my rusty French. With an eloquent Gallic shrug, he let us in.

The joke was on us. It was an undertaker's garage. Elaborately decorated black coaches and somber-garbed but grinning attendants surrounded us. One of the men apologized on behalf of his city for the moist reception. Then he added facetiously, "Vichy, remember, is famous for its waters."

My wife Mary and I were headed for the sprawling province of Languedoc, which stretches from the Velay region almost to Perpignan, and from the River Rhône westward to Toulouse, its ancient capital. In the next five weeks we drove 3,000 miles through castle-crowned Languedoc (map, page 5).

Land of the "Language of Yes"

The strange name comes from the old language of *oc*, or *langue d'oc*, a corruption of Latin by the inhabitants of southern Gaul. Dialects of it are still spoken in the south. The language of the north, also derived from Latin, became today's French. Dante is said to have first made the distinction between them by contrasting their words for yes—*oc* in one, *oïl* or later *oui* in the other.

A patchwork of fertile fields undulated to the horizon as we entered this land of the "Language of Yes." Toward evening, about 80 miles south of Vichy, we stopped at the edge of a large bowl-shaped depression. A shaft of sunlight shining through the lingering overcast bathed in dramatic limelight the crumbling but majestic Castle of Polignac. A red-roofed village clustered around the platform of volcanic rock on which stood the square keep (pages 12-13).

This symbol of ancient feudalism was the first of many we were to see. It spoke of a country often torn by strife, where a common man's life was valued little and rulers small or great depended for security on massive walls and the strong arms of their serfs. Not many went to sleep at night without first looking under the bed.

An Unbelievable Landscape

The sight we saw a few minutes later as we drove southeast from Polignac to Le Puy was almost unbelievable. A giant conical rock projected almost 300 feet into the air, and crowning it was an exquisite little chapel, blending so perfectly with its base it seemed to grow there. We knew this must be St. Michel d'Aiguilbe (page 9).

By what magic did those builders of old erect such a masterpiece in so inaccessible a spot? It has stood, exposed to wind and storm, pointing a symbolic finger heavenward for almost ten centuries.

Beyond appeared still other wonders. A fine Romanesque cathedral stood upon a hilltop, with buildings of a medieval town spilling down all around. Behind it, on a rocky platform, the highest projection of all, stood a heroic statue of the Virgin (page 10).

No wonder Elizabeth Pennell, in her book *French Cathedrals*, called Le Puy "the most

2 Compagnie Aérienne Française

Twenty Thousand Frenchmen Pack the Ancient Amphitheater in Nimes to See a Bullfight

This Roman arena, about 20th in size among 70 surviving, is one of the best preserved. In places the mortarless masonry is 105 feet thick. Thirty-four tiers of seats rise in four sections originally set aside for nobles, knights, plebeians, and slaves. Visigoths made the ring a fortress, adding towers and moats. Squatters of a much later era turned it into a tenement. Twenty feet of rubbish covered the ring when restorations began in 1813. Here the author saw a spectacular performance of Shakespeare's *Julius Caesar* in French.

picturesque place in the world . . . every feature in it sharply defined . . . well balanced and carefully composed, the whole effect artificial, theatrical, impossible."

Setting out next morning on foot to explore Le Puy, we were startled to see four men running directly toward us, shouting and waving sticks. Simultaneously a lady, seated at a café table on the sidewalk, screamed and leaped backward, spilling her coffee and upsetting her chair. A grunting pig darted from under the tables, barely missed Mary, and with a neat maneuver reversed his field. After a lively chase, the men caught up with the errant porker and maneuvered it squealing into a truck by its tail and one ear (page 7).

When Old Friends Meet

Crossing a wide modern boulevard lined with sidewalk cafés, we dodged two nuns on bicycles with robes billowing out behind them. Flags and banners fluttered in the old part of town in honor of the local holy week.

In a narrow street of shops we paused to buy cherries from a buoyant, gesticulating shopkeeper clattering about in wooden clogs. One place assailed our nostrils; it sold nothing but cheese.

A little comedy was enacted when two old men suddenly came face to face. Apparently they had not met for years. They embraced fondly, kissed each other on both cheeks, pulled each other's ears, spanked each other, then shook hands for half a minute, oblivious of bystanders who paused to smile.

A crowd was gathering before an altar set up at the far side of the sloping Place du Martouret. Our guide, small, blond Madame Marguerite Crespy, led us up a wide flight of stairs in the Hôtel de Ville, or City Hall. Here she produced a huge key that admitted us into the impressive council chamber.

Against the wall we saw a copy of the original flag of the United States. It had been given to Le Puy on June 14, 1918, by the Washington Campground Association of Bound Brook, New Jersey. The presentation was in memory of Lafayette, whose birthplace, the Château of Chavaniac, is less than 20 miles away.

Nimes's Roman Temple Inspired Thomas Jefferson's Design of the Virginia State Capitol

Rome's Nemausus, which Frenchmen now call Nimes, abounds in antiquities. One of them, the 20-century-old Greek-style temple, is celebrated for the perfection of its 30 Corinthian capitals. Its original name forgotten, the rectangular structure is known as the Maison Carrée (Square House). Venus of Nimes, a statue restored from 103 fragments found in 1873, stands in the temple's museum. A companion shrine once graced the site of the Municipal Theater (center). Vegetable hawkers here push their wares to market.

As a brass band played, a religious procession filed into the square. A hundred men dressed all in white like surgeons grouped themselves to the right of the altar (page 11).

"Those are the Penitents," said Madame Crespy.

The brief ceremony commemorated events inaugurated centuries before. Indeed, one of the banners bore the inscription, "Louis VIII, Founder of the Gray Penitents, 1226."

Up medieval streets more like staircases, full of old nooks and curiously carved doorways, we approached the Cathedral of Notre Dame. Lace was displayed on walls for tourists, but we found none of the expected pictorial old ladies, with bonnets like muffins, making it. Instead, the hands making the bobbins fly belonged to Marie Camille and Mauricette Archer, aged 16 and 13, respectively. Most of the lace for which Le Puy is famous is made during the long, severe winter (page 6).

A confusing maze of twisting passages brought us unexpectedly to a broad stone staircase leading into the Cathedral. Madame Crespy pointed out above the altar the famous Black Virgin, a copy of the original which, tradition says, was brought from Egypt by Louis IX and burned during the Revolution.

Mother Prayed for Joan of Arc

"Among the many famous personages who have made pilgrimages here," she said, "was Isabelle Romée, mother of Joan of Arc, who prayed for the success of her daughter's armies."

We climbed the zigzag path leading to the Rocher Corneille, the highest point in Le Puy. Through a doorway we saw a large rectangular pool, the surface a foot or so above the floor of a huge room. A dozen women washing clothes were convulsed with laughter at the antics of one who was clowning. Seeing us, the comedienne playfully pretended to hurl a handful of wet laundry at us. Then she let it fly at one of her neighbors.

We continued upward to the rock plateau where stood the brick-red 53-foot statue of the Madonna and Child, made from the bronze of 213 Russian guns captured during the

5

Drawn by Harry R. Oliver and Irvin E. Allsman

Romantic Languedoc's Borders Are Etched in History and Preserved by Tradition

Once Languedoc was a province stretching from the mountainous Velay region almost to the Pyrenees, from Toulouse to the Rhône. Today it has unity mainly in the memory of a common tongue, the *langue d'oc* (pages 1, 22). Insets show the Gorges du Tarn and France in its entirety.

Opposite page: An abandoned meander of the Vis River forms the fantastic Cirque de Navacelles. The new channel runs past a tiny village (center), whose inhabitants till the dry horseshoe bed. Rock contoured by the old channel stands like an oyster's half shell. An aqueduct (lower left) stretches between tunnels. A road zigzags up the canyon wall to the high, arid plateau.

Crimean War. Climbing the inside staircase, we emerged where the crown forms a balustrade and saw the marvelous panorama from a new vantage point.

In the distance to the northwest stood the Castle of Polignac. Below us was the Cathedral. Closer to westward, at Espaly, another volcanic rock formed the plinth for an immense statue of St. Joseph. A few hundred yards from us rose the conical rock of Aiguilhe (Needle) and its little chapel. It was like a dream. Then Mary, her nose buried in a guidebook, suddenly remarked, "I'd hate to climb 268 steps to church."

We had barely left Le Puy, on a roundabout route to Mende, when a flock of sheep and goats halted us. Two tousled dogs, encouraged by a weatherbeaten woman, nipped at the hind legs of the sheep straying all over the road. The goats, more intelligent, hugged the edge, craning their necks away from us. Every mile or so brought similar halts.

6

Every Delicate Thread Is Set by Hand: Le Puy Lacemakers Exhibit Their Winter's Work

Catherine de' Medici in 1545 introduced lacemaking into France from her native Italy. Le Puy teaches the art to girls in its primary schools. Teen-age Marie Camille and Mauricette Archer, who throw bobbins back and forth on pillows as they twist the threads, work on the wide step outside their home. Doilies, tablecloths, and a child's dress are displayed for sale on the walls (page 3).

About 15 miles from Le Puy we found strung out along the road the little place called Le Monastier, where Robert Louis Stevenson had bought dainty Modestine and set forth in September, 1878, on a 12-day hike entertainingly recorded in *Travels with a Donkey in the Cevennes*. He described it as a place of bickering, but the only argument we noticed was between two scrawny dogs snarling at each other in a doorway.

In a typical provincial French bakery we bought a thin two-foot loaf of bread for a picnic lunch. The tiny bakeshop in the rear was almost in darkness, yet the baker was kneading dough. Apparently he could do it blindfolded.

By chance we met the daughter-in-law of the owners of the hotel where Stevenson had stayed. She said that, the year before, a young lady from London had duplicated the famous author's journey. She had been greeted everywhere with banners, speeches, and festive hospitality—far different from the open amusement, misunderstanding, and frugal kindness that variously had attended Stevenson.

Though we could not follow his cross-country trail exactly, our route included many of the places he mentioned—Pradelles, Langogne, Luc, La Bastide. The automotive age has brought changes that made it difficult to recapture much of the flavor of his book. Not until a few days later at Le Pont de Montvert, on the southern slope of Mont Lozère, in the valley of the infant River Tarn, did we find a place as he had described it.

"I should find it difficult," Stevenson wrote,

French Pigs Come Equipped with Handles Such as Tails and Ears

Exploring Le Puy, the author was startled by four men waving sticks as they chased a loose porker. When the animal darted beneath a café's sidewalk tables, a woman screamed, upset her table, and spilled her coffee. Captured, the pig was hustled without leash or goad into this waiting truck. Here a drover, seizing a hog by the tail and preparing to twist an ear, shows how the runaway was propelled (page 2).

"to tell in what particulars Pont de Montvert differed from Monastier or Langogne, or even Bleymard; but the difference existed, and spoke eloquently to the eyes."

We sensed that difference and noticed that, as he put it, "the place . . . wore an indescribable air of the South." Definitely there was a greater liveliness in the speech and manner of the people.

Paul Piq, of the Gendarmerie, climbed into the car to escort us through the narrow streets. We parked near the river and crossed on foot the old stone bridge (page 14). In the tiny cobblestoned street an old man on his way to market held two pathetic squealing kids, up to their necks in gunnysacks.

At a small hostelry, the Hôtel des Cévennes, that had lodged Stevenson, Paul introduced us to the proprietor, Roget Chapelle, the acknowledged historian of the town.

A Cradle of Wartime Resistance

In rapid-fire French he told me of the turbulent history of the remote valley. He had traced it back to 600 B. C., when it was inhabited by Ligurians. They had lived undisturbed by wars outside, even when the Romans built a camp on Mont Lozère.

"In 1209," he said, "Pope Innocent III sent Simon de Montfort to wipe out the heretics of Albi. After a battle at Muret, about 400 defeated Albigeois fled up the valley of the Tarn and established a small colony on a hill near Le Pont de Montvert, where they could continue their form of worship. The ruins of this settlement still remain. The Albigeois

and the Ligurians intermarried, and some of the present inhabitants are their direct descendants. Not many outsiders came here until a few generations ago."

This was one of the Huguenot districts, and he told of the Camisards and the terrible War of the Cévennes that began here in 1702.

Of more recent interest was his claim that in this region had begun, in 1941, the resistance movement out of which grew the Maquisards, or Maquis, who so harassed the Nazi oppressors.

"At that time," he said, "we helped Jews fleeing the Nazis and hid them in mountain farms. Later we saved French youths from German labor camps by providing false identification papers. In 1944 General de Gaulle sent officers to train us in guerrilla warfare."

Sheep Cost the Causses Their Soil

From the pleasant town of Mende we explored the vast area of high plateaus known as the *causses*. The word (pronounced to rhyme with "dose") comes from the Latin *calx*, meaning calcium or limestone, which forms the land.

The area was once a great forest, but after the Revolution the trees were felled and sheep allowed to roam at will, cropping every seedling. The soil that had been made and held together by the trees washed away, and the tablelands became deserts. Without the forest to hold it, the rain disappears through the pervious limestone as through a sieve. Yet, in spite of lack of water, small communities manage to exist.

On the Causse Méjean we saw a patch of soil sown with oats. It was so pitifully full of rubble, we wondered that it would support a crop. Yet the villagers raise sparse crops of barley, oats, potatoes, and hay. Piles of rock near by indicated the prodigious efforts made to clear the little field.

One evening by the tiny village of Sauveterre we came across a haymaking scene. Dogs barked and played tag. Men, women, and children raked and pitched with wooden implements to fill carts drawn by pairs of acquiescent oxen. It was a cheerful tableau. All talked happily, and occasionally there would be a burst of song, as if to counterbalance the barren sadness of the land.

Most genial of all was a man atop a high-piled cart, who had lost his right arm in World War II. Queried on his means of livelihood, he replied, "Almost all of us Caussenards produce sheep's milk for making Roquefort cheese" (page 18).

The causses are mainly the property of big landowners, who lease them to farmers at variable rents, adjusted according to the market prices of their produce.

Below the surface, the causses are honeycombed with caves, grottoes, passages, underground rivers, and potholes known locally as *avens*. One afternoon we explored the Aven Armand. After donning coats and sweaters, we slithered down a steep man-made tunnel more than 200 yards long. Condensation had made it slippery, and to unaccustomed muscles the exertion made our knees wobble before we reached the bottom.

Emerging, we found ourselves in a chamber so vast that the Parthenon in Athens could have stood in it with room to spare. The sight was stupendous. Above us, in the middle of a huge red-rock dome, we could see a dark hole. This was the bottom of a 130-foot shaft leading to the surface. The aven is shaped like a fat, irregular bottle with a long neck.

Below us was a forest of giant stalagmites, some almost 100 feet high. Powerful electric lights shone alternately bright and dim as we wound in among them and examined the detail of their intricate and fantastic shapes. In 1897 the discoverer, Louis Armand, torch in hand, was lowered down the vertical shaft, then 115 feet more to the bottom of the main vault. Imagine his feelings when he saw this monumental fantasy for the first time!

In the Gorges of the Tarn

Several spectacular rifts cut through the region of the causses. The finest of these, the Gorges du Tarn, impressed us deeply. The multicolored cliffs, with variform rocks and mysterious caves, the blue-green river and shining white sand bars, the ancient terraces, the living verdure, the purple distances—these alone would have sufficed. But blending with Nature's artistry were charming little towns and villages, fairy-tale châteaux, castle ruins, and venerable churches, rich in history.

One morning we zigzagged down into the wide, green valley of Ispagnac, where the gorges begin. A dainty round-arched Gothic bridge led us to Quézac. As we approached, an old man drawing water at the village well spoke to us. A genial light kindled in his eyes when we told him we were Americans. He pointed out the little church, which contained another Black Virgin, discovered in a near-by field, and indicated the 16th-century Château of Rocheblave across the river.

"Quézac has little more of interest than these," he said. "But you must come to my home for refreshment."

He lived alone in two simply furnished rooms on the second floor of an old stone house. As in many of the other houses we

St. Michel's Chapel, Ten Centuries Old, Crowns a Volcanic Exclamation Point

Ages ago the soft cone and crater eroded away, leaving a hard plug of basalt. Visitors to the 289-foot summit must climb 268 laborious rock steps. This suburban section of Le Puy is called Aiguilhe (Needle) because of its prominence. Le Puy, too, is aptly named; it means "the Peak" in the Auvergne dialect (page 10).

Penitents Robe Like Surgeons for a Eucharistic Congress in the Pilgrimage City of Le Puy

Opposite page: Farmer and oxen plod homeward without a backward glance at red-tiled Le Puy. Notre Dame Cathedral (spire, center) enshrines a copy of the famous Black Virgin reputedly taken from Egypt by Louis IX and destroyed in the Revolution. Rocher Corneille, the huge igneous rock on the left, bears a lofty brick-red Madonna and Child cast from 213 Russian guns captured at Sevastopol during the Crimean War.

Polignac Castle's Square Donjon Rears from a Base of Frozen Lava

For 11 centuries the noble Polignac family has controlled this stronghold. Once the entire platform was covered with buildings erected on pagan ruins. Now the château crumbles; the lofty keep is restored.

Kodachrome by Walter Meayers Edwards

Red Roofs Girdle the Fortress; Farmers Till an Ancient Volcanic Bowl

Polignac's name supposedly derives from Apollo's. A temple to the god stood here in Roman times. His giant stone mask is preserved in the tower. A deep well reveals the chamber whence his oracle's voice was heard.

Le Pont de Montvert Sits in the Heart of the Cévennes

This mass of upthrust rocks forms the southeastern fringe of the Massif Central of France. People of the region have always demonstrated their independence, especially in religion.

In 1702 Le Pont de Montvert witnessed the opening combat of the fratricidal War of the Cévennes. The Abbé du Chayla, who had residence here, was accused of using pincers and live coals to convert "heretics." One night 53 enemies marched into town from the mountains and besieged his house. Du Chayla, trying to escape down a knotted sheet, fell and broke his thigh. Discovered, he was dragged into the public square and killed with 53 knife thrusts, each enemy delivering a blow to avenge a relative.

The Abbé's foes, who wore peasants' smocks, became known as Camisards (from *camisa*, shirt). Their movement grew into a rebellion against persecutions under Louis XIV.

Du Chayla's house stands on the extreme left. It has a "new" roof, the old one having burned in the 1702 fight.

The bridge spans the River Tarn, here several miles from its 30-mile-long gorge, a wild and spectacular chasm (pages 16, 26, 28).

Kodachrome by Walter Meayers Edwards

France's Sunday Drivers Take to the Open Road with Bikes and Trailers . . . Town Crier Wears Carpet Slippers in Le Monastier

Antoine Argaud, 75 years old, blankets the main street with his oral advertisements and public notices. He prefaces each announcement with drumbeats. "Don't make any picture postcards of me," he warned the National Geographic photographer.

Kodachrome by Walter Meayers Edwards

Point Sublime Looks Down a Thousand Dizzy Feet into the Tarn's Wild Gorge

For 30 miles the river has etched a deep rift in the plateau. Collapse of a huge cavern's roof formed the Cirque des Baumes (Grottoes) immediately below. Cliffside caves have given up the skeletons of Stone Age men.

saw in Quézac, chickens and goats occupied the ground floor.

In appreciation of his hospitality, we offered our host a can of pineapple. Though I told him the French word for it, *ananas*, he appeared not to have heard of it before. He chuckled with delight when we took him for a short ride in what he called our "Pleemoot" (Plymouth).

Farther down the canyon, in the cliff-hanging village of Castelbouc, we came upon the Bouty family shearing a sheep (pages 26, 27). They invited us for coffee to their tiny house. Typical of those in the small villages of the gorge, it was hidden behind the precipitous slice of rock on which stand the ruins of Castelbouc Castle.

Mademoiselle in Seattle Clothes

We entered in darkness. Then the shutters of the single window were opened to reveal a small stone-floored room, two little tables, and a few chairs (page 25). This, with a bedroom above, reached by ladder through a trapdoor, was home for Paul Bouty, his wife, and five children.

Pretty 17-year-old Marie Jeanne had received a package of food and clothing from Seattle. She exhibited the wrappings and asked us to interpret the address.

"It was kind of the American lady, wasn't it?" she said. "Clothes are so expensive. We make some of our own with the wool from our sheep."

Bouty met their bare needs by raising vegetables and vines on the terraces behind the village. The frail-looking one-eyed man had a stout heart, for he climbed the high cliffs to tend a wheat field on the causse at the top.

On a sunny day we drove from Mende, across the Causse de Sauveterre, and dipped sharply down to red-roofed Ste. Enimie in a narrow part of the Tarn canyon. Here the river makes a hairpin bend. On the stony beach rows of sheets lay bleaching. At the water's edge knelt half a dozen women dressed in black, scrubbing clothes. Joining the narrow road that borders the length of the gorge, we followed it to La Malène.

From a buxom woman we rented two flat-bottomed boats—one for each of us, so I could photograph the other—and four boatmen to pole them. We were absorbing the changing scene as we drifted on, suffused with the genial warmth of the sun, dreamily listening to the twitter of swallows that swooped around us and appreciating our remoteness.

All at once a voice with a Brooklyn accent broke in on our reverie.

"American?"

We turned to see a beached canoe and a small tent with two heads protruding.

"I'm an airplane mechanic from Paris," said the man. "Spent eight years in N'Yoik. Ain't this goige terrific?"

We stopped for lunch at the Détroits, where the river is squeezed between two vertical cliffs (page 28). Hardly had the boatmen started on their bread, cheese, and wine when one spied a small snake.

"Look out, that's poisonous!" he shouted.

They all grabbed rocks and gave chase. Outnumbered four to one, the snake soon succumbed. When I pointed out two more, they panicked and scurried to the boats.

A crew member entertained us by pouring wine down his throat as he held a goatskin container at arm's length. It was even more entertaining when another tried, and poured it in his eye.

Our brief voyage ended at the stupendous Cirque des Baumes, which we had seen earlier from the Point Sublime (page 16).

Ice to Eskimos

The following Sunday, when we passed again through La Malène, we found a fête in progress. A loud-speaker announced the results of a lottery to an intent little group. Our four boatmen left their seats in the audience, doffed their berets, and pleasantly shook our hands. The stout woman manager of the boat business, on her way to greet us, paused suddenly, listening.

"That's my name!" she exclaimed. "I've won a prize!"

"Five boat rides down the Tarn," blared the loud-speaker.

We drove one morning through a region of thick pine forest to the summit of Mont Aigoual, culminating peak of the southern Cévennes. At the meteorological station, Roget Nou, the weather observer, welcomed a break in his vigil. When he learned I came from Washington, he said, "We use the international code adopted there in 1949 for making our weather reports by radiotelephone. We call it the Code Washington."

Our conversation was interrupted by the entrance of a roughly dressed young man. He had driven his father's flock of sheep 65 miles, from the outskirts of Montpellier, to summer in the mountain meadows. With him were 856 sheep, one billy goat, and two dogs. All but the tiniest lambs wore flat-toned bells that made a delightful tintinnabulation as they grazed (page 38).

"I am substituting for the real shepherd," he explained. "He is sick from drinking ordinary water when he wasn't used to it."

18

"Made in Millau" Spells Glove Perfection

Millau, home of 200 glove companies, has been a center of the industry for more than seven centuries (page 21). Much of the painstaking labor is done in homes, where parents pass down trade secrets to children. Washable "doeskin" gloves in this display were made from the skins of black-headed sheep imported from British Somaliland.

His matter-of-fact remark expressed the unenthusiastic attitude toward water in this wine-drinking country. Much drinking water is sold in bottles, for some sources are contaminated.

After a strenuous day we welcomed the hospitality of the Grand Hôtel at Roquefort sur Soulzon. Despite the grandiloquent name, it has only 15 guest rooms. The manager and chef of chefs, the ebullient Monsieur Lautard, could have given no finer reception to a visiting prince. Later I learned that the hotel is owned and operated by the biggest producers of Roquefort cheese, the *Société Anonyme des Caves et des Producteurs Réunis de Roquefort*.

That evening a party of distinguished-looking men dined at a long table, consuming with particular gusto prodigious quantities of Roquefort cheese. They were the board of directors of the Société, the "big cheeses" so to speak. The board, in Roquefort for its annual meeting, included a baron, an admiral, a general, and a former executive of Rothschild's.

Realm of the "King of Cheeses"

Our own dinner was an experience. A waiter placed a footstool under Mary's feet. Another laid her handbag on a side table. A third inquired what kind of pillows we preferred for our beds.

Two helpings of superb crayfish soup, trout smothered in toasted almonds, buttered young string beans, and almost a whole roast chicken, brought me to the bursting point. Then a stiff-bodied waiter, elbows turned outward, slid in front of me with a flourish an enormous helping of cheese.

My impulse was to decline, but I checked myself. I shudder when I think of the consternation such a faux pas would have caused. Was this not Roquefort, "King of Cheeses"? Some might dispute the appellation, but certainly in Roquefort cheese is king.

At a discreet distance, the waiters watched until I had forced down the last delicious morsel. Still careful not to offend, we struggled through three desserts, then retired to sleep until factory whistles, announcing the next day's two-hour lunch period, awakened us.

Later, as we climbed the hill to the headquarters of the Société, we sniffed cold cheese-laden breezes through barred windows along the sidewalk. Our guide and expositor, Pierre

Rosières, explained the cheese-making process briefly while showing us through the caves.

"Sheep milk is used exclusively," he said. "In 900 dairies throughout the Massif Central, it is curdled, packed into molds, and injected with spores of *Penicillium roqueforti*. After a few days in cold rooms the cheeses are brought here by truck. They are carefully inspected before being sent to the salting room."

As he spoke, we entered a huge room, the rock roof of which was reinforced with massive concrete pillars. The wet floor was covered with creamy-white disk-shaped cheeses, like giant backgammon "men," stacked in threes. At a wooden table women in clogs were rubbing cheeses with salt, laughing and singing at their work (page 39).

A Question of Ventilation

"After the salting, the cheeses stand for a few days. Then they are brushed and pierced with needles in this machine," said Rosières. "The holes permit air to penetrate them so the mushroom spores can grow and form the characteristic blue-green mold."

Down a flight of stone steps he took us into a vast, dimly lit room filled with wooden racks stacked high with the five-pound cheeses. "Here they ripen, in from 50 to 50 days," he said. "There are ten more floors like this beneath us.

"The incomparable flavor," he proudly continued, "is due to ventilation from natural fissures in the rock which maintain the air constantly at about 44 to 46 degrees Fahrenheit and 95-percent relative humidity."

He shook his head when Mary asked if rats caused important losses.

"About 25 savage cats attend to that. They live on cheese themselves, but the loss is negligible, because, strangely, they always consume one cheese before starting a new one."

It takes a million sheep and 30,000 farms to supply the milk for the 17 producers, whose average annual output is more than 26,000,000 pounds of cheese. Of this, the Société produces more than half.

Women were wrapping cheeses in tinfoil, puncturing each with a thumb as a vent for gases that would form during ripening.

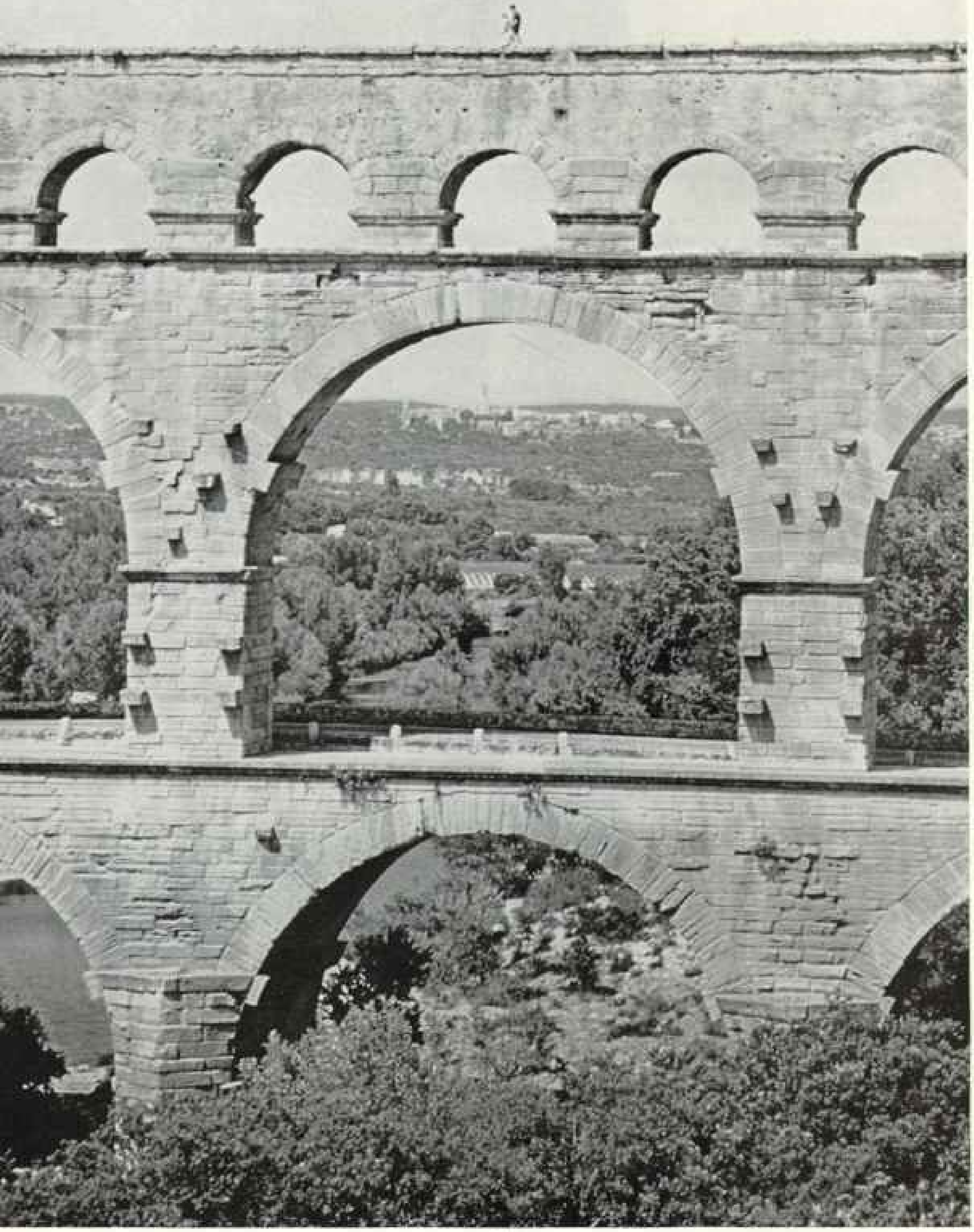
"The Nazis were interested in our foil supply, but we walled it up in an inside staircase," said Rosières.

"During the war," he added, "it was forbidden to listen to French-language radio

19

What's Cooking? Roquefort's Master Chef Has the Answer

Monsieur J. Lautard (center), manager of the Grand Hôtel, grew lyrical as he read his menu to the author's wife. At dinner that evening, almond-smothered trout, roast chicken, and buttered string beans followed crayfish bisque. The writer's appetite was flagging when in came a four-ounce slab of Roquefort cheese. French-American amity required him to eat every last crumb (opposite page).



20

Pont du Gard Endures as a Rugged Monument to Romans Who Built It 20 Centuries Ago

Using no cement, imperial engineers constructed an aqueduct to carry pure water from Uzès to Nimes (opposite page). They overcame contours with bridges, tunnels, and siphons; they hung scaffolds on these jutting stones. Medieval men, too negligent to clean out its limestone deposits, abandoned the structure and even quarried it. This bridge, leaping the River Gard (lower left), is a spectacular remnant of the 30-mile water system. A modern road follows the lower level. The central arch frames the village of Castillon.

broadcasts from London. We listened regularly to a radio in the room where our baby daughter slept. In 1943, when she spoke her first words, they were 'Ici Londres' [This is London]."

About 10 miles north of Roquefort lies the town of Millau, which rivals Grenoble as headquarters of France's glove industry. There are more than 200 small firms and a "Big Three," of which the house of Jonquet is representative. This firm is especially proud that all its gloves, even those of kidskin, are washable (page 18).

News of a week-long festival to begin in Arles next day started us off eastward to the valley of the Rhône. We seized the opportunity to visit ancient Nîmes, with its well-preserved Roman arena and its Maison Carrée, which so pleased Thomas Jefferson that he used it as a basis for the design of the Virginia State Capitol at Richmond (pages 2, 3). Another memorable sight near here is the fabulous Pont du Gard, part of the aqueduct built by the Romans for the Nîmes water system.

23

The Aqueduct's Waters Flow No More; Grass Grows on Stone

Ancient engineers must have hoisted the heavy stones, some weighing 6 tons, with block and tackle. Power presumably was supplied by treadmill crews walking like squirrels in revolving cages. Completed, the channel delivered an estimated 700,000 cubic feet of water a day. Walking along the weathered stone roof, the photographer and his wife found several slabs missing. Above the river, they looked down 160 feet.

While in this region we noticed brown fields of what appeared to be large thistles. They grew in profusion and were plainly a crop rather than mere weeds. The two- to five-inch heads were cylindrical, tapering at the ends, and were covered symmetrically with sharp curved tines. They proved to be teasels, cultivated for use in the textile industry.

Lowly Thistles Help Make Cloth

In Carcassonne later, Alphonse Cambriel, who is engaged in the unusual business of processing and selling teasels, took us through his plant. Several girls were clipping the stalks from a mound of teasels (page 40). A machine sorted them according to size. Other girls cut them to prescribed lengths and drilled a hole through the axis of each.

"In textile factories they comb up the nap of cloth by passing it over rotating teasels threaded on spindles," explained Cambriel. "The process is used in the manufacture of such products as Angora wool sweaters, fur gloves, Basque berets, blankets, and the felt rollers used in paper mills to carry the wet web of paper-in-the-making.

"We ship them all over the world. These are going to New Zealand," he added, indicating a colossal crate marked 125 Kg (about 275 pounds).

On our way westward from Nîmes we admired the stately gray buildings and monuments, pleasant gardens, and wide boulevards of the university city of Montpellier. Here among a fine collection of paintings in the

Troubadours Sing for Golden Flowers in the Language of Yes

Ancient French, derived from Latin, split into two dialects, the north's *langue d'oil* and the south's *langue d'oc*, both so called from their manner of saying "yes": *oil* (later *oui*) or *oc*. Liquid, elegant langue d'oc was the tongue of the troubadours. The south's old language is spoken by few. The learned Academy of the Floral Games preserves its literary traditions (page 24).

Félix Saurine's painting of a 15th-century floral court hangs in the Academy's headquarters in Toulouse. It depicts a tournament of troubadours competing before Clémence Isaure (right), traditional founder of the Academy. One bard, plucking his harp, stands ready to receive a golden rose (center).

← Gold and silver flowers are the Academy's prizes to modern troubadours composing poems in the medieval tongue. A sample text is shown by the old book.

Bread Eater and Mattress Makers Carry On Their Pursuits in the Public Square of Alet

Alet bears an air of antiquity. Half-timbered houses overhang twisting, narrow streets. This young lady, eyes agape, was fascinated by the mattress job, a common outdoor sight in France.

Musée Fabre I was surprised to find a picture of the "Infant Samuel" by Sir Joshua Reynolds. He painted the child Samuel at least nine times, the best-known version being in the National Gallery in London.

Plane trees bordered the road for miles as we left Montpellier. These long avenues of majestic shade trees, with leaves like our maple and bark like the sycamore, an allied species, form splendid approaches to many French towns.

The approach to Albi was no exception, but the trunks were being swathed in pads of straw to protect them from racing cars—and also to soften the shock of collision for the drivers—during the running of the Grand Prix Automobile d'Albi.

A Cathedral Like a Fortress

Forbidding as a fortress loomed the red-brick Cathedral of Ste. Cécile, dominating the skyline (pages 29 and 32). Its sheer corrugated walls, narrow loophole windows, machicolated parapet, and single tower, like a castle keep, give it an air of grim severity. It was conceived in the 13th century by Bishop Bernard de Castanet, Holy Inquisitor of Albi, who busied himself stamping out what remained of the Albigensian heresy and appropriating the property of his victims.

Next day, led by Jacques Rieux, whose father owns an old and historic Albi hostelry, we scrambled across roofs, slithered down river banks, picked our way over railroad ties, and groped through dark, narrow old streets to view this austere southern-Gothic structure from many angles.

To gain the floor level of Ste. Cécile, 30 feet above the street, we climbed a ramp to the crenelated Avant-Porte, the outer portal, and mounted a gradual flight of monumental stairs to the huge, elaborately ornamented, gray stone porch. The Flamboyant tracery contrasts as effectively with the mellow reddish

brick as a lace vestment with a cardinal's cassock.

Entering the Cathedral, we found ourselves in a cool room, very wide and high, with a vaulted ceiling and no pillars. The construction is massive and simple, but the decoration is gorgeous. We gaped in amazement at the rich blue and gold of the ceiling (page 31), at walls almost completely covered with frescoes, and at the stupendous *jubé*, or rood screen, the full width of the nave, that looked like petrified lace. Tradition says Cardinal Richelieu climbed a ladder to assure himself the delicate carving wasn't painted plaster.

"Magnificent Folly"

I bought from the sacristan a little book from which I translated the following appropriate words about the rood screen by the novelist Prosper Mérimée:

"I don't like jubés. They make churches shrink; they give the effect of a large piece of furniture in a small room. However, that of Ste. Cécile is so elegant, so perfect in workmanship, that, completely filled with admiration, one shuns criticism and is ashamed to be reasonable in the presence of this magnificent folly."

Behind the rood screen the entire enclosure of the choir, filling the eastern half of the church, is similarly carved, while standing in regularly spaced niches are beautifully executed small statues of angels, saints, Apostles, and other Biblical figures. Seventy empty niches, in the façade of the jubé, are reminders of how close this masterpiece of sculpture and all the frescoes came to destruction during the Revolution.

An immense painting of the Last Judgment, done by French artists, once covered the inner surface of two of the massive brick piers of the tower and the space between them. Unfortunately, the central portion was sacrificed for access to the tower guard room, converted into a chapel, and to make room for the great organ. The vast painting's somber tones and curious conception, suggestive of illustrations for Dante's *Inferno*, are in strong contrast to the bright Italian frescoes done several decades later (page 30).

How to Hold Your Girl

Albi is a red city. Most buildings, including the Cathedral and the many-arched bridges, are of red brick. Roofs are red tile. Here even the River Tarn is red. From golden dawn to blazing sundown the roseate hues make a visual symphony as tones endlessly blend and change through every mutation of the weather.

Toulouse, Languedoc's principal industrial center, 40 miles southwest of Albi, is also a red-brick city. Arriving in the evening, we strolled beside the broad Garonne, where men were fishing with unusually long poles. Small white sails, seen through arches of a distant bridge, flitted about like butterflies. Boys walked with their girls, holding a firm but affectionate grip on the backs of their necks—a style in courting behavior new to us.

Next morning M. Théodore Puntous, Perpetual Secretary of the Academy of the Floral Games, took us to the old Hôtel d'Assézat, the Academy's headquarters. He showed us gold and silver flowers awarded annually as prizes for verse in *langue d'oc*. In this way the literary traditions of the language are preserved. Portraits of celebrated members, including Louis XIV, decorated the walls of the salon. In the foyer hung a rich painting of the floral games of 1498, illustrating how this traditional custom originated in the "love courts" of the troubadours (pages 1, 22).

Lovers of architecture would consider the Romanesque church of St. Sernin alone worth a journey to Toulouse. The Cathedral of St. Etienne, on the other hand, is a hodgepodge of several styles of architecture, a masterpiece of incongruity, all out of shape and balance. Henry James described it aptly as a "dislocated fragment."

At the base of the central pillar we saw the tomb of an unselfish benefactor of France, the Baron Pierre Paul Riquet de Bonrepos (1604-80), who devoted his life to promoting the canal system of this region. Passing through Toulouse, it links Bordeaux on the Atlantic with Agde and Sète on the Mediterranean.*

The eastern part, the Canal du Midi, built and largely paid for by Riquet, serves the grape-growing regions of Bas (Lower) Languedoc. Wine making is big business here, and Marshall Plan aid helps increase production.

Vineyards Suffered in Wartime

Louis Pullès, who owns a small vineyard near Carcassonne, told us the vines were neglected during the war and are still not back to normal.

"The Nazis commandeered all but the oldest horses," he said. "Manpower was short, many workers being absent in prison camps or at forced labor. We lacked fertilizer, sulphur for dusting, copper sulphate for spraying, and chemicals such as arsenic and vitriol for combating disease in the vines. Horse

*See "Across the Midi in a Canoe," by Melville Chater, NATIONAL GEOGRAPHIC MAGAZINE, August, 1927.

Kodachrome by Walter Meayers Edwards

Farmer's Daughter, Cooking Stew, Quickens the Flames with Bellows Tube

Paul Bouty, his wife, and five children live a frugal existence in two small rooms in cliffside Castelbouc (pages 26 and 27). Their pantry stands above the hearth. Marie Jeanne wears a new sweater, a gift from America.

↑ Castelbouc Hangs Above the Tarn Like an Indian Pueblo

In feudal times a trail of military value wound through the Tarn's gorge. To guard it, the river lords erected a series of castles. One of these was Castelbouc (Castle of the Billy Goat), which perches on the rocky wedge at the left.

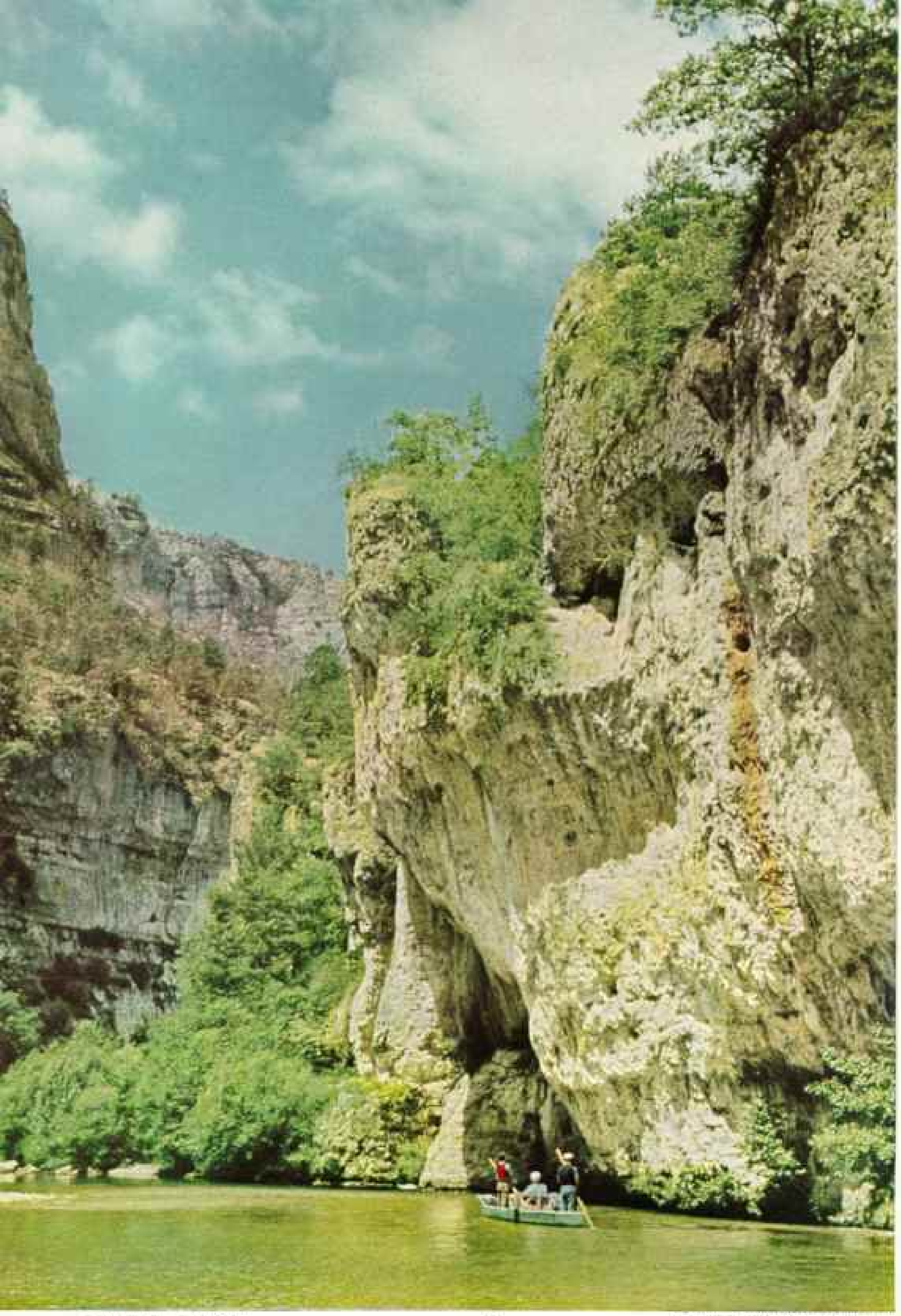
War in 1588 left the castle shattered. The village never fully recovered.

Dwellings surviving at the river's edge are, in the main, ghostly ruins. Some 30 people live in houses hidden behind the rock, and they, shoring up the soil with walls, cultivate every last inch.

← Paul Bouty and Marie Jeanne watch a friend shear a sheep on their Castelbouc farm. They will spin some of its wool for their clothing.

→ Carafin Caussignac cultivates a vineyard overhanging the River Jonte at Le Truel. In response to a call, he cheerfully marched up the terraced slope for his picture. It was a hot day, and he called his work *très pénible* (great drudgery).

Kodachromes by
Walter Meayers Edwards



  Kodachrome by Walter Meayers Edwards

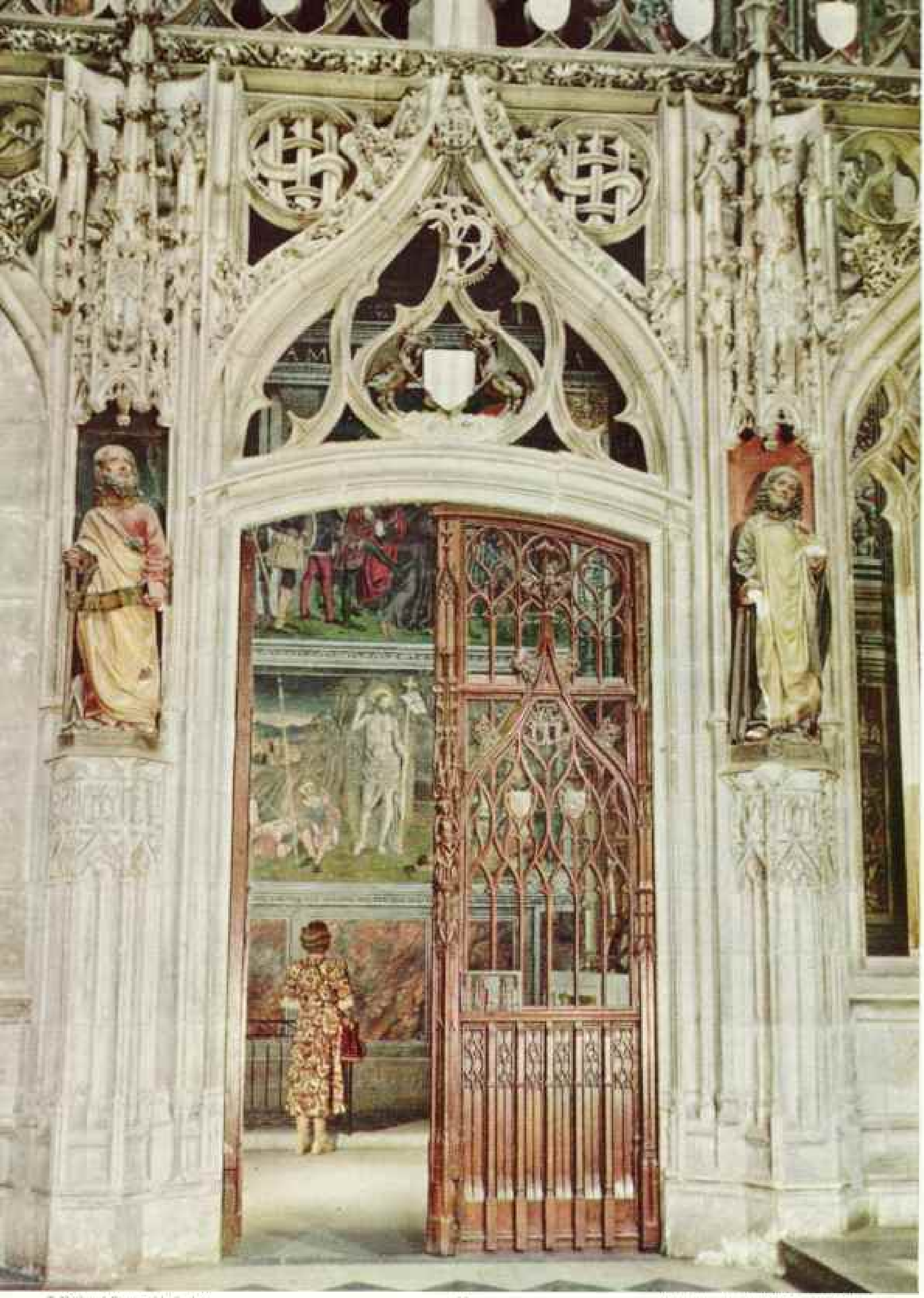
Creamy Limestone Cliffs Capped with Green Overhang a French Grand Canyon

Here the Détroits (Straits) squeeze the Tarn. The name suggests the narrows from which Michigan's Detroit took its name. The author's party drifts lazily down the gorge. Boatmen must pole back against the current.

Kodachrome by Walter Meayers Edwards

Donjonlike Tower and Loophole Windows Give Albi Cathedral a Fortress Look

Ste. Cécile is a grim monument to the 13th-century crusade that mercilessly stamped out the Albigensian heresy, which took its name from Albi. For decades the struggle ravaged southern France (pages 30, 31, 32).



Kodachrome by Walter Meayers Edwards

Medieval Painters and Sculptors Made Ste. Cécile Their Masterpiece

Thirty chapels grace the inner walls. Saints Anges (Holy Angels), one of the finest, here reveals a painting of the Resurrection. The delicately carved portal, flanked by St. Matthew and St. Simon, leads from the choir.

Saints and Cherubs Parade Across the Cathedral's Gold and Sky-blue Ceiling

Christ (shown inverted) hangs above Ste. Cécile's high altar. Winged ox, man, lion, and eagle, symbols of the four Evangelists, converge around Him. Italian artists did the entire decoration in less than three years.

Kodachrome by Walter Meayers Edwards

Ste. Cécile's Mellow Brick Glows in Morning's Golden Light. Old Bridges Cross the Tarn

During the French Revolution the Cathedral became Albi's Temple of Reason. Religion haters removed sacred statues. Empty niches bear witness to the depredation.

Blue Sky, Fleecy Clouds, and Yellow Grain Splash Color Across the Causse du Larzac

Marcel Reynal's McCormick-Deering reaper says "America"; his beret spells "France." This estate's enormous size encourages use of machinery. Tiny farms on every side find hand labor more economical. Much of the plateau is desert.

Kodachrome by Gilbert Grosvenor

Dreamlike Carcassonne Springs Out of the Age of Knights. Towers and Mile-long Walls Present an Incredible Picture

This medieval museum piece remains a living city; Frenchmen still dwell in its creaky houses on crooked streets. The old fortress is called the Cité; its newer companion quarter is the Ville Basse (Lower Town). School children cross a 13th-century bridge spanning the River Aude (pages 35-37).

Sight-seers Take a Fairy-tale Tour in Carcassonne

Here stands a feudal city complete in every detail. Its defenses include examples of almost every system used from late Roman times until the 14th century. Double walls ring the citadel. Fifty-four towers rise from the battlements.

In Caesar's time the town was the seat of a Celtic people who called it Carcaso. Some of its foundations were laid by Visigoths between the fifth century and the eighth. Invading Saracens took over next; feudal lords followed them. King Louis IX built the outer ring of fortifications. Eventually Carcassonne's military importance waned. For centuries the magnificent fortifications lay neglected; quarrymen plundered them for stone. Restoration began in the last century.

Today travelers, marching through in droves, bring life to the Old Town.

This party leaves the door to the cone-capped Tower of Justice, or Tower of the Inquisition. It deserves two names because, tradition says, both Louis IX and the Inquisitors held tribunals there.

Just beyond, the Tour Pinte stands as the solitary square tower among the 54. Towers at the right guard the 12th-century Castle, a self-contained inner stronghold.

Bursting Rockets Paint the Sky; Carcassonne Burns with Simulated Fires

On July 14 the ancient Cité celebrated Bastille Day with American Fourth-of-July effects. Flames lit up the 1,800 feet of walls facing the Ville Basse.

Kodachrome by Walter Mearns Edwards

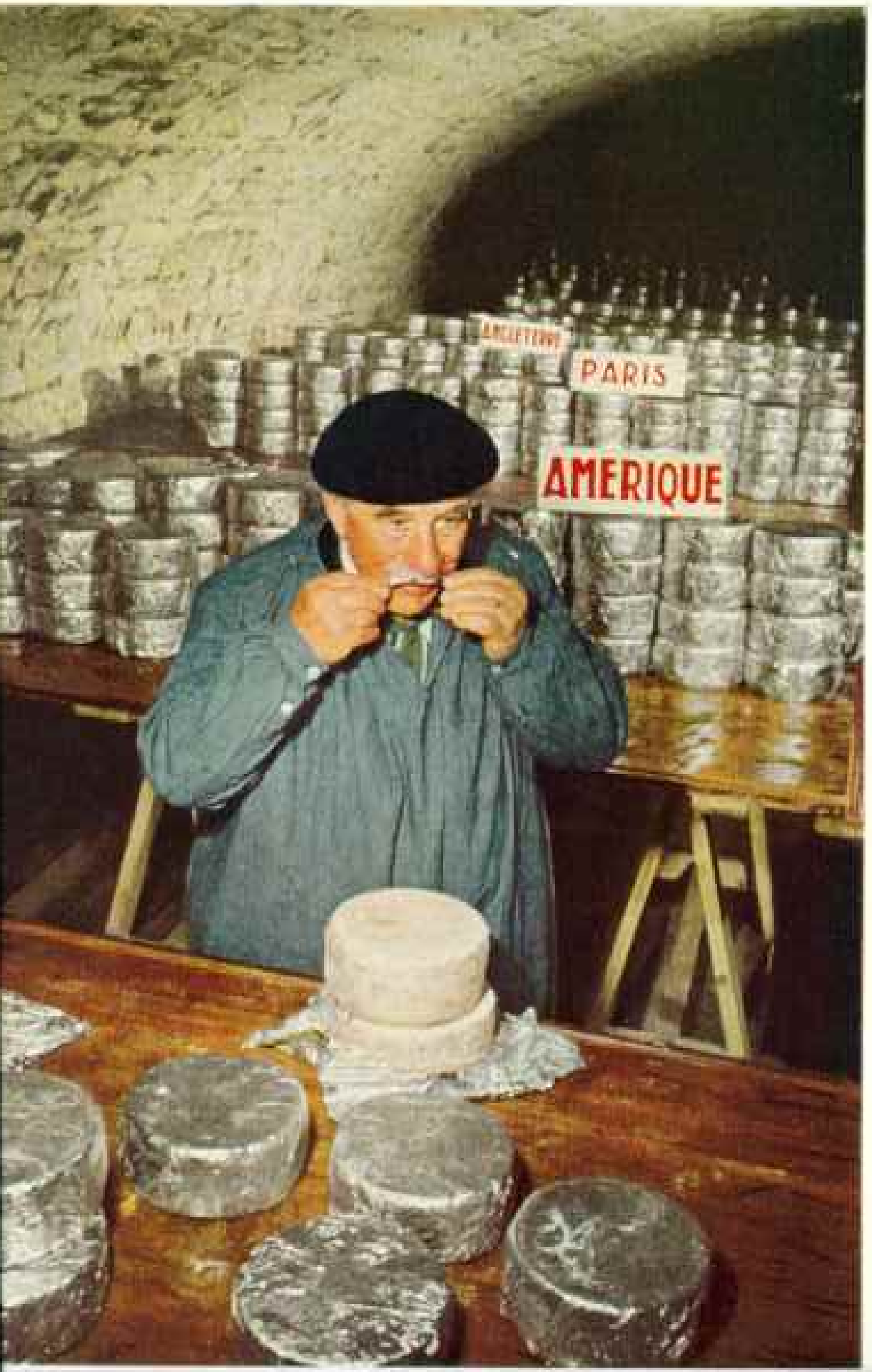
Flares Stab the Darkness; Glowing Ramparts Seem Ready to Melt and Topple

The show suggests the London conflagrations during the Blitz. A halo surrounds the Cathedral of St. Nazaire (directly above).

Kodachrome by Walter Meayers Edwards

Belled Sheep, Including a Few Black Ewes, Graze a Trail Up Mont Aigoual, Their Summer Pasture

Each year the sheep migrate from the hot Mediterranean plains to the cool mountains. Not this flock, but hundreds of others on the Massif Central give the milk going into Roquefort cheese (opposite page).



Cured in Caves, Cheese Is King in Roquefort

A million sheep labor on 30,000 French farms to supply the milk enabling Roquefort sur Soulzon to produce 26 million pounds of cheese a year.

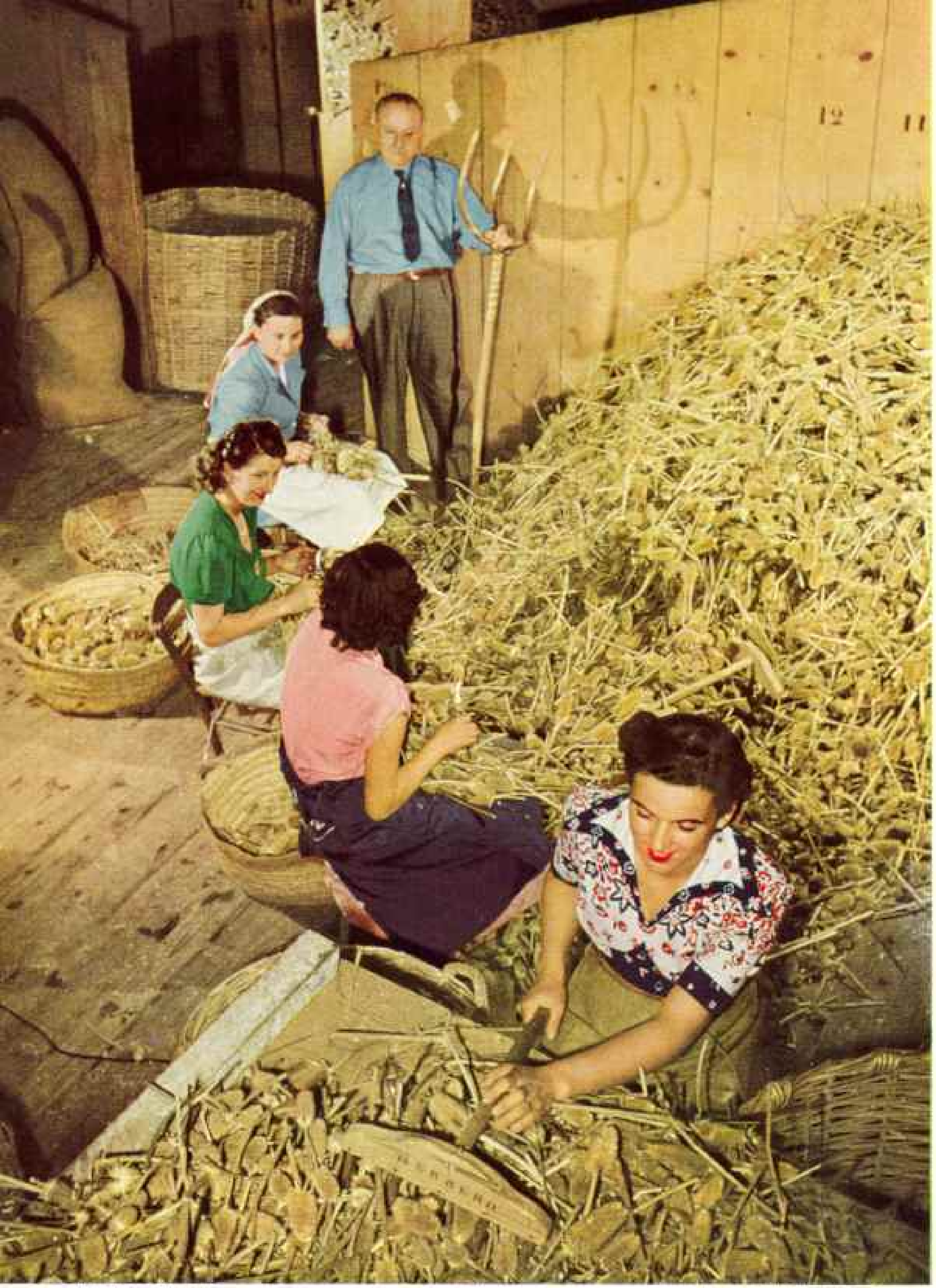
Dairies curdle the milk, pack it in molds, and inject *Penicillium roqueforti*, the mushroom spores that develop into the characteristic blue-green mold. Then the cheeses are hauled to Roquefort.

There the product ripens in caves naturally air-conditioned by cool, moist drafts. After 30 to 50 days' aging, the cheese is put into cold storage to await shipment.

← Eugène Palès, a taster, has worked 60 of his 78 years in the caves. He tests these tinfoil-wrapped cheeses to determine strength and flavor and sorts them to suit the tastes of customers (America, Paris, England). Any lot that fails to satisfy him is denied the trademark "Roquefort."

→ Salt is hand-rubbed on the cheeses. Machines will brush it off after several days.

Kodachromes by
Walter Meayers Edwards



Kodachrome by Walter Meayers Edwards

Mounted on Machines, These Sharp-tined Teasels Brush Up the Nap of Woolens and Felts

Languedoc cultivates its prickly herbs for the textile industry. Alphonse Cambriel (with fork) ships them from Carcassonne. His employees clip the stalks and pierce the natural brushes to fit spindles.

fodder and gasoline for tractors were also in short supply."

Lacking the constant attention they require, the vines weakened and many died. Some were destroyed because Vichy made the growers plant other crops. It is a six-year job to replace them. After deep plowing to get rid of old roots, the soil must be planted for two years in a cover crop, then two years in grain, before new vines are planted. Two more years pass before they bear their first fruit.

Half the World's Wooled Sheepskins

From Toulouse we headed for Mazamet, a town of 15,000 inhabitants, below the northern slopes of the Montagne Noire. Astonishing in this remote mountain town is an industry that has grown up during the past 100 years—that of fellmongering, or separating wool from sheepskins imported from far parts of the earth.

Mazamet's annual purchase of wooled sheepskins from the meat producers of the Southern Hemisphere had almost reached its prewar level of 66,000 tons—considerably more than half the world's production. About 50 percent of the pulled wool is exported to England and the rest is sold to France's own textile industry.

Some of the skins after pulling are sent to the United States, but in normal times most are tanned locally into linings for shoes, handbags, and the like, and exported mainly to Germany, the Benelux countries, Scandinavia, and North Africa. The tanning industry was hard hit by the economic upheaval following the war and is still struggling to regain its former outlets.

Pyrenees Dim in Distance

Leaving Mazamet, a sea of red-tiled roofs below us, we climbed up and over the Montagne Noire and nosed down into the vast plain of Carcassonne. In the distance to the south we could dimly discern the Pyrenees. A huge anvil-shaped cloud born of winds from Spain hovered at the end of the range, where it dips down to the Mediterranean.

From Carcassonne's boulevard-encircled Ville Basse, or Lower Town, we reached the old stone bridge over the River Aude and caught our first thrilling glimpse of the Cité, the fortress city. There it had stood for centuries, commanding the strategic approaches to Catalonia (pages 34, 35).

A few minutes later we entered the old city across the drawbridge of the Porte Narbonnaise.

A winding street barely wide enough for the car brought us to the vine-covered entrance of the Hôtel de la Cité. The only hotel within the ramparts, it is almost as much of an attraction as the fortress itself. Soon we were installed in a luxuriously furnished room overlooking the Ville Basse.

When we went down to the regal dining room, decorated with fleurs-de-lis and lions rampant, I ordered a specialty of the house—fresh-water crayfish and Norway lobster tails, *au gratin*, with a complicated wine sauce. It was so delicious I had it four times in as many days.

After a stroll in the garden we lingered on our balcony, watching the distant lights twinkling. Carcassonne seemed to epitomize all that was romantic. We could imagine kings and knights, fair ladies in long pointed hats and flowing gowns, the clank of armor, the tread of a sentry on the ramparts, the . . . What was that?

Scene Straight from Middle Ages

A sharp command uttered in military fashion rang out clearly in the still night air. A light suddenly illuminated a conical tower on the ramparts to our left, and there, in chain mail and shining helmet, strode a soldier of the Middle Ages. It was weird and startling, as if our thoughts had suddenly materialized. Then as suddenly the vision was gone.

We knew we hadn't been dreaming, and hurried out to investigate. A few minutes later we were seated under the stars in the open-air theater, watching Henry de Montherlant's *La Reine Morte* performed by a cast from the Comédie Française, using the ramparts as a stage.

Next morning, when we ordered tea for breakfast, Mary was amused by the tag attached to the tea bag, called phonetically a *tiboll*. It read "*Dose pour 1 personne.*" Since then she often asks if I'd care for a dose of tea.

Fencers Vie on Bastille Day

Metallic clicking sounds of swordplay and shouts of "En garde!" and "Touché!" attracted us to the window. Below, under the trees, were white-clad figures vigorously parrying and thrusting.

It was Bastille Day, the French national holiday equivalent to our own Fourth of July, and this was the annual fencing tournament of the Cité of Carcassonne for the Cup of July 14th. There were five teams—two from Toulouse and one each from Carcassonne, Perpignan, and Foix (page 42).

At the end of the all-day match, officials

42

Masked Swordsmen Lunge with Epées. Their Shining White Armor Is Padded Canvas

Team mates, one a left-hander, practice for Bastille Day bouts in Carcassonne (page 41). If their electric epées were hooked up, wires on the ground would run up the backs of both men, connecting sword tips to control boxes. Then, once a touch was made on flesh, mask, or cloth, a buzzer would sound and a light would flash, resolving any doubt about the judge's eyesight. No right-hand novice enjoys a left-hander's disconcerting thrust. Most dueling teams like to have at least one southpaw.

presented the cup to the captain of the winning team and distributed the prizes. A table displayed sweaters, a toilet kit, an electric iron, a giant bottle of cologne, a pair of sneakers, a necktie, socks, candy, several bottles of wine, and many other items.

In order of precedence according to his score, each contestant made his own selection. Since there were 29 prizes and only 25 fencers, the last four went to the judges, and everyone was happy—a very civilized performance.

Madame Louis Pullès, who had studied at the University of Michigan, was our guide as we toured the ramparts. In excellent English she described in vivid detail all the ingenious methods pre-gunpowder military minds had devised for repelling attack.

I can well credit the claim made for Carcassonne, that every such means is represented in its defenses. Trickery was an important ingredient in medieval recipes for resistance, and boiling oil or molten lead would pour from the most unexpected places.

When at the end of the 13th century the great fortress reached the zenith of its strength, it remained impregnable until the age of firearms made its defenses obsolete. Louis IX had constructed the entire ring of outer walls and towers, and his son, Philip the Bold, by the time of his death had completed the work by enlarging and reinforcing the inner ramparts.

By 1855 the Cité had decayed into a squalid habitation for the very poor and was about to become a quarry, when the brilliant architect, Viollet-le-Duc, commenced the task of restoration.

Except for the huge circular barbican, which guarded the approaches from the River Aude, the fortifications look today substan-

As the Farmer Cuts His Wheat, Hungry Sheep and Goats Rush In, Their Bells Tinkling

A village called Lagorce crowns the distant escarpment, which rises a few miles north of Vallon. Its 17th-century château is a crumbling ruin. Leaves of the mulberry trees (foreground) are raised to feed silkworms. Competition first from Japanese and later from nylon makers has injured the French silk industry.

tially as Philip left them. No more perfect museum of early military architecture could be imagined.

At intervals all day, the stirring strains of "The Marseillaise" were wafted up from the Ville Basse, where other Bastille Day celebrations were in progress. As is inevitable in France, there was a bicycle race, and the boulevard was lined with spectators fluttering small tricolor flags.

Carcassonne's Ramparts Aflame

Photographer Armand Dumont had invited us to his roof to view the Cité fireworks display. As darkness fell, the streets were filled with people hurrying to similar vantage points.

Near the zero hour, in the dim starlight, we could see shadowy figures on neighboring roofs. Occasionally a match would light up a face for a few seconds.

Suddenly the silence was shattered by a violent detonation. The show was on!

For twenty minutes colorful bursts, sprays, flashes, and loud reports filled the sky.

Then followed a dramatic spectacle. All along the ramparts fires broke out, until the entire Cité seemed in flames (pages 36-37). Its towers and crenelated walls, its castle and cathedral stood out boldly, shimmering in the heated atmosphere. Fancy conjured up an invading army in the surrounding darkness.

For several minutes the "fires" burned fiercely, then gradually subsided. As if merging into the dim recesses of history, the fortress disappeared into the night and all was dark again.

A haunting fade-out, we thought. Next morning we left Languedoc, but the memory of that vivid climax to our journey still lingers in our minds.

National Geographic Photographer B. Anthony Stewart

Frost Outside, Yet Bananas, Papayas, and Vanilla Thrive in Longwood's "Tropics"

In the garden conservatory on the Pierre S. du Pont estate near Kennett Square, Pennsylvania, gardener Charles H. Briggs (right) shows a visitor fragrant vanilla beans. This vine, which ordinarily rambles, is trained ball-fashion around its trunk. Mr. Briggs picks bananas from the giant tree (left) and papayas (background) all year long.

Wonderland in Longwood Gardens

By Edward C. Ferriday, Jr.

"THERE are two things you must do in this town," the good citizens of Kennett Square, Pennsylvania, will tell a person passing through on U. S. Highway No. 1. "Eat some of our mushrooms and see our gardens."

Residents are at a loss for words to describe these specialties. The fresh, tender mushrooms are grown all around the town, the Nation's leading mushroom-producing center. As for the gardens, they are the Longwood Gardens a few miles out of town on the country estate of Pierre S. du Pont, a wonderland that one must see to appreciate.

Having seen Longwood—all of it—I know what Kennett Square folk mean when they say it must be seen. Its indescribable glory rendered me speechless at a performance of *Patience* in the unique and magnificent open-air theater on the grounds (pages 60, 61 and 63).

Lights Play on Shimmery Water Curtain

The closing notes of the Gilbert and Sullivan operetta faded into the air. As the audience of 2,200 burst into prolonged applause, the curtain rose—not fell—on the Philadelphia Savoy Company production. The curtain rang down, the cast took a curtain call, and the curtain went up again.

This was no ordinary theater. Its "curtain" was a line of small jets of water that shot up into the air (page 62). Strong white light beamed through, making it opaque. Light rays reflected on each tiny droplet of water, transforming the curtain into a multicolored, diamond-studded screen spraying up from the 62-foot stage.

Attendants quickly removed the aluminum covers from fountain basins in the stage floor. Suddenly behind the curtain spired tall streams of water delicately shaded from pale pastels to deep reds and purples.

For the next 10 minutes I watched an ever-changing display of fountain patterns and lights. Through the rainbow mist, the arborvitae wings and vine-covered backdrop took on a fairyland appearance as additional fountains off stage in the shrubbery went into action. An arch of color surged toward the center from either side, while behind it towered a column of water 50 feet high (page 64).

Streams of water rose higher or diminished as the pressure increased or decreased. Finally this breath-taking panorama of water and color ended in a grand finale with all fountains pushed skyward to their limit. Only white lights illuminated this silvery climax.

As I wondered how much more beauty could be found in one place, a voice over the public address system invited theatergoers to "the main attraction," the fountain display in front of the garden conservatory terrace.

Such exhibits are not extravaganzas given only on special occasions. They are presented after every theatrical performance. But the grounds, gardens, and conservatory are open to the public every day, all seasons of the year. Since the gardens were opened in 1921, more than 3,000,000 visitors have enjoyed the wonders of Longwood.

Longwood, 30 miles southwest of Philadelphia and 11 miles northwest of Wilmington, is one of the showplaces of America. Its history reads like that of the United States itself. William Penn conveyed the tract of land by grant to George Peirce in 1702. The Peirce family built the original house in 1730 and occupied it until 1906. The old house forms a wing of the present du Pont mansion.

The Battle of Brandywine in the Revolutionary War raged a few miles from Longwood. Just before the Civil War the property became a station on the Underground Railway and a rendezvous for runaway slaves. Later it was the Quaker headquarters. In fact, the Quakers gave the estate its name of Longwood because of a long wooded strip near by. A few of these trees still stand.

In 1906 Mr. du Pont bought what was then known as Peirce's Park. After 25 years of careful planning and work under his supervision, the Longwood of today emerged. Using the charm of the old grounds and gardens as a foundation, he developed the estate.

Nature and Artifice Blended

He constructed the theater, a majestic water garden, the many fountains, the small lakes, and the $1,500,000 conservatory. He blended nature with artifice. Gradually a rich man's dream became a reality; Pierre du Pont made Longwood a garden second to none.

In 1946, he endowed the Longwood Foundation which established the Gardens as a permanent public park for everyone—rich and poor—to enjoy. There is no admission fee except on Sundays, when a nominal 60 cents is charged. All of this money is turned over to local hospitals.

The fountains in front of the conservatory rival those at Versailles (pages 49 and 54). So well camouflaged are the nozzles, basins, and floodlights of the 22 fountain displays

National Geographic Photographer B. Anthony Stewart

Touch System on Fountain Keyboard Plays Symphonies in Water and Color

Longwood's fountain displays rival those at Versailles, France. They make the gardens one of America's outstanding showplaces. Like an organist at a console, superintendent Russell P. Brewer (left) fingers 290 switches and levers to fashion multitinted shower patterns on the lawn before him. The board's color tabs are so finely graduated that he can make light changes undetected by the human eye.

that a quick glance over the huge lawn in daytime reveals nothing but orderly clumps of boxwood, bordered by trim hedges and skirted with a double row of maple trees. But about 30 evenings every summer water and colored lights go into action, transforming the lawn into an enchanting scene.

Water Display—Push-button Style

The constantly changing, intricate patterns of the gigantic fountains and multicolored lights are controlled by the mere touch of a finger. Just below the level of the terrace stands the glass-fronted control room (above). At the control board one man—usually Russell P. Brewer, superintendent of maintenance—operates the many water jets and lights like an organist playing a console.

The "keyboard" consists of 108 levers which control the intensity, change, speed and order of change of the colored lights, and 182 switches which control the circuits of the colored lights and water. So complex is the board that Brewer still discovers new combinations for water patterns. The color switches are so finely graduated that the operator can make light changes that the human eye cannot detect.

When Brewer came to Longwood in 1915, he and his associates, under Mr. du Pont's direction, laid out and engineered the entire fountain system. In 1937 New York engineers sweated over fountain display plans for the World's Fair. To obtain the necessary know-how, they went to Longwood.

The pride of Brewer's staff is Old Faithful, Longwood's largest fountain. By use of compressed air, it can shoot a regal stream up to 140 feet in the air (page 50). It is supported by two single columns 80 feet high and 12 smaller ones that fling showers 30 feet into the air. Or Old Faithful itself can be spread into a fan-shaped spray 40 feet high and 100 feet wide (page 53).

National Geographic Photographer B. Anthony Stewart

One Orchid Requires Eight Years to Bloom. That's Why Corsages Are So Expensive

Growing wild from the Equator to the Arctic Circle, the orchid ranks as one of the world's largest families of flowers. Into the flask gardener Louis Jacoby holds went 1,000 orchid seeds which will germinate, like bacteria, in agar culture. Of these, less than 150 will reach the 18-month-old community pot in his other hand. The visitor displays a 10-year-old white cattleya valued up to $140.

The entire fountain system in front of the conservatory uses about 250,000 gallons every half hour.

"But," Mr. Brewer told me, "we lose only about three percent of the water to evaporation and wind."

The rest flows through the basins, pools, and canals to underground pipes and back to the pump house where it started. Here 18 huge pump motors, two air compressors, and five transformers supply light and power.

Water is supplied by Longwood's own artesian wells and 670,000 gallons are stored in the fountain basins, canals, pools, and underground reservoir.

Should all of Longwood's fountains—conservatory, theater, and those in the formal Italian water garden—be turned on at once, they would require a total volume of 18,000 gallons each minute.

Such facts amaze the visitor; he begins to grasp the magnitude and ingenuity of the operation. But facts and figures are not needed to impress him, only his eyes.

Probably the greatest attraction at Longwood and the one seen by most persons is its conservatory. Here the visitor finds a labyrinth of hothouses covering more than 2½ acres, or 120,000 square feet under glass.

Longwood Springtime Is Eternal

Conservatory gardeners turn up their noses at changing seasons. Even when snow blankets the whole countryside, there is an abundance of flowers.

Beneath glass, gardeners create spring, summer, or autumn. They can give one greenhouse a Maine climate, another California; others simulate a Central American jungle and an Arizona desert. I found roses blooming in one, carnations and snapdragons in another, all out of season.

In February blossoms crown fruit trees. There are patches of shoulder-high pansies,

of sweet peas, tulips, hyacinths, daffodils, and fern trees.

I stepped from the Temperate Zone into the Tropics and found orchids in full flower (page 53). Here I found real hothouses, filled with fruit-laden papayas, red-berried coffee trees, a breadfruit tree, vanilla vines (page 44), ixora and passion flowers.

I looked up above the other plants and saw stalks of bananas. Old-timers on the Longwood staff remember when President Calvin Coolidge visited the 1,000-acre estate. He was taken on a tour of the conservatory, saw everything, but made no comment. Then he looked up and saw bananas growing. He studied them for several seconds, turned to his guide, and remarked, "Bananas."

Desert plants of all sizes and shapes thrive and flower in the cactus house. One cactus of the genus *Opuntia* grows so well that more than two tons of thorny leaves and stem have been hacked off to keep its size down.

I saw what looked like a man from Mars. He wore a gas mask, large gloves, boots, and a heavy apron. Carrying a nozzled hose which was attached to the large tank strapped to his back, he was on his way to gas peach trees with a new type of aerosol bomb.

"Everything Under the Sun"

Being able to grow "nearly everything under the sun," as John H. Marx, superintendent of horticulture, puts it, requires an elaborate heating and ventilating system. Temperature and humidity are of prime importance. Azaleas and camellias (page 55) must be kept relatively cool, between 42° and 60° F. Bougainvillea (page 57) gets about 70° during the day. For orchids 60° is minimum, 90° desirable.

In the T-shaped main display room, every gardener finds the floral wonderland he dreams of. Plants in bloom are brought from the greenhouses and sunk, pots and all, into beds and borders edging the lush green lawn (page 58). The visitor can see flowers of all descriptions, everything from agapanthus to wisteria.

No plant is permitted to fade or wilt. Fragrant bloom goes on throughout the year, from January's cyclamen and hyacinth to the Christmas poinsettia (page 59).

The conservatory staff of 22 forces a variety of plants in succession (page 56). Thus the display room has tulips and other spring flowers over a three-month period. After that, tulips bloom in the outside gardens. By planting at intervals, the greenhouses have sweet peas seven months and roses ten. Some plants, like orchids, blossom all year.

"Visitors fire a lot of questions at us and often make suggestions," explained Mr. Marx. "Once a lady examined our staghorn ferns and remarked that even Longwood seemed to have trouble with black spots accumulating on the leaves. She said, 'I got rid of mine with a brush. A spray does no good.' We had to tell her those were spores."

The collection of shrubs and trees at Longwood is among the largest in the United States. Different families of plants number well over 200, with many varieties of each. Many horticulturalists refer to Longwood as "America's finest garden."

Another Longwood feature is its organ, among the most complete ever built. An organ is considered large if it contains as many as 4,400 pipes; Longwood's has 11,000.

The instrument measures 63 feet long, 40 feet high, and 30 feet deep. Its pipes are housed in chambers equivalent to a 10-room house. The largest pipe stands 34 feet high and has about 13 vibrations a second; the smallest corresponds to a thin pencil, with about 8,000 vibrations. The organ is powered by three electric motors.

The organ also has a percussion division—called "the jazz band"—including tympani, drums, bells, triangles, chimes, tambourine, cymbals, and xylophone. It contains a concert grand piano, three harps, a vibra harp, and Chinese gong. With its 200 stops, organist Firmin Swinnen can produce almost any musical effect he desires.

Mr. Swinnen, who became Longwood organist in 1923, has given more than 1,500 Sunday afternoon concerts.

Longwood is a little city in itself. It has its own fire department, reservoir, water system, baseball team, gun club, and almost 100 up-to-date houses and dormitories. Its 125 employees and their families eat dairy products, fruit, and vegetables from the Longwood farm.

In one month Longwood uses 40,000 kilowatt-hours of electricity, enough to supply an average family for about 22 years. It requires 200,000 cubic feet of gas monthly, which would cook the meals for one household for nearly seven years. More than 1,000,000 gallons of water are used each month, a 10-year supply for one family.

This "little city" is a part of Longwood that visitors rarely see. They are usually too busy gaping in awe at the magic fountains, exotic flowers, and glorious greenery.

And what interests city dwellers almost as much is the fact that everywhere they hear birds—"real birds," as one man accustomed only to sparrows and starlings called them.

Kodachrome by B. Anthony Stewart and John E. Fletcher

Longwood's Fountains, Like Geysers or Fireboats in Full Career, Drench the Sky

Old Faithful Spouts Like Its Namesake in Yellowstone

Longwood, one of the world's finest formal gardens, stands near Kennett Square, the Pennsylvania mushroom-growing center 30 miles southwest of Philadelphia.

Pierre S. du Pont, the Delaware financier, taking over the estate in 1906, made it a glittering showplace. In 1946 he gave it to the public.

Each year Longwood Gardens attracts some 225,000 visitors. They marvel at its rare flowers, out-of-season fruits, and especially at its showy fountains.

Here Old Faithful, Longwood's largest fountain, drives water 110 feet into the sky. Compressed air might push the stream up another 30 feet. Auxiliary streams consist of two 80-foot vertical jets at the sides and 12 arching jets at the base. In concert, they here play the so-called cathedral pattern.

Old Faithful alone requires 1,000 gallons of water a minute, a third the volume of Yellowstone's geyser in full eruption.

The view shows a few of the 310 electric lamps required to light the rectangular basin. The conservatory stands in the rear.

Kodachrome by B. Anthony Stewart and John E. Fletcher

Spectators Scamper as Fickle Winds Scatter Spray

Longwood's fountains were designed by its own staff of engineers. Twenty years' work gave them so much know-how that World's Fair engineers sought their advice on the creation of a similar spectacle in New York.

Those who saw the Flushing Meadow multicolored display will have a good idea of the show here when lights are turned on. Longwood's fountains have been called America's most spectacular night display (pages 61, 62, 64).

The 22 fountain displays in front of the conservatory are operated by one man in the control room. There, like an organist at the console, he taps levers and switches and plays symphonies with water and lights. Pumps and floodlights instantly respond to his touch.

Water comes from Longwood's own deep wells. After passing through the nozzles it returns to various storage places, losing some three percent to evaporation and winds.

These spectators, venturing too close to the central canal's 16 large jets, absorbed some of the lost spray.

Kodachromes by B. Anthony Stewart and John E. Fletcher

Kodachrome by B. Anthony Stewart

In April the Rhododendron Bears a Treeful of Blazing Color

Ficus pumila, one of the figs, covers the pillar. Hybrid azaleas crown pots on the right.

Kodachromes by B. Anthony Stewart and John E. Fletcher

Old Faithful's Atom-bomb Effect Is Called the Peacock Tail

Longwood's engineers, experimenting, learned how to convert the fountain's tall, thin column into this low, fat mound, mist darting in all directions. These visitors rest on the rectangular basin's balustrade (p. 50).

Australian Tree Fern Spreads Above Asia's Orchids

These *cymbidium* orchids remain in the growing house for 10 months. On blooming in February, they move to the greenhouse amphitheater. Relatives grow wild in the Himalayas and other parts of the Orient.

Kodachrome by B. Anthony Stewart

Visitors on the Conservatory's Terrace Admire the Rounded Boxwood and Cubed Maples

Here the fountains, plashing gently, flow by pressure from a 50,000-gallon reservoir sunk in the wooded hilltop.

Moistened Walks in the Greenhouse Satisfy the Azaleas' and Camellias' Craving for Humidity

The azalea and camellia house keeps temperatures cool—between 42° and 60° F. Marguerites, better known as daisies, brighten the foreground. Azaleas fill the center. Camellias appear in the far background.

Kodachrome by B. Anthony Stewart

A Gardener Checks the Temperature in No. 4 Growing House

Fuchsia overhead, dahlias on the right, and bougainvillea on the left enjoy 70° F. by day and 50° by night.

Kodachromes by B. Anthony Stewart

Begonia Seedlings, Grown Indoors, Fill Row on Row of Pots

When three months old, they will go to the conservatory to border walks and brighten garden patches.

Club Members Dine in a Perfumed Banquet Hall

Longwood's indoor theater, a sunken garden, occupies the center of the conservatory. When its floral tenants are removed, the hall can seat more than 800 people.

Here members of the Kennett Square Lions Club occupy the tables. They think so highly of the site that year after year they come back for their get-together dinner.

Bougainvillea blooms overhead; gloxinia glows in the foreground; Australian tree ferns stretch roofward.

Bougainvillea appears hundreds of miles north of its natural clime. It grows outdoors in the deep South and southern California. Louis Antoine de Bougainville, a French circumnavigator, discovered the plant in South America in the 1760's. It belongs to the four-o'clock family.

Gloxinia, named for P. B. Gloxin of Strasbourg, France, produces bell-like flowers on long stems. Not a hardy plant, it grows best in Peru, Brazil, and Mexico. California and Florida also enjoy gloxinia.

Australian tree fern, a green and graceful tropical plant, grows exceptionally well in conservatories. Its scientific name is *Alsophila* (grove-loving) *australis*. Reproduction, as in other ferns, is by spores, an older and more rudimentary device than the flowering plants' encased seeds (p. 53).

Kodachrome by B. Anthony Stewart

No Flower Ever Fades in Conservatory's Display Room

Here is a garden of endless bloom; spring reigns perpetually. As potted plants mature in the growing houses, they are moved to the conservatory and sunk in beds. None is permitted to wilt publicly. Flower succeeds flower through the year, beginning with January's cyclamens and Roman hyacinths, followed by primroses and daffodils, and ending with the Christmas poinsettia (opposite page).

This picture may be dated by the wisteria tree (left), which blooms in March. Summer will see it transplanted into the open. Winter it will spend in the peach house.

The wisteria's care is only one of thousands of tasks which keep a garden staff of 58 busy throughout the year.

John Marx (right), superintendent of horticulture, and Lewellyn Hanway, assistant gardener, here inspect the tulips. New bulbs freshen the bed weekly through March and April.

Kodachrome by B. Anthony Stewart

Poinsettias Flame at Christmas in the Fern Passageway . . . Nectarines Are Picked in May under the Conservatory's Glass

Boston ferns overhang a rail system once used to carry plants; rubber-tired carts now do the job. The espaliered nectarine tree is flattened against a wire frame. Other Longwood fruits grown out of their natural climes include bananas, oranges, grapefruit, figs, and apricots.

Kodachromes by B. Anthony Stewart

Kodachrome by B. Anthony Stewart

Ladies of the Chorus Try On Crowns in a Dressing Room Beneath Longwood's Outdoor Stage

Peggy Lukens (left), Anne Fairchild, and Joan Grosvenor Blair (seated) make up for their parts in *Patience*. Members of Philadelphia's Savoy Company sang this Gilbert and Sullivan operetta at the outdoor theater in 1916. Coming back to Longwood each June, they have repeated the show three times. Opposite page: Donald Bishop, Howell Zulick, and Robert Carnwath, all Savoyards, practice make-believe behind the water curtain, a series of lighted jets (pages 62 and 64).

Patience's Players, Officers of the Dragoon Guards, and the Chorus of Rapturous Maidens Rehearse a Curtain Call

In this afternoon shot, the tile stage reveals aluminum covers which are removed after each evening performance to permit the theater's color fountains to play, as they do on the opposite page. The dramatic water curtain, spurting from the trough to a height of 8 feet, forms a sparkling, opaque screen between audience and cast. The nighttime picture shows the curtain operating at low level. Fountains glow pink here; a few minutes later they shifted to blue (next page).

Kodachrome by B. Anthony Stewart

Fairyland's Mist and Color Compose Liquid Fireworks: the Stage Fountains

Labrador Canoe Adventure

By Andrew Brown and Ralph Gray

With Illustrations from Photographs by the Authors

TWO Indians ran dark hands and eyes over our twin aluminum canoes lying outside a warehouse in Burnt Creek, northern Quebec mining camp.

Prospectors, geologists, and drillers strolling by in their iron-reddened clothing expressed doubts about the unfamiliar metal craft. One hairy giant muttered something about "tin-can-oes."

We kept ears cocked for opinions; in that water-laced land canoes are indispensable for cross-country travel, and experts in their use are a dime a dozen. No one knows these northern waters as do the Indians, prospectors, and local trappers.

Despite pessimistic comment, we were confident the little canoes could carry us from the Quebec border across hundreds of miles of Labrador wilderness to Atlantic tidewater. It could be disastrous if they let us down!

We saw that the Indians admired the slick paint job (one canoe red, the other blue). But the taller native shook his head and drew a hand sharply across the metal skin, as if slashing it with a knife.

"Mathieu say the first jagged rock will gash 'em," interpreted John Michelin, one of our trapper guides.

"Well, they weathered a rough test last summer running the Susquehanna River," we pointed out, reassuring ourselves as well as the guides.* "We'll go ahead as planned. They'll do better than you think."

By journey's end, the 18-foot Grumman aluminum craft were scratched and dented, but watertight and sound. And—final vindication—our guides wanted to buy them.

Million-Paddle-Stroke Journey

In five weeks we paddled 578 miles on waters of Labrador's Hamilton River, trudged 61 miles over portages and up lookout hills, and navigated 150 fateful yards by raft. From height of land to sea level, each of us dipped a quarter of a million paddle strokes.

We embarked near the heart of the vast peninsula of Labrador-northern Quebec (Ungava).† End of our water trail was North West River, trappers' town on Lake Melville, tidal arm of the Atlantic (map, pages 68-9).

A chief objective was North America's next-to-greatest waterfall, the seldom seen Grand Falls of the Hamilton, a stupendous cataract 245 feet high (pages 73, 94, 96). Niagara, by its huge volume, alone surpasses it.

We traveled the interior of the land where Europeans probably made their first landfall in the New World. Yet the tides of history have largely swept by this corner of North America. Explorers recoiled from Labrador's barren, arctic coast. The wooded inland, far more pleasing and habitable, still is rarely visited.

In Labrador's wilderness the dense spruce forest marches north, like an immense army, to the edge of subarctic barrens. Myriad lakes break its ranks; also stretches of spongy muskeg and the scars of forest fires. Water laces the country everywhere—twisting rivers, lakes great and small, and grassy marsh.

Moss takes the place of soil. Gray or yellowish caribou moss, really a lichen, covers drier ground with its fluffy mat. Crossing moss-quilted bog and boulder fields, every step is a gamble.

Rails Soon Will Split the Wilderness

The Hamilton, Labrador's mightiest river, gathers its flood from this bewildering tangle. Long the domain of snowshoe and canoe, its western sources soon will echo to locomotive whistles and the clatter of cars on rails.

For the upper Hamilton basin encompasses part of vast, newly explored iron deposits that straddle the Quebec-Labrador border region. Track laying has begun on a 360-mile railroad to carry the ore from semibarren hills of Labrador and Ungava to the Gulf of St. Lawrence, whence ships will bear it to market (page 69).‡

It was early summer, 1950, when we set out to see and picture Hamilton River wilds. At Montreal we picked up our two trapper guides, John and Leslie Michelin, distant cousins. They had come from North West River, Labrador, by plane (pages 77, 81).

Like other Labrador settlers, these men are of British stock, mixed generations ago with Indian and Eskimo blood. The Michelins blend also a French-Canadian strain; John's grandfather came from Quebec.

The Labrador Mining and Exploration Company (LEC), major operator in the Que-

* See "Down the Susquehanna by Canoe," by Ralph Gray, National Geographic Magazine, July, 1950.

† See "Quebec's Forests, Farms, and Frontiers," by Andrew H. Brown, National Geographic Magazine, October, 1949.

‡ See "Sea to Lakes on the St. Lawrence," by George W. Long, National Geographic Magazine, September, 1950.

56

Wrestling a Canoe Through Gull Island Rapid Requires a Mountain Goat's Footwork

For 34 days last summer a four-man National Geographic party paddled and portaged across Labrador's wilds. A few tough situations brought discomforts. In shallows the men dragged their craft against the current. Here, on the raging Hamilton, they check a canoe's downstream plunge (page 98).

bec-Labrador iron strike area, flew our National Geographic party into the interior. This courtesy let us start canoeing at the top of the country.

The LEC flies DC-3's between the Gulf of St. Lawrence and an airstrip ten miles by road from their Burnt Creek base camp (page 74). Trucks, jeeps, bulldozers, heavy mining and construction machinery, as well as hundreds of men and the food to feed them, all have been flown in over the "Labrador hump."

By jeep from Burnt Creek we visited the iron deposits whose metal soon may find its way into American automobiles, structural steel, refrigerators, and rails. Dr. Albert E. Moss, geologist, took us to drill sites where crews worked round the clock, mapping limits of the ore bodies (page 75).

The LEC had 'dozed out 150 miles of roads to their iron beds. A road to Astray Lake in the Ashuanipi basin sped our plunge into the bush. A truck bounced us out to the tip of that last antenna of civilization.

On a Sunday afternoon we launched our canoes and slipped away into the silent wastes. John Michelin, our head guide, took the helm and Andrew Brown the forward paddle of bright-red *Loon*, Leslie Michelin the stern and Ralph Gray the bow of sky-blue *Trout*.

A few times during our journey we shifted canoes for photographic purposes. The guides always protested; they became attached to their respective craft.

We leaned to our paddles; clear water boiled from the blades. Wooded points and islands lured us into the unknown. The canoes raced side by side through the unfolding beauty and majesty of an unspoiled land.

Clouds swept in and rain tinkled on the lake. That shower ushered in a wet spell lasting three weeks, with only occasional interludes of fine weather. Soon Ralph greeted each morning with, "Well, it's another Labradull day!"

On Monday, after 25 miles of paddling down Dyke Lake, we clambered up barren-topped Fault Hill. A mighty sweep of country lay revealed (page 76). Long ridges banded the gently rolling land. Lakes filled nearly every depression. Higher hills thrust up bare crowns, overtopping the spruce and fir forest that reached, green and untouched, to the horizon. In silence we gazed out upon the haunting scene.

Beach Barely Wide Enough for a Fire

Skimming down the swift Ashuanipi River next evening, our wool shirts beaded by a steady drizzle, we searched for a campsite.

"We'll try here," John called out at last, indicating a narrow, rocky beach at the foot of a 40-foot sandy bluff.

Our paddles swung the canoes in toward shore. Ralph and Andy jumped out and tied the craft to boulders.

"We'll pitch the tent on top of the bank, I low," said Leslie. "It's a good job we've got this beach to unload on, and for our fire."

It took fancy stepping to move around, after the fire was blazing and all the supper things were strewn along that skimpy shore. To pass the fire we had to climb the bank or wade the brimming river.

In gathering darkness, Andy, hands full of food, slipped on a stone and teetered like a ropewalker at the stream's edge. Only a quick step into thigh-deep water saved him from a headlong plunge.

Long after the sky was black we pulled ourselves up the steep slope to the tent. Cobblestones dislodged by our feet rolled out of sight and plunked into the inky Ashuanipi.

The following day was better. The rain let up and the clouds parted briefly. Toward evening we navigated our first bad rapid. A tossing run of white water—the icing on any canoeing cake—tumbled us into Sandgirt Lake at sunset (page 82).

High water submerged the boulders in most of the rapids on our route, but huge swells in midstream or the "bathtubs" just below them would have upset the canoes in a flash.

Just for a lark, we might have run some of the big rapids down the middle. We could never forget, however, that there was no help nearer than 200 miles during much of the trip. In such isolation, loss of a canoe or injury to a man would have been calamitous.

So, when the current began to drive hard and breakers gleamed ahead, the guides picked one side of the river or the other for the descent. Close to either bank, the drag of points, boulders, and shallows slowed the river's pace.

John, whose self-confidence was limitless, had a nerve-racking habit of slipping toward the brink of even the worst rapid on a mid-channel course. More than once his choice of right- or left-shore route was so long delayed that Andy, awaiting the decision, felt sure the canoe must be drawn into the turmoil of midstream.

Loon twice failed to reach safer water near shore. At the last second John had to head the prow downstream, saying, "We'll just have to let 'er go!" Moving much too fast on the first of these occasions, we gave a rock a solid whack and momentarily "hung up," but bobbed through unhurt.

To reach mystery-shrouded Unknown Falls, hidden in wilderness to the southeast, we made a 12-day round-trip journey from Sandgirt Lake through waters of the Hamilton River's Atikonak branch.

The Pleistocene ice sheet was the landscape architect of our route. Ancient glaciers planed down the Labrador plateau the way a scraper smooths a rough road. They pared off hilltops and filled depressions with boulders, gravel, and sand.

After the ice retreated, the melt-filled lakes spilled through shallow depressions across a land almost devoid of valleys. A confused water pattern resulted. It is common for a major stream to find two, or even three or more exits from a big lake.

The Atikonak River, for example, in mid-course enters 50-mile-long Ossokmanuan Lake. The river pours from that water giant by two widely separated outlets. One stream flows to Sandgirt Lake. The other, Unknown River, plunges over two pairs of waterfalls and joins the main Hamilton some 15 miles below Grand Falls (map, pages 68-9).

Route Unknown Even to Guides

The all-water route between Sandgirt Lake and Unknown Falls was as new to our guides as to us.

Caching most of our outfit on an island, we ascended the Atikonak and were caught up in a battle with racing current and wind-lashed lakes.

Often we seemed to ride a watery treadmill; no matter how hard we dug at the stream, trees on shore crawled astern in slow motion.

John and Leslie never spoke of a river's current; it was always "tide." "There's less

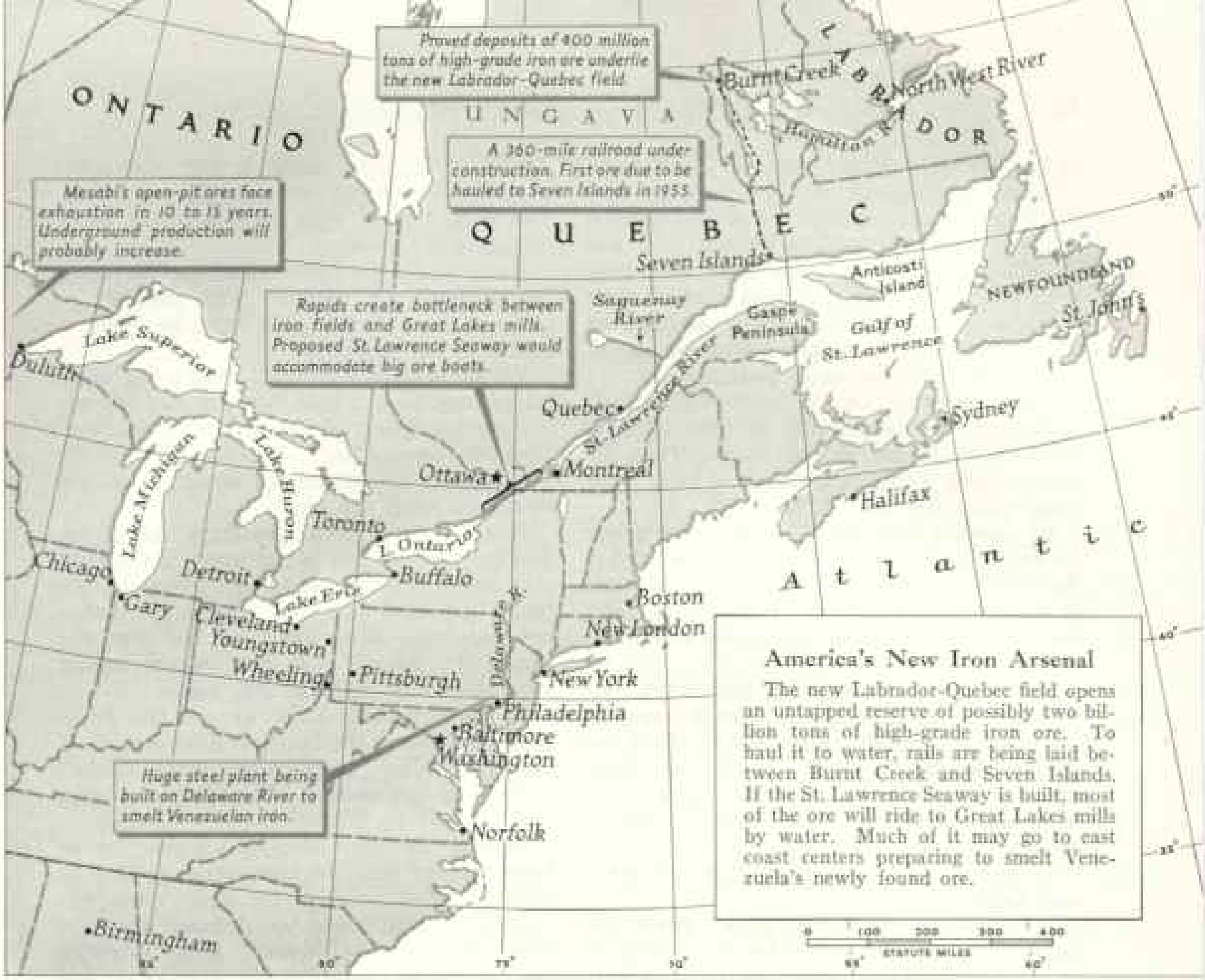
tide behind that island," they'd say, or "We'll have fair tide today."

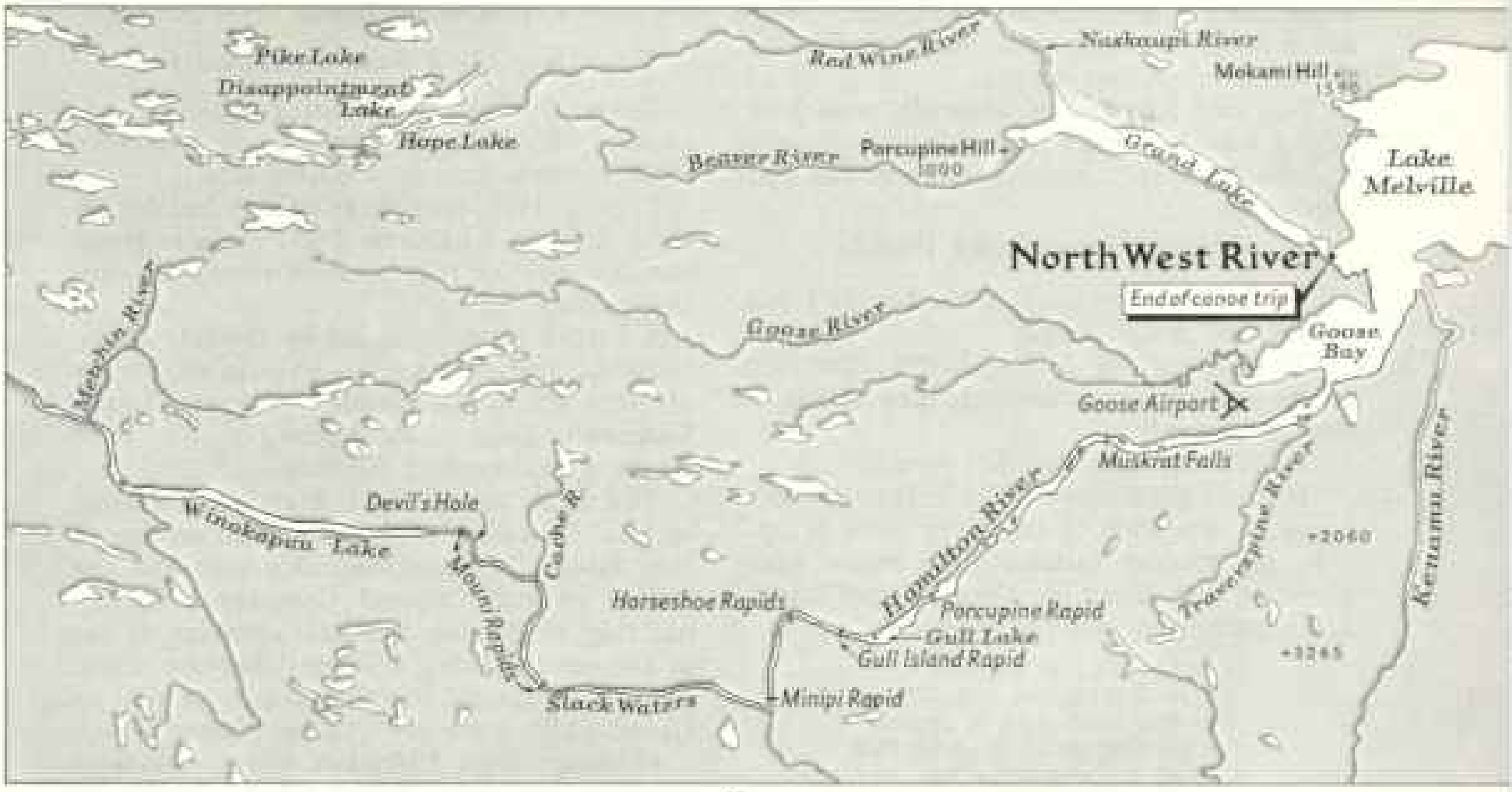
Three miles up the Atikonak we reached a wild rapid. Here, and at a rough place a few miles above, we had to track the canoes through.

Tracking Calls for Close Teamwork

In tracking, the bowman trudges the shore towing the canoe like a canal-barge mule. The steersman, meanwhile, stays aboard to guide the craft past rocks and points. Our tracking lines, 60 feet long, were tied to the bow seat thwarts.

Surmounting the steepest pitches required close teamwork and concentration. Ralph and Andy, hauling alongshore, watched constantly for footing and also kept a weather eye to the rear to see how the canoe was coming along. A sudden tug on the rope at the wrong moment might jerk one of the paddlers into the water, for each often rose





Hamilton River Drains a Pulpwood Reserve Unknown to the Woodsman's Ax

Canoeing unspoiled lakes and streams, the authors invaded the primeval realm of the loon, otter, and trout. From Astray Lake to North West River they paddled and portaged 600 miles. For the first 31 days they met no other men. To see Unknown Falls they made a 200-mile side trip from Sandgirt Lake (left).

to his feet when shoving against the bottom.

Where tracking was easy, the linesmen held the ropes in their hands. But to drag the loaded canoes up plunging chutes, they had to pull in, or pay out, the lines over their shoulders, leaning against them with all their strength. Steady tension was essential, even while splashing knee-deep across coves or clawing at rocks for extra purchase.

That first day on the Atikonak, drizzle soaked us. Below the belt we were dripping from footwork through the rapids. Then the river opened into a lake where a head wind flung spray over us.

By camping time our teeth were chattering. As we unloaded on a willow-bordered shore, the drizzle turned into steady rain. Masters at fashioning comfort out of desolation, John and Leslie promptly cut dry spruce and tamarack for the fire.

Leslie split a six-inch log four ways, unsheathed his knife, and from the dry centers cut shavings so thin they curled. Even on sodden ground a single match set them aflame. He piled on bigger and bigger sticks until the crackling blaze burned fiercely enough to ignite whole wet logs.

"I reckon he'll burn now, right enough," said Leslie.

John planted the "kittle stick" aslant the fire and hung water to boil for tea. Each of us stood in a cloud of steam as the fire's heat vaporized the moisture in our clothes. Raindrops made the coals spit. Andy and Ralph, thawed out, started supper.

"Not such a bad place, after all," said John. Like a woods creature he had burrowed under a sheltering spruce where the fire would toast him.

Home, Home in the Bush!

"You're right in your element, aren't you, old-timer?" Ralph asked.

"There's nothing I likes better than bein' in the bush," John answered, then started to sing to prove it.

"What's the name of that song?"

"He ain't got a name. 'The Trapper's Song,' I guess. A couple of the b'yes made it up."

In his spirited falsetto John began again his lilting tune about life along "Grand River," as Labradormen call the Hamilton.

> A jolly crowd of trappers,
> We are leaving one and all.
> The first hard work is started
> On the portage of Muskrat Fall,
> Getting in the canoe, b'yes,
> And all seems so fine,
> Going up Grand River
> With pole and tracking line.

Six days out, we reached the upper end of Gabbro Lake and couldn't find the inlet. Islands and capes were utterly confusing. The wind howled, and we tossed like corks in the heavy swells.

Andy took a compass reading and corrected for magnetic declination. With the help of our Canadian topographic map he chose a course to the south.

We floundered southward, quartering steep waves, and took a pass between two islands. No opening appeared through the shore ahead. Had the compass lied? Was the map wrong? We guessed so and turned southeast to run downwind with the sea.

After miles of futile searching for an inflowing river, we ran out of water at the head of a bay. No channel there! Next day we found the inlet—a broad stream, at that—not two miles from where we had read the compass! Moral? If you won't believe your maps and compass, stay home.

In Ossokmanuan Lake we got lost twice more, pushing to the heads of dead-end leads.

"Well, fellas, we're bight-bitten again," said John resignedly. The guides always said "bight" for "bay."

Beyond "Ossok's" island-girt midsection we knew by the map we were drawing close to Unknown Falls, though the exact route was uncertain. But when we detected the first slow eddies of Unknown River slipping blackly out of Ossokmanuan, each of us felt his pulse step up a few beats.

Few Eyes Have Seen Unknown Falls

Unknown Falls were not completely unknown, but even on latest maps Unknown River's course is only a dotted line.

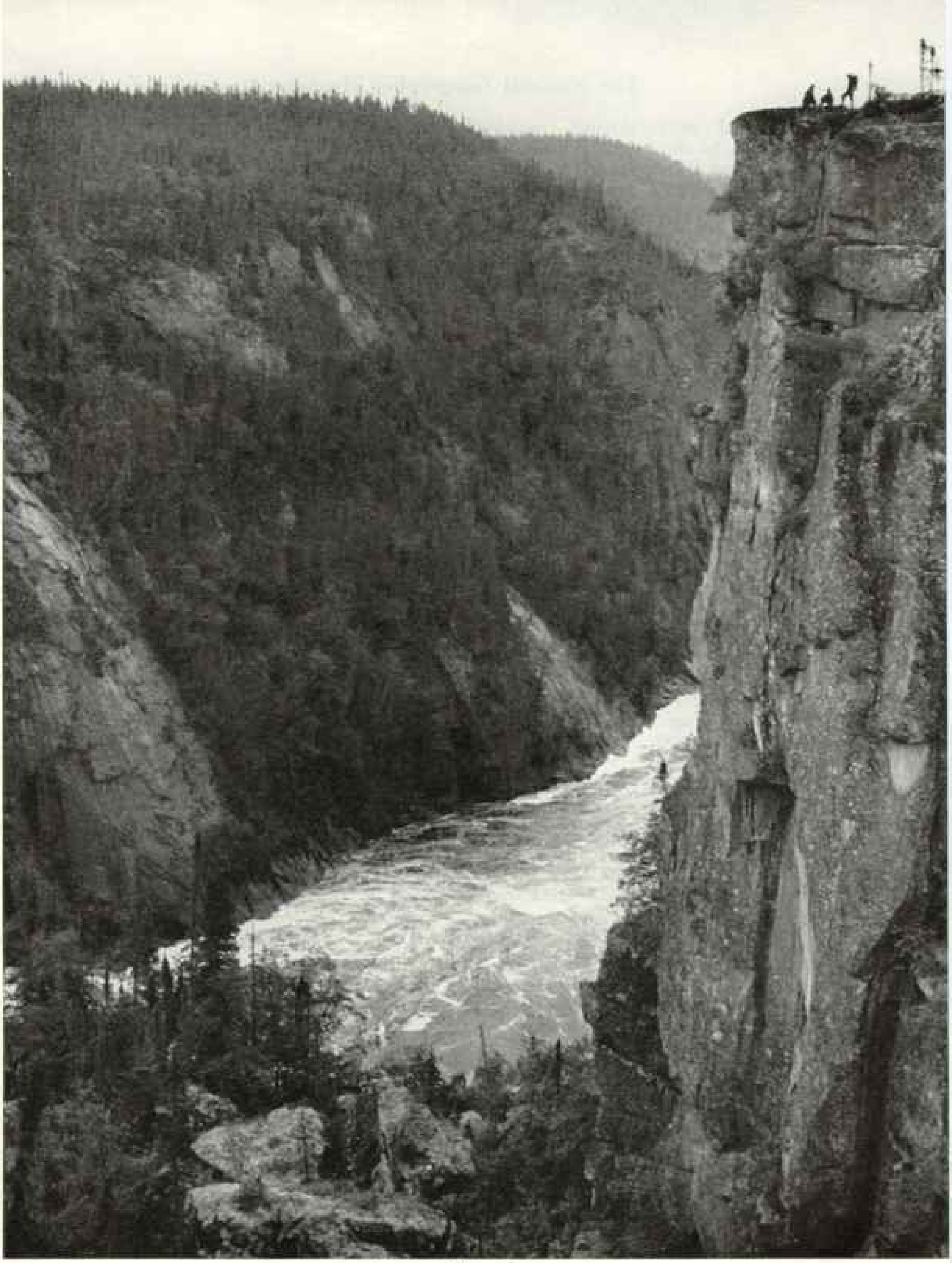
Prior to 1929, only three parties had fought their way to Unknown Falls. Each group saw one pair of falls and departed, unaware that another existed.

A British expedition, led by the late H. G. Watkins, visited Unknown Falls in the winter of 1929 and located both Upper and Lower Unknown Falls. Mountains of ice from frozen spray flanked the falls.

The next year Elliott Merrick, traveling with a Labrador trapper, snowshoed to all four falls. Between Merrick's visit and the arrival of our National Geographic Society party in 1950, none but Labradoreans, as far as the record shows, reached Unknown Falls. Even from the air these cataracts, as well as Grand Falls, have rarely been photographed.

Drifting down Unknown River, we were alert for surprises. Below a heavy rapid the stream swept the flanks of a high hill we had sighted from Ossokmanuan Lake.

We moored our canoes and climbed up a



71

Hikers Perched on Bowdoin Canyon's Brink Appear Lost in Labrador's Immensity

Boulder-strewn terrain was so punishing that expedition members gladly canoed 100 miles to save walking 10. They had to hike to reach Grand Falls (page 94). Here the Hamilton, having passed over the cataract, roars through its 400-foot-deep gorge. For the next 15 miles the river is too hazardous for canoes.

nearly vertical slope through incredibly tangled woods to the barren summit. The country unrolled like a map.

Ghostly wraiths of vapor marking Unknown Falls lay 10 airline miles away, just beyond a fine-looking lake Watkins had identified as "Lake E." The falls were twice that far off by the river's roundabout course.

In the far distance the dense white "steam" of Grand Falls stood out like a snowbank against rolling green forest and purple hill.

Before leaving that prominent peak we scratched our names and the date in the lichen cover of a flat rock. Then we tumbled downhill to our canoes.

Two miles of paddling brought us to a pitch where reefs tore the dark water into white shreds. We made camp just below.

A 36-hour downpour held us captive. The second morning the river had inched up almost level with our tent site.

But it was water from the sky, not the river, that plagued us. Our new "waterproof" tent had a rubberized floor to keep out moisture from chance rivulets and rain-soaked moss. That it did, almost too well!

Walls and roof of the shelter proved vulnerable to the weeping Labrador skies. Rain penetrated the paraffined cloth to drip on blankets and sleeping bags. It trickled down the walls and collected in low spots on the impermeable floorcloth.

Too many mornings the guides awoke shivering in sopping blankets, their hips and shoulders awash in pools of water. Air mattresses, which the guides had refused, held Ralph and Andy above high-water mark.

Modern Packing Allowed Varied Diet

The wetter the weather, the bigger our fires—and the more Lucullan our repasts!

We did our buying for the trip on the premise that a wilderness menu can list something more than a tiresome succession of beans, pork, hardtack, and pemmican. We wanted good food, but had to keep total weight down because of the canoes' limited capacity.

So our grub stores featured solid foods of high nutritive value. We stocked up liberally on canned meats—boned chicken, bacon, ham, Spam, corned beef, and tuna. There was plenty of sugar and peanut butter—but not enough jam. We slathered jam on everything from cereal and biscuits to crackers and cake.

Dates and raisins, dried prunes and apricots were our fruits. We never could serve enough mashed potatoes (we just added the powdered tuber to hot milk or water) to satisfy the guides. Favorites also were hot bouillon from cubes, and vegetable stew (dehydrated), mixed either with ham or chicken.

For grain foods we took oatmeal, rice, corn meal, and flour mixes—pancake, biscuit, and cake. Cake mix, too, was in short supply before the trip was half done.

We did our baking in a tin-plated reflector oven. From the supply of plain flour John occasionally made "river cake," or "flummy-dummy," chewy bread baked over stove or fire in an ungreased skillet (pages 81, 99).

Butter and dried eggs came in cans; we had powdered whole milk and tinned evaporated milk. Tea and powdered coffee rounded out the list of staples.

Not far below Lake E, past two more rapids, we came into an expansion at whose foot plumes of vapor hung above tossing breakers. There was the thunder of falling water. We had reached Unknown Falls!

After lunch that brilliant Friday, July 21, we set out afoot to see the right-bank falls—first the right Upper Falls and then the right Lower Falls.

Upper Cataract Resembles Victoria Falls

The majestic Upper Unknown Falls suggested to us a lesser Victoria Falls; in half a dozen spouts the river tumbled 90 feet over an escarpment into a wild gorge running nearly at right angles to the face of the falls (page 78).

An island divided the cataract into two sections. The western (left-bank) fall was the greater.

While good weather still held, we hiked north along the right bank of the canyon, seeking the lower pair of falls. Topping a rise, we saw the river sweep from the gorge, divide around an island, and disappear. Two more wraiths of "smoke" hung in the clear air.

A half-hour later we stood in admiration of the right-bank Lower Falls (page 92). Funneled into a single channel, the river fell more than 100 feet, straight and sheer. Spray billowed up from the foot. Swirling mists dimmed the caldron from which the stream, a mass of foam, surged down a sheer-walled canyon.

The air was full of mist. A hindrance to photography, these air-borne water droplets caused a rainbow that arched against the glistening cliff (page 80).

That night we stumbled into camp long after sunset. Heaping plates of hot chicken and vegetables (from dehydrated stock) revived our strength.

Next morning we canoed across the river to the western shore and bushwhacked to the left-bank side of the Upper Falls, a race

Kodachrome by Andrew H. Brown

Grand Falls, Continent's Greatest Next to Niagara, Pours Out Its Beauty in a Wilderness

So unpeopled and inaccessible is Labrador that few men have seen this spectacle. Plunging 245 feet over the cataract, the Hamilton makes a swift left turn into Bowdoin Canyon. In 16 miles the river drops 1,038 feet.

Kodachrome by Andrew H. Brown

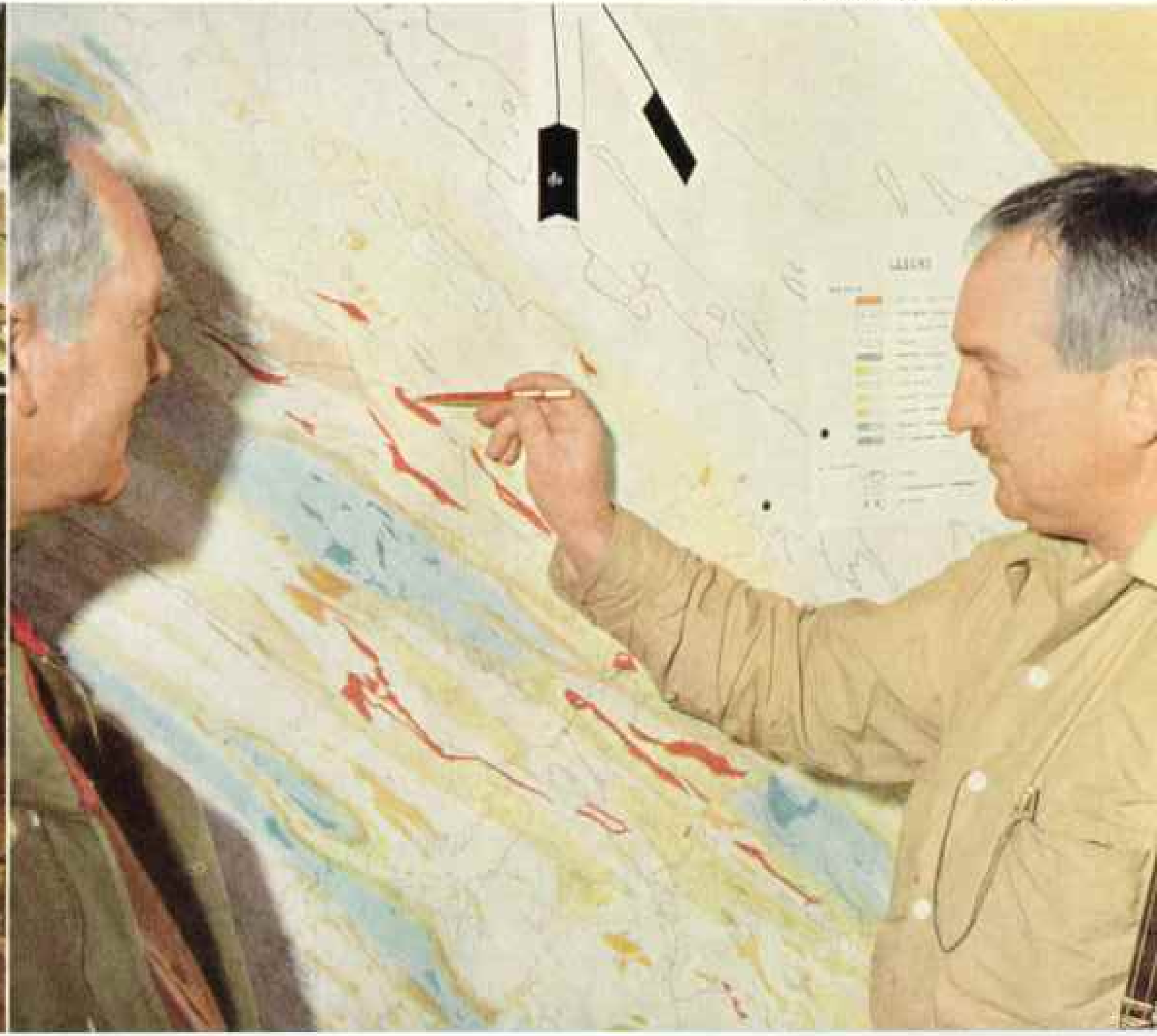
A Forest Fire Cleared the Site of Burnt Creek, Booming Headquarters of a Subarctic Iron Bonanza

This bleak region was long considered worthless, but it replenishes North America's reserves of high-grade iron as Minnesota's ranges show signs of depletion. Burnt Creek, Quebec, saw the National Geographic party transfer from plane to canoes.

Drillers Probe the Earth for Iron Ore Samples . . . A Field Map's Red Patches Indicate Major Deposits

The original strike, made by gold prospectors, has developed into a proved 90-mile-long field crossing the Quebec-Labrador boundary. Most deposits lie at the surface, within easy reach of power shovels. Only a part of the strike has been mapped. Drill crews are still busy determining limits and composition of the ore. Burnt Creek discovered its own deposit accidentally when drillers test-drove a new bit into the ground. Everything from food to machinery has to be flown in. No ore yet goes out.

Kodachromes by Andrew H. Brown



Kodachrome by Andrew H. Brown

Canoe Travelers Scout the Water Route Ahead. Evergreens Spread Across a Landscape Scraped by Ancient Glaciers

During most of their voyage the canoeists were 200 miles beyond help. On their second day out of Burnt Creek they scaled flinty Fault Hill to survey the terrain. They were rewarded with this fine view of Ashuanipi River flowing out of Dyke Lake.

Captive Goose Struggles for Freedom . . . The Aluminum Canoe Is Scratched but Not Punctured

Guides Leslie Michelin (center) and his cousin John Michelin (left and right) were skeptical about "tin-can-oes" until rocks and currents proved their worthiness. They ended the long water journey offering to buy a pair. One day a molting Canada goose waddled ashore as the canoes approached. Having shed flight feathers, it was unable to take wing. Captured, the bird was photographed and released.

Kodachromes by Andrew H. Brown

Kodachrome by Andrew H. Brown

With a Hoarse Shout, Unknown River Leaps a 90-foot Hurdle in Wild Descent from the Labrador Plateau

Right-bank Upper Unknown Falls is one of four foaming cataracts within a five-mile circuit. The larger left-bank Upper Falls lies beyond the island on the right. Downstream, the river divides again and tumbles over twin 100-foot cascades, the Lower Unknown Falls (page 80).

Campfires Fry the Expedition's Food, Dry Drenched Clothing, and Thaw Chilled Travelers

John Michelin, Leslie Michelin, and Ralph Gray (l. to r.) have just returned from Grand Falls. The Hamilton's tumultuous rapids, glimpsed through the trees, rush toward the cataract (page 75). Andrew Brown (right), soaked by spray, hangs his pants on a spruce limb. Canned meats, flour mixes, dried fruits and vegetables, powdered eggs, milk, and potatoes satisfied four ravenous appetites.

Kodachromes by Andrew H. Brown and Ralph Gray

Kodachrome by Ralph Gray

Rainbow Dips an Airy Arc into Lower Unknown Falls' Awesome Canyon

Trees cling to the brink of cliffs dropping 150 feet. Sunlight refracted by the spray breaks into its basic colors. Water swirls from the right-bank falls (just out of sight to the left).

"We'll Be Home Tomorrow!" Guides Get Shaved to Greet Wives

John (left) and Leslie Michelin are trappers; their eyes light up at the mention of prime furs. Lately they have earned extra money guiding mineral prospectors into their lonely territory. They steered the authors across 600 primitive miles.

John Michelin, in Month-old Beard, Kneads "Flummy-dummy"

No yeast or shortening goes into the trapper's chewy bread. The authors, tired of prepared mixes, found it tasty. Right: Michelin scorns ready-made cigarettes and lighters; he rolls his own and lights them with a firebrand. Biscuit mix bakes in a reflector oven.

83

Reduction by Ralph Gray

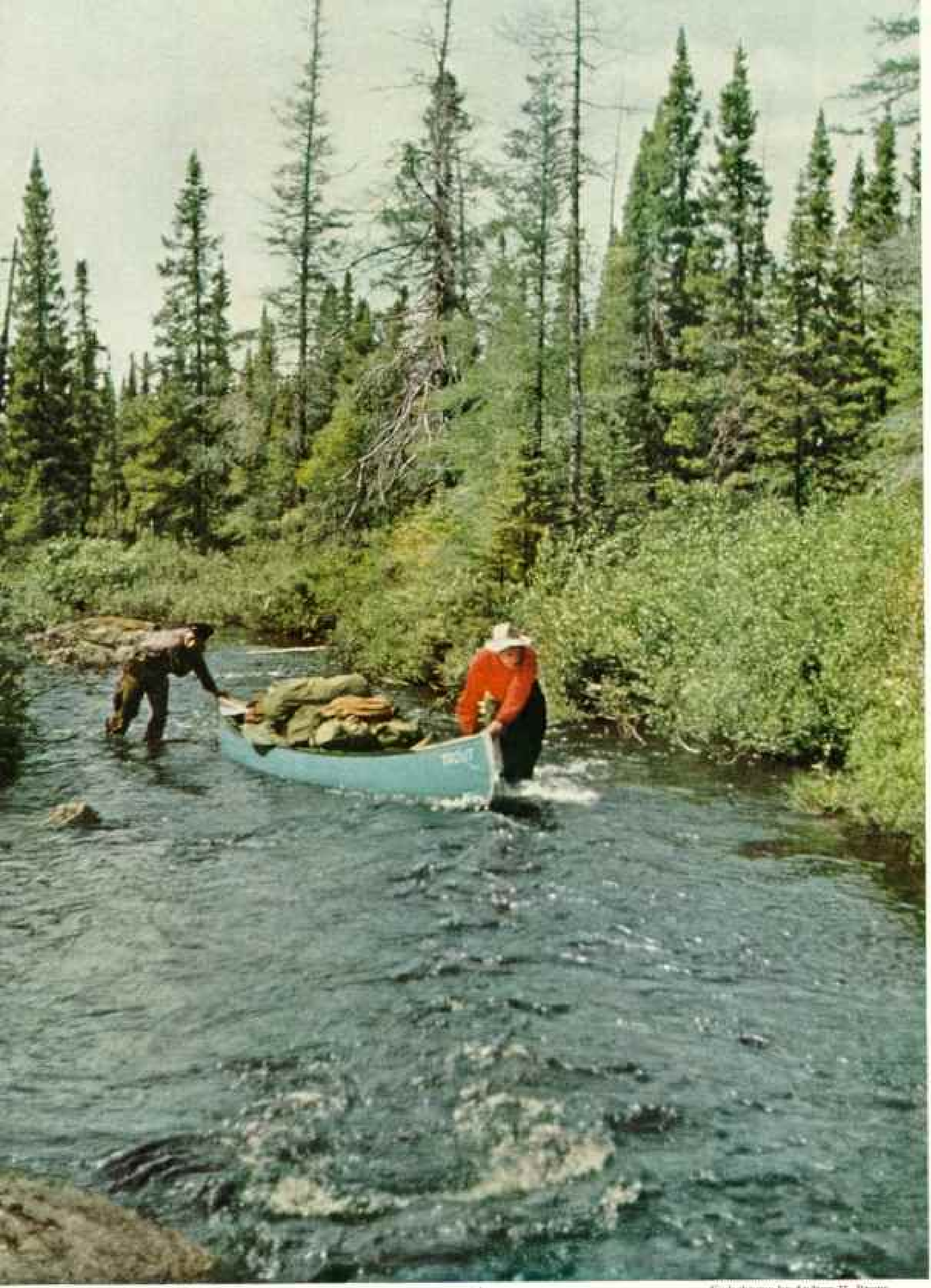
Appetites Call a Halt for Lunch. *Trout* and *Loon* Nose onto Sandgirt Lake's Pebbly Shore

Ashuanipi and Atikonak Rivers empty into this broad lake; the Hamilton flows out in four channels. *Trout* flies the National Geographic Society's flag. Canvas covers, screwed to gunwales, protect dunnage from rain and upsets. John Michelin shoulders campfire's "kittle stick."

Loon Leaps Down Whitecapped Mouni Rapids at Motorboat Speed. Fifty Miles a Day Was Easy Going

Devil's Hole lies not far behind. There *Loon*, caught in a whirlpool, swirled in a glassy pit, her bow rising three feet above the stern. Water splashed aboard. It seemed as if the canoe must sink when suddenly the eddy's menacing eye vanished.

Kodachrome by Ralph Gray



Kodachrome by Andrew H. Brown

Manhandling a Canoe Up a Creek's Stony Treadmill Is a Slow-motion Job

It was far easier to drag the canoe up shallows than to carry it through the spruce jungle. Here mosquitoes and tiny black flies scourged the men with fiery lances. A guide (hand on neck) slaps an invisible foe.

Kodachromes by Andrew H. Brown and Ralph Gray

Sun-toasted Canoe Bottoms Smooth the Wash Like a Hot Iron

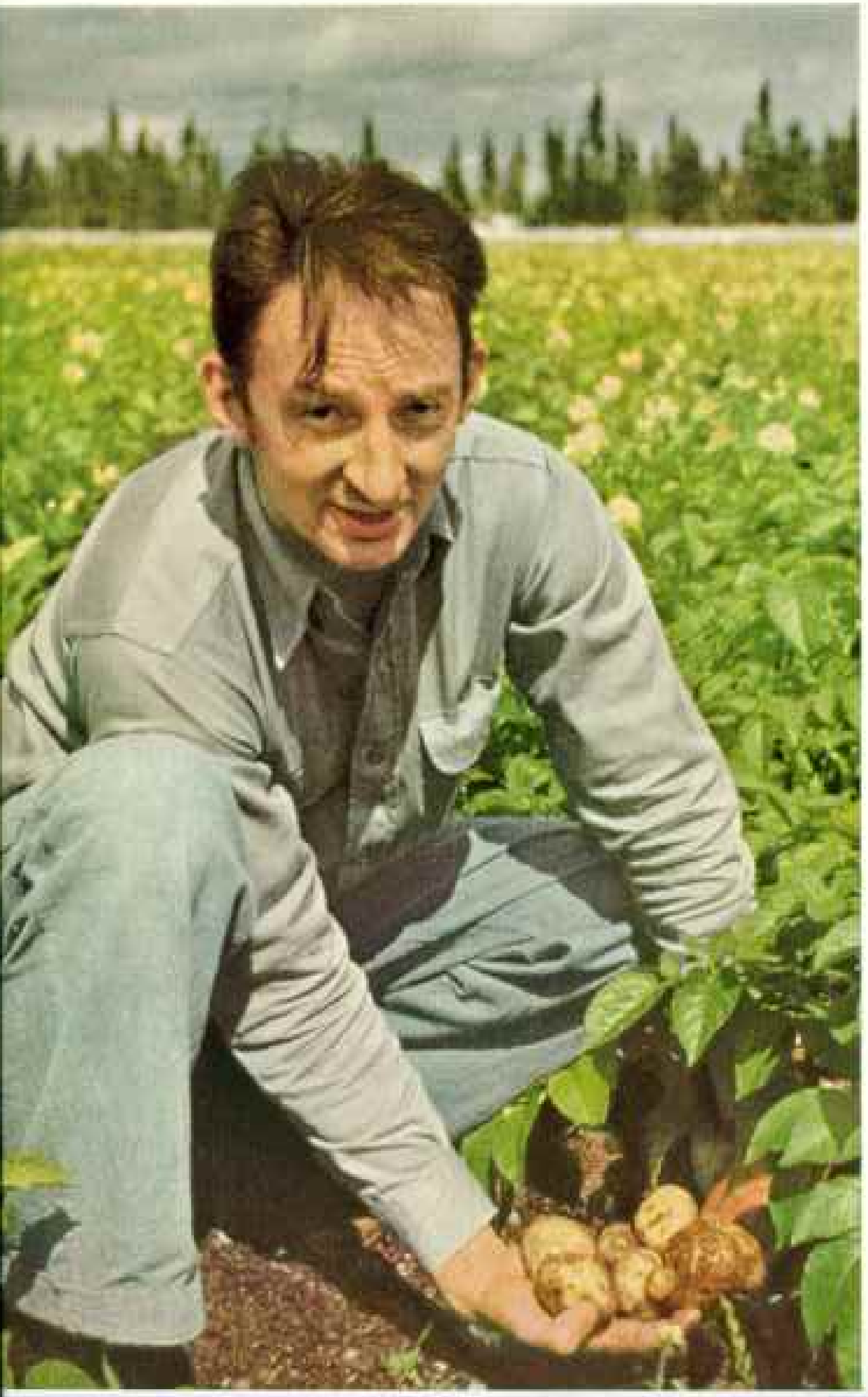
Sunday's long rest relaxed the strains of Big Hill portage. Every man washed his clothes and took a sponge bath. Only John Michelin (sitting) had nerve enough to plunge into the ice-cold Hamilton. Leslie Michelin fishes for trout; he landed several.

Portage Makes Outdoor Men Pay for the Wonders They Have Seen

Skirting Grand Falls, the voyagers made nine carries, one for 5 miles. These men, carrying 120 and 90 pounds, follow a footpath, a rarity in the wilds. The rest of their gear requires three round trips. Canoe-toting, with black flies biting, is the toughest chore.

Kodachrome by Andrew H. Brown

Winokapau Lake, Impassable When Gales Lash Its 35-mile Trough, Welcomes the Paddlers with a Glass-smooth Face



Potato Gardener and Indian Bask in North West River Sun

Fresh out of the wilderness, the authors were thrilled by the sight of subarctic gardens. Some 120 miles removed from the Labrador Current-chilled coast, North West River is able to grow lettuce, carrots, peas, beans, turnips, and cabbages, though summertime frosts are not unknown.

Grenfell mission maintains this flourishing potato field to help feed its doctors, nurses, and patients. Stephen Hamilton, a Massachusetts artist painting landscapes around North West River, cultivates the garden for exercise.

Chief Otwan was christened Antoine, but other Indians simplified his name. His people, the Montagnais, roam between the St. Lawrence and the Labrador ports, selling furs and buying supplies. When store-bought food runs out, they prey on caribou, and, if the herds disappear, they fall back on fish.

Kodachromes by Andrew H. Brown and Ralph Gray

Kodachrome by Andrew H. Brown

In North West River the Voyagers Said Good-bye to Labrador

This riverside town is the "metropolis" of an enormous territory. Trappers, traders, medical missionaries and their charges make up a population of about 300. Right: the Hudson's Bay Company trading post.

of frothing water. Eddying mists alternately obscured and revealed the snowy face of its two 90-foot chutes.

The sun still shone bright, so we hustled downriver, jumping brooks and striding across burned-over lands.

The map showed a tributary flowing into Unknown River from the west, above the left-bank Lower Falls. Anticipating that the stream might be too deep to wade, we had brought with us an ax and some rope to build a raft. We could not have portaged the canoe five miles across that rough country.

Sure enough, the tributary soon blocked our way. It was a moat between us and the fourth Unknown Falls (pages 92-3).

The stream gushed into Unknown River just above the brink of the chutes. If the raft we planned to build should be carried out into the main stream, we'd have slim chance of getting ashore before the racing tide hurled us over the fall.

Raft River Imposes a Barrier

Fortunately, the tributary—which we dubbed Raft River—flowed with slackened current through a pool just before dropping into Unknown River.

John and Leslie cut six or eight dead trees and bound the trimmed logs together.

"Looks O.K.," said Ralph, but when he and Leslie stepped aboard, the raft sank to the bottom! The men quickly cut and tied in another layer of logs.

We poled to the head of the pool. Away from shore, even 12-foot poles failed to touch bottom. Leslie, viewing our flimsy vessel askance, volunteered to stay behind. Ralph and Andy were determined to cross. John thought the voyage worth a try.

Leslie cut two paddles. They were heavy, awkward, and narrow, but better than poles that wouldn't reach bottom.

Pushing off into the welter of the inflowing rapid, we caught the current. At first, the heavy raft scarcely responded to our paddle thrusts.

"Let's go back and start higher up," John shouted, glancing at the approaching white crest of the outlet rapid.

"We're all right now," Andy said, as the raft lurched heavily toward shore. We landed halfway down the pool.

It was a short walk to the left-bank Lower Falls. Here again an islet split the flood into two thunderous sluiceways. This chute was more broken up than the others. The creamy spate of waters surged with terrifying force through the corkscrew canyon that received it.

We returned to our jerry-built raft, stepped aboard, and shoved off. Suddenly one of John's legs dropped through the logs right up to his thigh.

"Paddle back!" he called out. "I'm stuck. We'll go over the rapid!"

With a frantic tug, John retrieved his leg, but a moment later Andy's foot slipped through. The raft was loosening up. Grunting with the effort, we leaned to paddles and poles—and presently the eddy caught us. We swung safely in to shore.

Leslie helped us to relax with a cup of hot tea.

Well, we thought, our persistence paid off, despite the chance taken. We were the first, we were quite sure, ever to reach and photograph both pairs of Unknown Falls in summer.

Below its two foaming steps down from the plateau, Unknown River is unnavigable to its junction with Hamilton River below Grand Falls and Bowdoin Canyon (page 71).

So we had to retrace our route to Sandgirt Lake.

Stalking a Stag Caribou

We set backs and shoulders against Unknown River rapids to reach Ossokmanuan Lake again. Threading islands just below the lake, we heard a loud whisper from Andy: "Look there, on the beach! A caribou!"

A magnificent stag with a spreading rack of antlers was browsing on willows at the water's edge. John ordered us to paddle quietly. We might slip close enough for a picture.

We were 100 yards from the caribou when he came stiffly to the alert, nose lifted to sniff the air. He cantered up the beach, toward John and Andy. But out of camera range the animal took alarm, shook his antlers, and plunged into the woods.

The second rapid below Gabbro Lake, scene of tough tracking on the upstream leg, gave us a thrilling run on the way back to Sandgirt.

As the tide bore us toward the white water, John rose from his seat to choose the way. The middle was impossible; a group of boulders tore the river apart. Two chutes eliminated the right-bank side.

The river had less speed sweeping the left bank in a wide curve, but the tide curled back in foam from innumerable rocks.

Andy noted John's expression, severe, intent. Running the rapid was like threading a stack of needles against time. Once committed to the current, there was no turning away.

Wave crests around visible boulders, or

below submerged ones, stayed in place. We twisted through, facing each hazard as we met it. Responding to John's steering, *Loon* slipped past one rock on the left, barely grazed two more on the right.

A hard bump over a shoal at the bottom, and the rapid was behind us! *Trout* followed close on our heels. "A good run!" observed Andy. John's face, now relaxed, was wreathed in smiles.

Sandgirt Lake Weds Hamilton's Two Branches

From Sandgirt Lake, meeting place of Hamilton River's Ashuanipi and Atikonak branches (page 82), it is a 50-mile coast down to Grand Falls. *Loon* and *Trout* danced through a rapid at the outlet; below, the river flowed quietly through flat country.

On Forget-me-not Lake a loon alighted close by, wings outspread, skimming in on its breast like a seaplane making a perfect landing. Not half an hour later, a real seaplane flew directly over us, but gave no sign of seeing our canoes.

Gliding along that calm evening, we watched whitefish by the thousand bulging up all over the glassy water to feed on mayflies that dotted the surface like fleets of miniature feluccas.

Throughout the day we flushed ducks in pairs or small flocks. Loons voiced their maniacal giggle. This country is the nesting range of many species of ducks.

Birds were abundant on the upper Hamilton. On the lakes of the Ashuanipi terns nest by hundreds. Sometimes 20 or 30 of them—mewing like a fenceful of cats—went through their graceful aerial paces overhead. Gulls, too, were common.

Single geese and a few small flocks of the handsome birds flew over us. One discovered that on ground John could outrun it! (Page 77.) In dark woods we flushed flocks of spruce grouse. Often these "fool hens" sat motionless on limbs as we brushed past.

Trappers, Born and Bred

By trade our guides were trappers. Our route from Sandgirt Lake down the Hamilton bisected the hunting grounds of these men and their friends, who come inland from Lake Melville on the coast.

In the last 15 years more and more of the trappers' income has been earned as guides and canoemen for mineral-prospecting outfits and for work at the war-built Goose Airport.

But talk of fur still lights special fires in their eyes. Fur has meant bread and butter, tobacco, clothes for the baby, and a new dress for the wife. But its capture also has spelled adventure.

In this part of Labrador, men trap fox, mink, otter, muskrat, weasel, beaver, lynx, and bear. Marten (high-quality Labrador pelts often were sold as "sable") used to bring big money. Catching them is now prohibited by law.

"A marten is so dumb," Leslie said. "If 'e come to one trap and find another animal has beat 'un to it, 'e'll go 'long the trapline till 'e find 'nother trap free!"

John and Leslie were constantly alert for signs of fur. A faint track, a nibbled twig, floating leaves, a worn place in the moss—nothing escaped them.

For 20 miles below Sandgirt Lake we skirted John's trapping grounds. On Flour Lake we piled ashore to visit his "home tilt," or trapline headquarters. "Tilt" is the Labradorman's term for a log cabin. Most tilts are only forehead-high, as if built for midgets.

John's cabin had a rough-hewn floor and a glass window over the low door. Against the back wall was a bunk of spruce poles. Four sticks rising from the floor supported the sheet-iron stove.

Big and little traps hung on the walls. Skin-stretching boards were stacked under the bunk. Colorful pages torn from magazines partially papered the walls.

Peeled Log Walls Are Bulletin Boards

As in all tilts, the peeled logs were closely scribbled with "calling card" messages of visiting trappers: "Dec. 16, 1945. Came here from Eagle Cliff. Blowin and snowin all day. Henry Best." Or: "Nov. 28, 1948. Thin ice comin from Cross Island. Good sign of mink. Lonesome for the old woman yet? Harvey Goudie."

More than 40 tilts like John's are scattered along Hamilton River between Birch Lake and the mouth. Most of these are base tilts. Dozens of smaller overnight cabins lie hidden away among the hills and along lonely lake and brook shores.

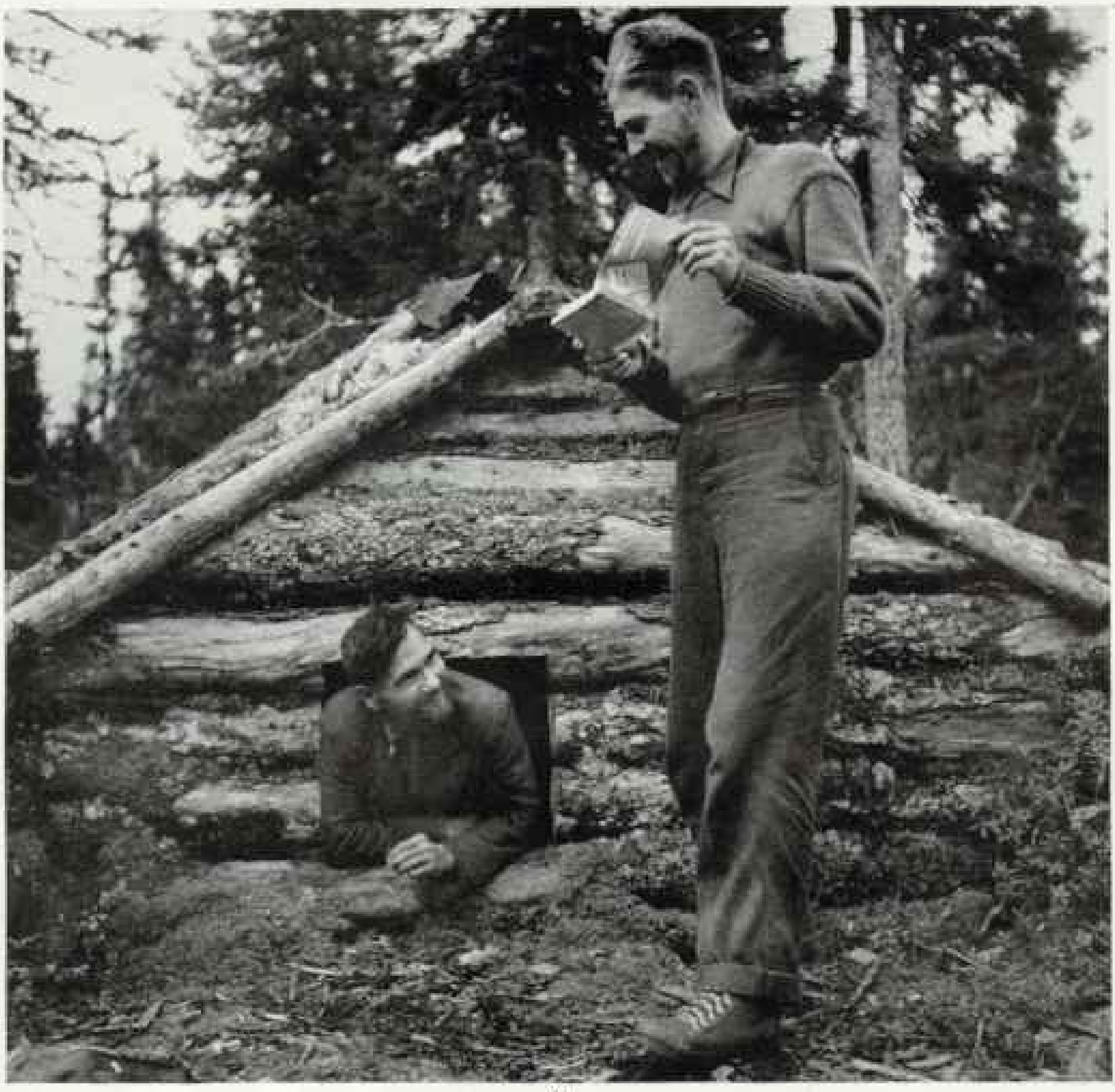
Whenever we asked, "How far to a good camping place?" or "How many miles to the next lake?" Leslie and John answered in terms of tilts or "spells."

"Oh, it's quite a piece yet—maybe two tilts," or, "Not far. 'Bout half a spell, I s'pose."

Tilts are about a day's snowshoeing (10-20 miles) apart, and a day's travel is five or six spells, in the sense of distance between resting spots.

Spell also means a short smoke or tea stop.

Trapping territories are inviolate, John ex-



91

Trapline's Log Cabin Seems Built for Midgets. Men Must Bend Double to Enter

Trapper Earl Baikie (not shown) pitched his Hamiltonside base low to conserve labor and heat. His smaller "tilts," with barely enough room to sleep, stretch inland a day's march apart (opposite page). Here one evening Baikie read George Bernard Shaw's *Arms and the Man*. Visitor Ralph Gray examines the copy.

plained. No man will trespass on another's area. The Indians know the white trappers' limits. With few exceptions they set their traps elsewhere, mostly among the more remote lakes and streams.

Traplines pass from father to son, or to another relative. There are no deeds to any of these lands; they are trapped by right of prior possession, a kind of squatter's rights.

Trappers Trek Inland in Early Fall

Early in the autumn the men set out by canoe for the trapping grounds. Each man hauls inland two or three barrels of flour in 100-pound sacks. They also take plenty of pork, bacon, lard, bully beef, rice, sugar, and —most important of all—pounds and pounds of tea to restore trail-fagged spirits.

Trapping begins in November, when animal pelts are thick and dark. The Labradorman sticks to his furring until late December or early January.

"Bound fer down," the trapper piles his furs on a long, slim sled, throws on sleeping bag, ax, and grub bag, and heads for home. He rarely uses dogs; his sled is designed for a man to pull.

Some men make a spring hunt, from after New Year's until late March or early April.

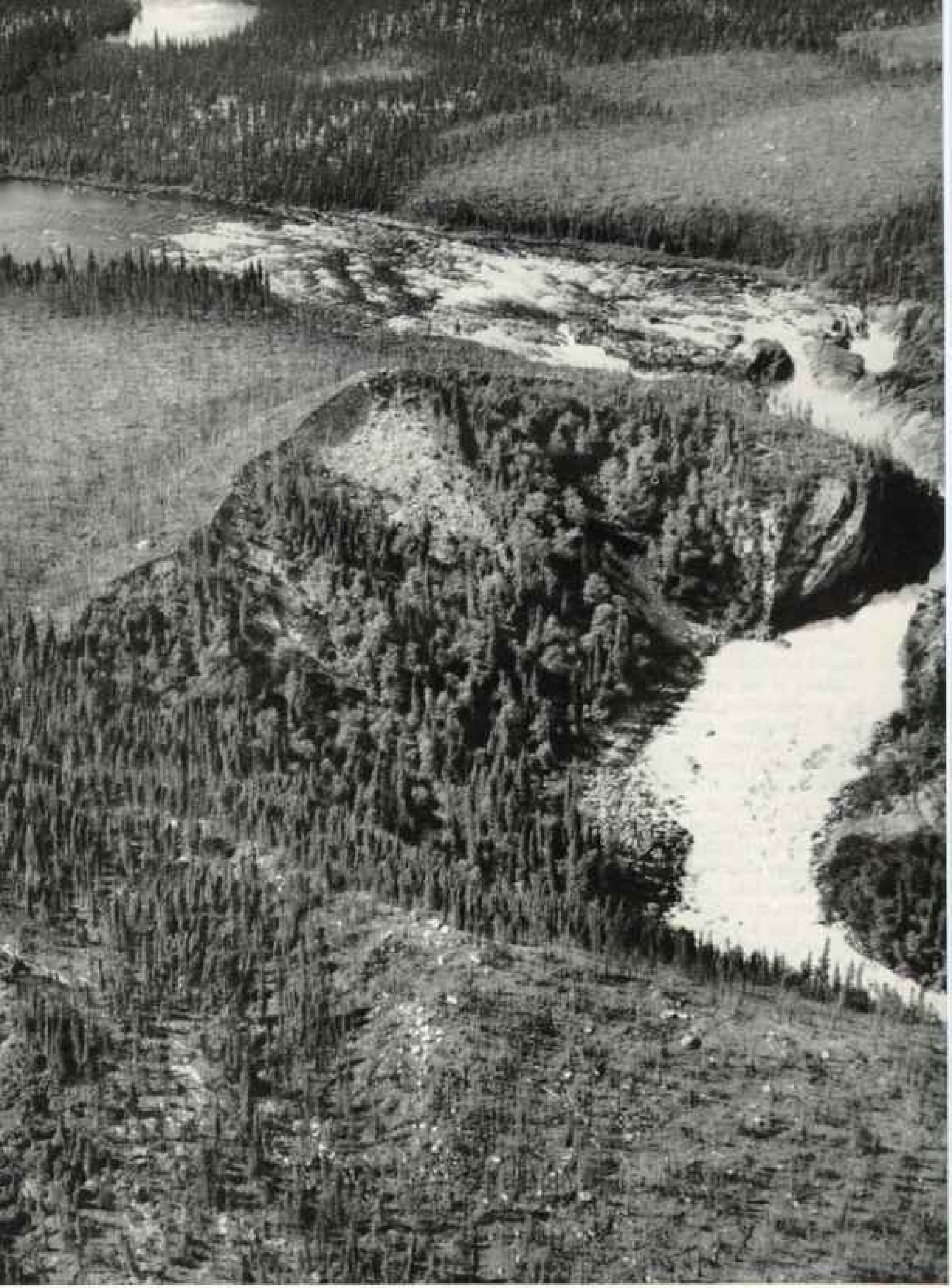
The forest animals are hard to see, especially in summer. As we skirted quiet shores, ripples frequently betrayed swimming muskrats. We glimpsed only one mink and one slinking weasel.

A memory we cherish is of a playful pair of otters, swept along in smooth, fast current

92

Unknown River, Gouging the Landscape, Leaps Lower Unknown Falls in Twin Cataracts

The first three expeditions to the Unknown found only one pair of falls. Not until 1929 did a single party locate both Lower Falls and Upper Falls, three miles apart (pages 70, 78).



91 Ewing Galloway

An Air View Delineates Rapids, Islands, and Trees with Needle-sharp Clarity

To see this spectacle, the National Geographic party had to raft across the tributary in the central background (page 89). Just below the falls the Unknown's waters reunite; they flow into the Hamilton.

above an Unknown River rapid. The sleek couple gamboled with the abandon of kittens, nipping at each other's flanks and whiskers.

The otters seemed oblivious of the rapid raging just below. Superb swimmers, they live largely on arrow-swift trout and other fresh-caught fish. Some brook trout we caught had raw, healed, or partly healed scars that our guides identified as otter wounds. Otter runs, or rubs, and otter slides were common above Grand Falls.

The Gateway to Grand Falls

Hamilton River's strong tide bore us swiftly toward Grand Falls.

When the going was easy, Ralph often broke the silence with lively song. That day, drifting lazily toward Jacopie Lake, Andy joined Ralph in a lusty chorus.

The duet was abruptly cut short when the current hurled the two canoes into Louis Rapid. Then we were in Jacopie Lake, at the brink of the Hamilton's 16-mile tumble to reach its ancient valley. From Grand Falls we would return to Jacopie, start of the portage route that by-passes the impassable stretch of river.

Many of the principal lakes and landmarks on the Hamilton River were named by A. P. Low, Canadian geologist. His reports on amazing journeys that crisscrossed the Labrador-Quebec peninsula in the '90's of the last century still are standard references.

We left most of our outfit on an island at the outlet of Jacopie Lake, then ran downstream to Earl Baikie's tilt (page 91). Below, rapids were unnavigable.

Carrying tent, sleeping bags, and food for three days, we struck out afoot down the right bank. The five-mile walk to the falls proved a cruel obstacle course laid out with marshes, brooks, and spruce thickets.

A mile above the falls begin the stunning rapids that urge the river toward its mighty plunge (page 96). On a bluff above that tumult we set up camp (page 79).

"Let's call it Pride Camp," Andy suggested.

"Why?"

"Pride cometh before a fall, you know!"

Ralph solemnly shook his head, muttering, "Poor Andy, bushed at last!" But all of us were very proud and pleased to be there.

In the flawlessly clear morning we walked through mist-drenched forest to the green meadow opposite the falls. This vantage gave a full-front view of a breath-taking natural spectacle (page 73).

In a single, massive spout, resembling white-hot metal spilled from a crucible, the river poured into a cliff-hemmed caldron as if impatient to fill it. Swinging 90 degrees left, the turbulent stream then churned into Bowdoin Canyon (page 71).

John had seen Grand Falls a half-dozen times; Leslie once before. Yet these men, who live out their lives amid natural majesty, sat speechless and stared. They were as enthralled as were we first-timers, standing face to face with that incomparable sight.

In rapids just above the falls the Hamilton drops 219 feet. The falls are 245 feet high; in lashing descent through Bowdoin Canyon the river plunges another 574 feet. In 16 miles the stream hurtles downgrade 1,038 feet—one of the most tumultuous descents of any major river on earth. And the Hamilton here is a broad-backed, full-volumed river.

We spent two days at Grand Falls, absorbing grandeur and clicking our camera shutters. Mist fell constantly from the towering vapor column. Handkerchiefs held over our camera lenses protected them until the instant for pressing the trigger.

Rainbows, often double, arched through the sun-struck "steam." The flat rays of the setting sun suffused the tall cloud with saffron, then pink, then lavender, long after the forest had turned to ebony and the river to dullest pewter.

Glory of Falls Still Unsullied

Reluctantly we turned upriver. We were grateful, though, to have seen the cataract in its pristine state. Men thus far have not had reason to harness the silver glory of Grand Falls, to cut the spear-straight trees that crowd about it, or build viewing towers, access stairs, or fenced overlooks.

The region is isolated, but not inaccessible. Pontoon aircraft and flying boats land on any of the larger waters. With completion of the railroad from the Gulf of St. Lawrence to the new iron area, the Grand Falls district will be much easier to visit.

Back at the camp beside Earl Baikie's tilt, John and Andy went fishing in a big eddy. They caught 20 brook trout and landlocked salmon, ranging from two to three and a half pounds, a welcome fresh-food addition to the store-bought diet.

Skilled axmen from earliest teens, John and Leslie felled firewood trees in whatever direction they chose.

At this camp John found a dry spruce just behind the tent site. He chopped at the tall bole with his usual verve, notching it to fall away from the tent. Andy glanced up from supper preparations and noticed that the tree had a natural list toward the tent.

"Hey, John!" he called. "Won't that fall the wrong way?"

John scoffed and lifted his ax to finish the job. But before he struck another blow, there was a sharp crack and the tree toppled in a direction opposite from that John intended, missing the tent by inches.

John looked sheepish, but not for long. These men never make enough mistakes to unseat the assurance upon which their lives depend.

The next few days we paid in portaging for all the wonders we had seen. The Big Hill portage route around Grand Falls is 17 miles of lakes, ponds, and brooks, and 10 miles of backbreaking carries (page 85).

Between navigable waters each man played pack animal, making three or four round trips laden with gear.

"How long is this carry?" Ralph asked Leslie as we wearily stepped out on yet another swampy shore.

"About half an hour," Leslie answered.

There were three "5-minute" (long count!) portages, a couple of "15-minute" ones, and three "half-hour" carries. The guides' identification of time with distance smacked of Einstein.

The last portage, however, the actual "Big Hill," was too long to measure in minutes or hour fractions. It was just "five miles" long —and no fooling! The last half-mile dropped 700 feet to the Hamilton shore, in some places at a 60-degree slope.

That Big Hill was a bad place to find footholds with 100 pounds on your neck. Fires had burned off all vegetation, even moss. The fire-bleached cobbles and boulders rolled at a touch; sand and gravel needed only a nudge to start sliding for the river.

Mosquitoes and Black Flies—by the Bushel

July's wet weather yielded to hot sun in August. Clear skies were welcome, but not the accompanying plague of black flies. Mosquitoes had been wicked during the damp weeks, and black flies were depraved in the dry. No tiniest crack or tight place in our clothing escaped their grisly attentions.

These little bugs had white legs, and Andy called them "tiny black monsters with white spats." Headnets came out on portages; hands immobilized with bags, paddles, and rod cases, or pulling on tumpline straps to relieve weight on head and neck, couldn't mash blood-sucking flies.

When breezes blew, the middle of a lake was fairly fly-free. The "land-based fighters" pretty well let us alone out there. Ashore, the relentless attacks elicited from Ralph the plaintive query, "What in thunder did they live on before we came along?"

Repellent smeared on fly-chewed foreheads and napes of necks made them sting as if we wore crowns and necklaces of thorns.

Sunday followed our last day on the portage. We rested, bathed, laundered, read, and fished. More fat brook trout sizzled in the pan.

That evening we stepped away from the fire's glare to watch dazzling northern lights. Veils of green merged into white and yellow bands that danced sinuously around the black heavens.

Lower River Gives a Fast Ride

It is more than 200 miles by the river from the Big Hill to the mouth. Swept along by the stream like twigs in a flooded gutter, we went the distance in four and a half days. One day we made 70 miles.

Our first hours on the lower Hamilton made clear why the natives call it "Grand River." A stream of extraordinary beauty, it flows now fierce, now tranquil, hemmed in by bold hills often soaring 1,000 feet or more (pages 66 and 97).

Saguenay-like cliffs alternated with wooded slopes. Streams striped the mountainsides with white, noisy cascades. Delicate birches with twinkling leaves were a welcome foil to somber evergreens.

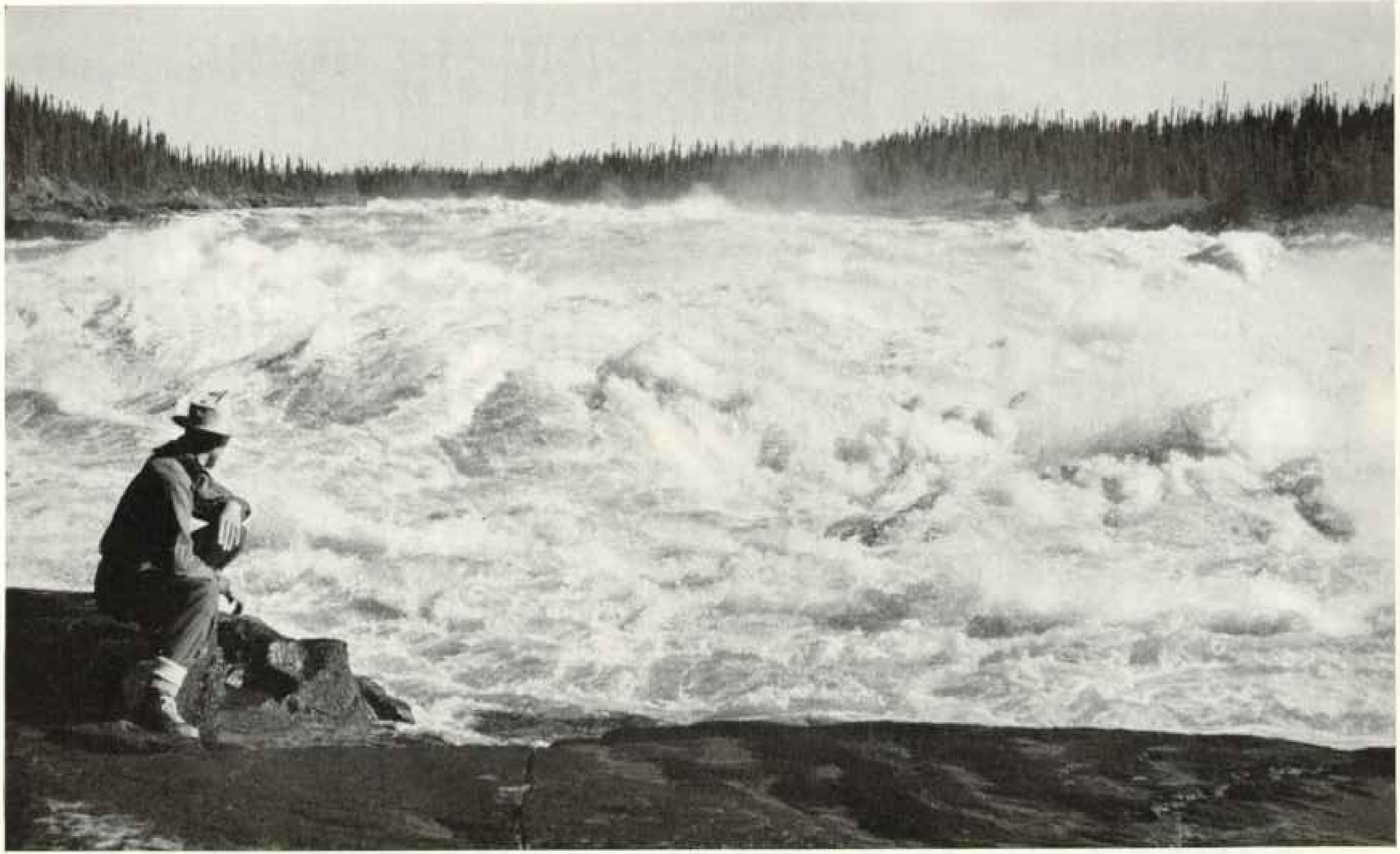
A delight of the Hamilton voyage was the pure, clear river water. We drank it anywhere. Held up in a jar to the light, it seemed almost colorless. But slipping over pebbles or sand bars, the water resembled clear glass faintly stained with brown. In backwaters it glistened opaque and dark as the pupil of an eye.

Forty-five miles below the Big Hill the Hamilton entered Winokapau Lake, a beautiful body of water 35 miles long (page 86). It is prodigiously deep; two soundings by earlier parties gave 407 and 427 feet.

As we turned each rocky bend in the lake, we were entranced by a new vista of calm blue water mirroring steeply plunging hills.

Immediately below Winokapau the Mouni Rapids picked us up and flung us 12 miles down the valley at the fastest clip in more than 600 miles of travel. With high water, rocks were no hazard; we had only to keep a sharp eye for heavy swells and boils that surged up, black and smooth as obsidian, to snatch the canoes from course (page 83).

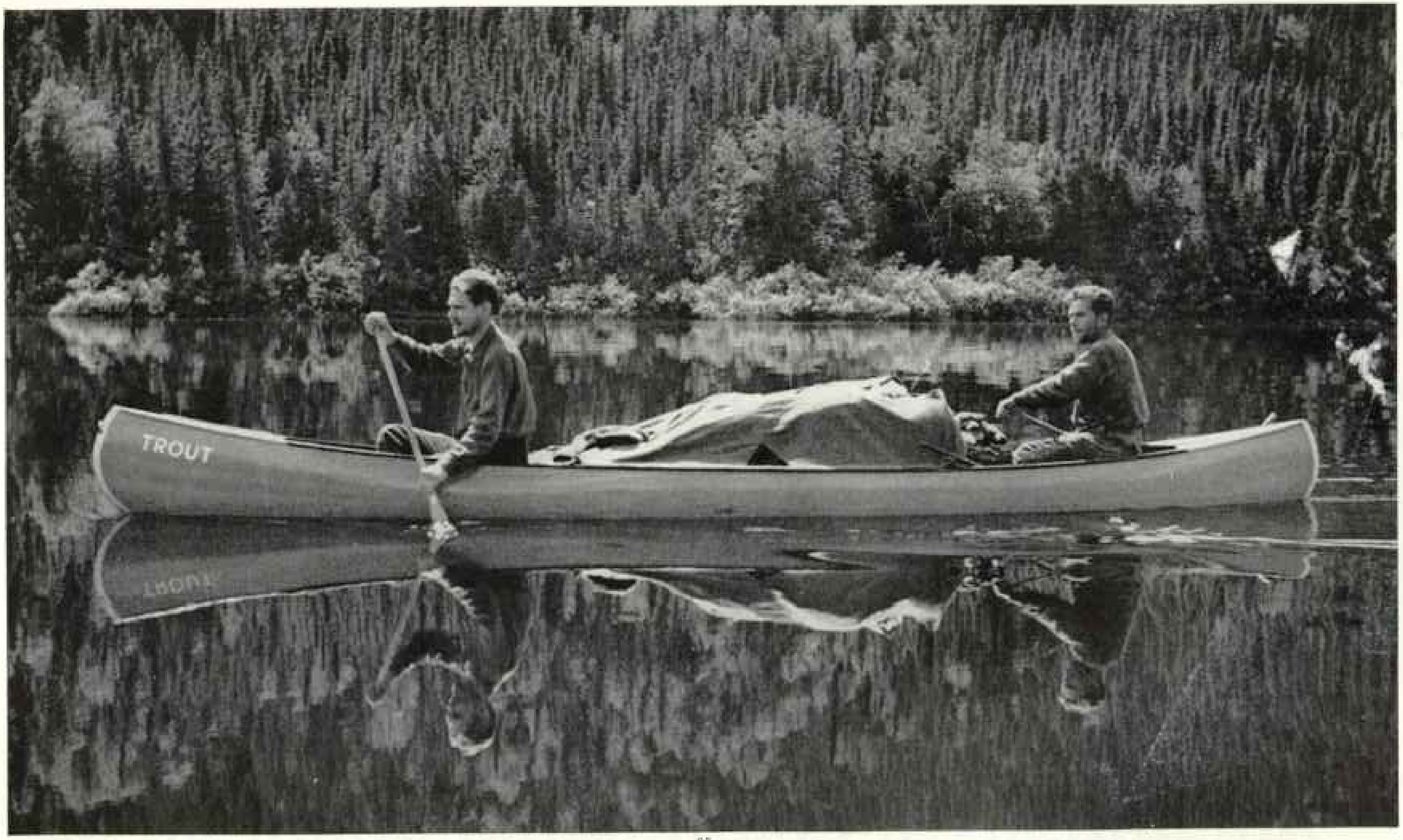
We whizzed past sandy banks and rocky bluffs at what seemed express-train speed. A blue mountain would loom in the distance and slip to the stern in half an hour.



96

A Violent White Flood, the Hamilton Lunges Toward Grand Falls with Relentless Power

Mr. Gray, hypnotized by the onrush, felt he was moving backward while the stream stood still (page 94). About 600 feet to the right the falls make their drop.



97

Far Past Grand Falls, the Hamilton Flows Mirror Smooth. *Trout* Paints a Perfect Image

Here the sun, in hiding almost a month, gave the photographer the chance he had been waiting for. His picture pinpointed every shaggy tree. Waterfalls and portages forgotten, the paddlers took life easy. Crystal-clear water was pure and delicious.

The Devil's Hole is a famous danger spot in the Mounis, where whirlpools form and vanish between down-tide and up-eddy. John thought the half-flood might make it tough.

Ralph and Leslie had been left a mile or two behind when Andy and John slammed into the Devil's Hole. John looked over the confused white chop at the heart of the pool and headed the canoe into the countercurrent.

But the eddy at that water stage was mightier than John thought. As if dragged by some underwater demon, *Loon* was swept into the core of the maelstrom. As bad luck would have it, the spiraling eyes of two small whirlpools merged at that instant into a single jumbo swirl. The little craft fell right into it.

Whirlpool Nearly Sucks In a Victim

First the bow was down, with water overlapping the gunwales. The canoe twirled twice. Then the bow lifted free and the stern slid into the glassy pit.

Andy turned to John for orders. The guide was three feet downhill. It seemed as if *Loon* must swamp. John had laid his paddle across the gunwales and gripped both sides of the craft to balance it. The canoe spun.

"Paddle! Paddle!" John shouted.

By good fortune, the whirling eye filled as suddenly as it had formed. Grateful to be dry and upright, the two men drove their craft out of trouble.

John pulled in for a smoke. Andy unbuttoned his collar.

"For a minute I thought we was goin' under," John said and let out a deep breath.

As we raced down the last of the Mounis, Leslie's quick eyes caught the shine of tents through trees. It was an Indian camp.

With smiles and a spate of Indian words, Semu, head of the family, welcomed us. John, who speaks their language, interpreted.

Semu and his wife and three children reached the Hamilton from the south with no fat, no sugar, and only a handful of flour. Semu told us they had been in the bush continuously for a full year. His wife reclined at ease by the fire, puffing a pipe.

At a word from Semu, his oldest boy vanished, to reappear with a large sack. From it he extracted what looked like shabby rags, stiff and black with dirt. It was dried, smoked caribou meat, tough to chew, but very tasty. Each of us tore off a chunk, John and Leslie the more liberal portions.

We left what food we could spare with Semu and set sail again.

Next day we drifted through the Slack Waters. The virgin greenwoods were wonderful to see.

The Hamilton, rising on a high plateau and emptying into the ice-chilled Labrador Current, ties together regions of startling vegetative contrast. Those who link the name Labrador with the scoured rocks of its arctic coast would be astonished to glimpse the luxuriance of growth 200 miles inland up the Hamilton. There splendid spruces and firs, often two feet in diameter, rise in company with groves of birches and cool colonnades of gray-barked poplars.

Below the Slack Waters the hills drew in. The loud shout of the Minipi Rapid, one of the roughest on the river, swelled and ebbed on the air.

Here, where trappers have drowned, special caution ruled. The Hamilton narrows to 100 yards and roars around a turn down an obvious grade. The safer course lay along the inside of the bend—but you can't see your way around a convex curve!

In awe of the rush in midstream, we hugged the shore and leapfrogged through. John and Andy slipped over a bubbly chute and swung into the safety of an eddy.

Down a Foaming Staircase

Then Leslie and Ralph came on down, grinned at us in passing, and vanished around the corner in a welter of white water. They in turn seized overhanging bushes, waiting to watch us splash down the foaming steps.

The stream straightened for a dozen miles down a corridor in the hills. The current was swift, but held no dangers. In the Horseshoe Rapids we had to cross through heavy swells to hold the safer channel.

At Gull Island Rapid, John and Leslie thought they could let down the canoes by the tracking lines without unloading. First hazard was a pair of big boulders with water rushing through in a spout not quite wide enough to float our long-suffering craft (page 66).

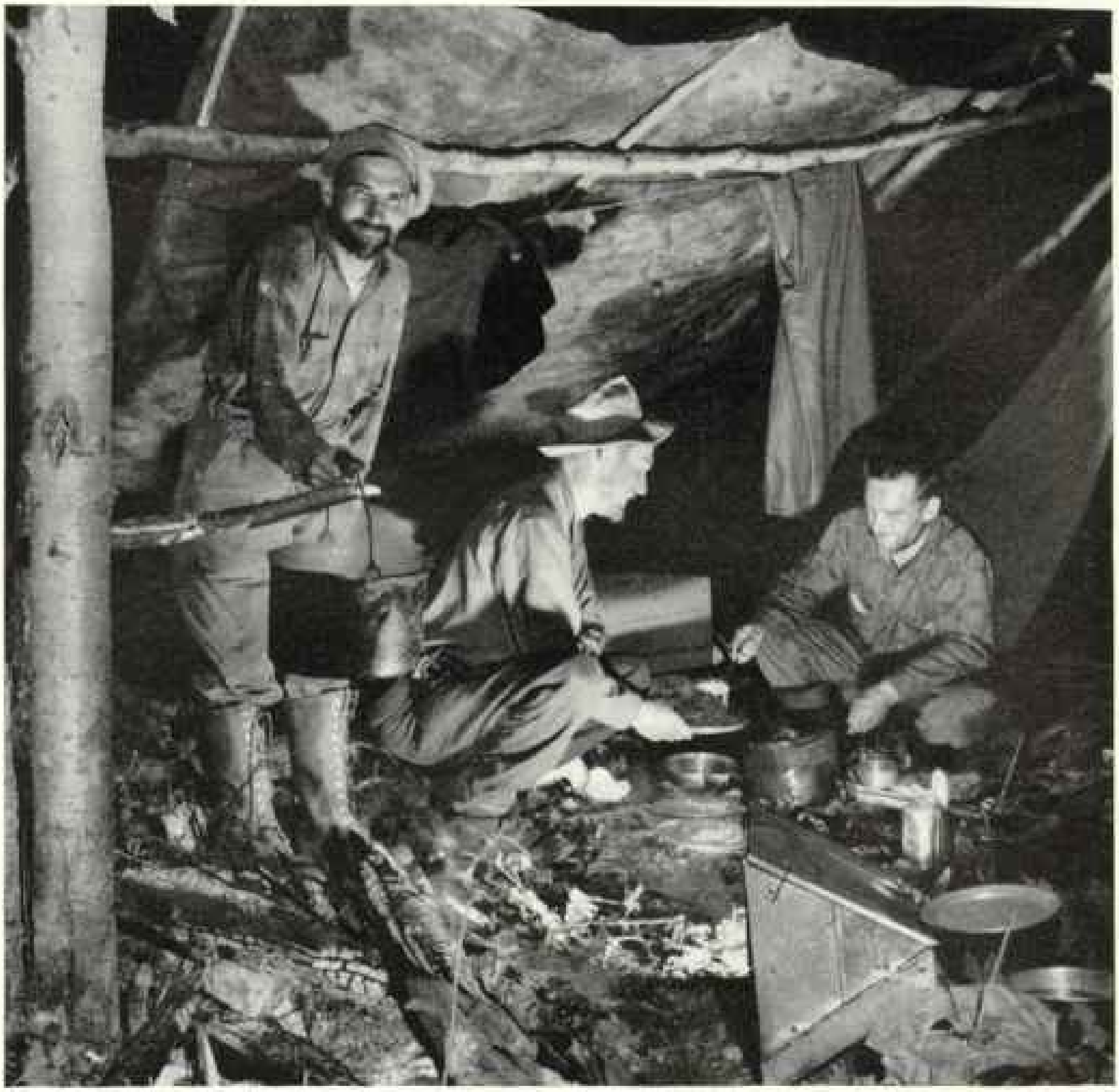
It took a lot of "heave-ho" and clenching of teeth to lift the canoes over the obstacles.

John hopped from rock to rock like a cricket on a hot hearth, hauling back on the canoe by a line taut as a fiddle string.

Momentarily out of control, *Loon* leaped a chute, dragging John by the rope. The metal craft smacked the pool below so hard that spray flew to either side, and the nose of the canoe buried itself in the water. We had to unload to empty out 10 gallons of cold river.

Muskrat Falls was the last obstacle. There the river leaped two chutes, each 25 feet. The portage was over a high sandbank.

Five miles below Muskrat Falls we found an anchored motor launch. Herbert Michelin and Cortland Best, friends of John and Leslie,



99

Muscles Are Weary, the Weather Is Foul, but Isn't Supper Grand!

A gathering storm pursued the canoeists across Gull Lake, but tent and tarpaulin rose and teakettle boiled before the first raindrops fell. Lower right: Bread bakes in 20 minutes within the metal reflector oven, so named because its slanting sides reflect the campfire's heat onto a cooking tray (page 81).

were cutting timbers for power poles at Goose Airport. We persuaded them to quit logging temporarily. They hauled aboard our dunnage and canoes.

War's Echoes Dimly Heard

Out of reach of all news for five weeks, we were eager to catch up on the strife in Korea.

"What's the news?" Ralph and Andy asked together. "Is the war over?"

"Oh, we don't hear a real lot about it, y'know," Herbert casually answered. "But they're still pickin' at it." Without a break he turned to Leslie: "How's signs of fur upriver, b'ye? Do it look good for the fall?"

We chugged 40 miles out of the Hamilton and through Lake Melville to the town of North West River (page 88). What a treat to move across water without stabbing it with slabs of wood!

We reached the largest village in Labrador (population 300 plus) and our journey's end at 10 o'clock on the evening of Friday, August 11. We climbed to the dock in the darkness and looked at each other with a full measure of respect. The adventure was won.

Next day, sunny and still, we loafed on bluegrass lawns and talked with friendly villagers. We strolled among the gardens of the Grenfell mission and helped pick potatoes, peas, and carrots for our dinner (page 87). Along lanes and walkways delphiniums bloomed.

Past the town soccer field we climbed Sunday Hill to watch the sun set over Grand Lake. It was like a holiday back home.

Spain's Silkworm Gut

By Luis Marden

WHEN Don Quixote, Spain's mad hero, started his knightly adventures, he and Sancho Panza were riding along a road in La Mancha.*

"After they had gone a couple of miles," Cervantes wrote, "Don Quixote caught sight of what appeared to be a great throng of people, who, as was afterward learned, were certain merchants of Toledo on their way to Murcia to purchase silk."

In 1605, *Don Quixote's* publication date, Murcia was already famous for its thread silk. It took an accident to establish a new and unusual silk product—silkworm gut.

A Discovery by Ragpickers

The story goes that, more than a century ago, a Murcian tossed off-size worms on a refuse heap. Strolling ragpickers, curious to examine the silk-producing mechanism, tore one open. Experimenting, they stretched its two gelatinous silk glands into long threads of tough, translucent silk. So was a new industry born.

Since that time Murcia has supplied the world with this filament. Some 20 plants, making gut and fishing equipment, place Murcia in competition with Redditch, England's famed tackle town.

In peak times Spain turns out 90,000,000 strands of gut a year. Lately, artificial substitutes have reduced gut exports sharply.

Fishermen, who buy 70 percent of all gut, use it to conceal the connection between lines and lures (page 108). Surgeons, taking the remainder, employ it to sew wounds.

Both anglers and doctors once used horsehair. Some English fishermen still prefer white horsehair, and plastic surgeons occasionally sew with horsehair sutures.

But just as the silkworm took the place of the horse, so nylon, product of the laboratory, now pushes the silkworm into the background. In similar fashion, nylon put the bristle hog out of the toothbrush business.

Moth Undergoes Three Transformations

Bombyx mori, the silkworm moth, has a four-stage life cycle: egg, larva, pupa, and imago, or mature moth.†

In the thread-silk industry, sericulturists kill the insect in its cocoon or pupal stage. Then they unwind the cocoon's thread and spin the filaments into raw silk.

Gut makers, eliminating the cocoon stage, stop development one step earlier. As the worms prepare to spin their silken chambers, they are killed and cured in an acid solution. Then the two silk glands are removed and stretched into filaments (page 105).

Gut making is woman's work. Murcia farmwives buy silkworm eggs from breeders in autumn and keep them chilled until spring. On the first Friday in March they take the eggs to church to be blessed.

Most growers incubate the worms between folds of cloth, but some farm women hatch them in bags hung between their breasts. Now the Spanish Government is introducing oil-burning incubators.

When the minuscule worms hatch out, they begin a mulberry-leaf feast which they interrupt only for four moltings (page 102).

Finally, in three to five weeks, the worms, now grown to three inches, stop eating and prepare to spin cocoons. At this precise moment they are tossed into the lethal bath.

Each Murcia family has its own formula for the pickling. Some use beer and water, others vinegar and water, or vinegar and salt. One woman's recipe: "Add salt to vinegar until an egg will float three-quarters submerged."

Chickens Snap Up the Leavings

Old women draw the gut (page 104). Opening a pickled worm, the farmwife removes the silk sacs and tosses the looted carcass to a circle of eager chickens. Now, with one swift movement, she pulls the two sacs to their full length, 8 to 18 inches. When she has stretched several hundred filaments, she washes the bundles and finger-combs the strands (page 106). Finally the gut is dried in the hot sun (page 107).

This raw product goes to processing plants in bundles resembling carroty wigs.

The breaking point of most gut varies between 3 and 17 pounds. For more delicate, almost invisible, sizes, processors draw strands through pierced-diamond dies. Some of the finest measure three thousandths of an inch; they snap under a few ounces' strain.

Though nylon has the advantages of continuous length, exact, uniform diameter, and dry flexibility, many expert anglers prefer gut. It remains supple in icy water and it sinks more readily than nylon. Thus a future seems assured for Spain's strange industry.

* See "Speaking of Spain," by Luis Marden, National Geographic Magazine, April, 1950.

† See "Strange Habits of Familiar Moths and Butterflies," by William Joseph Showalter, National Geographic Magazine, July, 1927.

Kodachrome by Luis Marden

Señoritas Comb Golden "Wigs" of Silkworm Gut, Spain's Gift to Fishing and Surgery

Silkworm gut, made by stretching the twin silk sacs of *Bombyx mori*, goes into sutures and fishing leaders (page 108). These young women wash fresh filaments at Murcia, world's silkworm-gut center for more than a century.

Kodachromes by Luis Marden

A Silk Moth's Life, from Squirmy Caterpillar to Peanut-shaped Cocoon, Is a Glutton's Banquet of Mulberry Leaves

Thousands of worms ravenously feeding sound like rustling rain. When just about to spin cocoons, the worms are killed and toughened by 12 hours' immersion in vinegar, salt, and water. Then they are torn open and the silk sacs removed and stretched. These silk-encased pupas were spared to become breeding moths, which do no eating. Big peach-colored cocoons (upper center) indicate the Spanish gut breed. Gut worms spin larger, coarser cocoons than thread worms.

A Sericulturist, Demonstrating with a Giant Model, Points Out the Twin Silk Sacs, Source of Gut

Silkworms spin one filament from each sac, joining the two before they issue from the mouth (right) as a single thread. These girls study silkworm breeding under the director of the Spanish Government's Sericulture Station in Murcia.

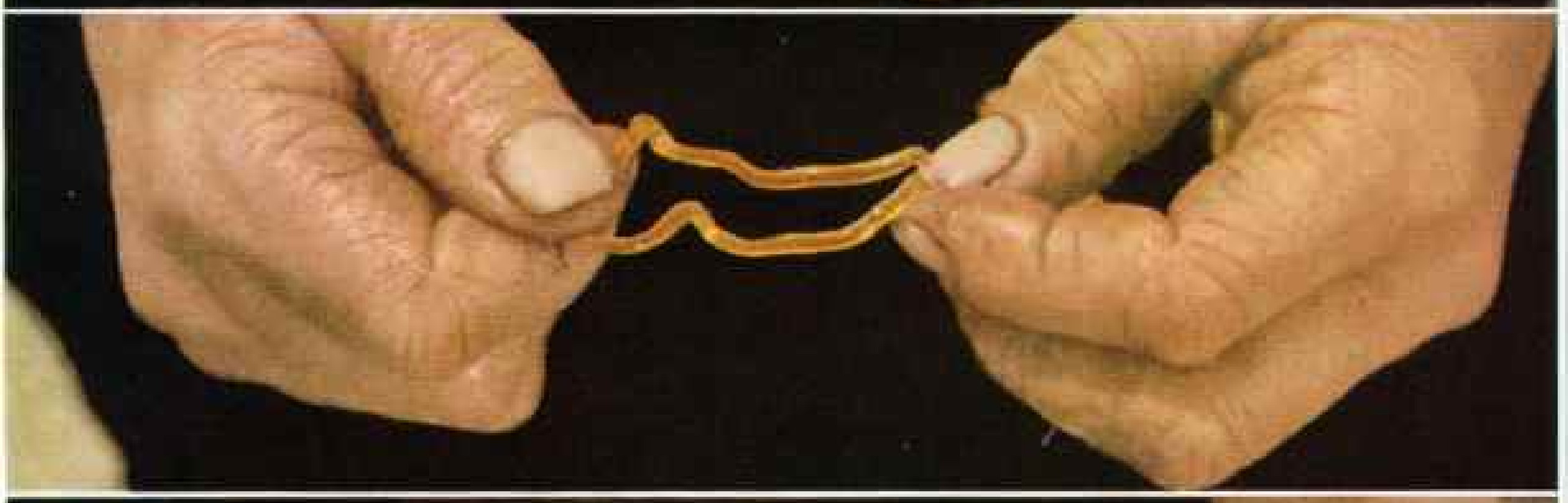
Kodachrome by Luis Marden

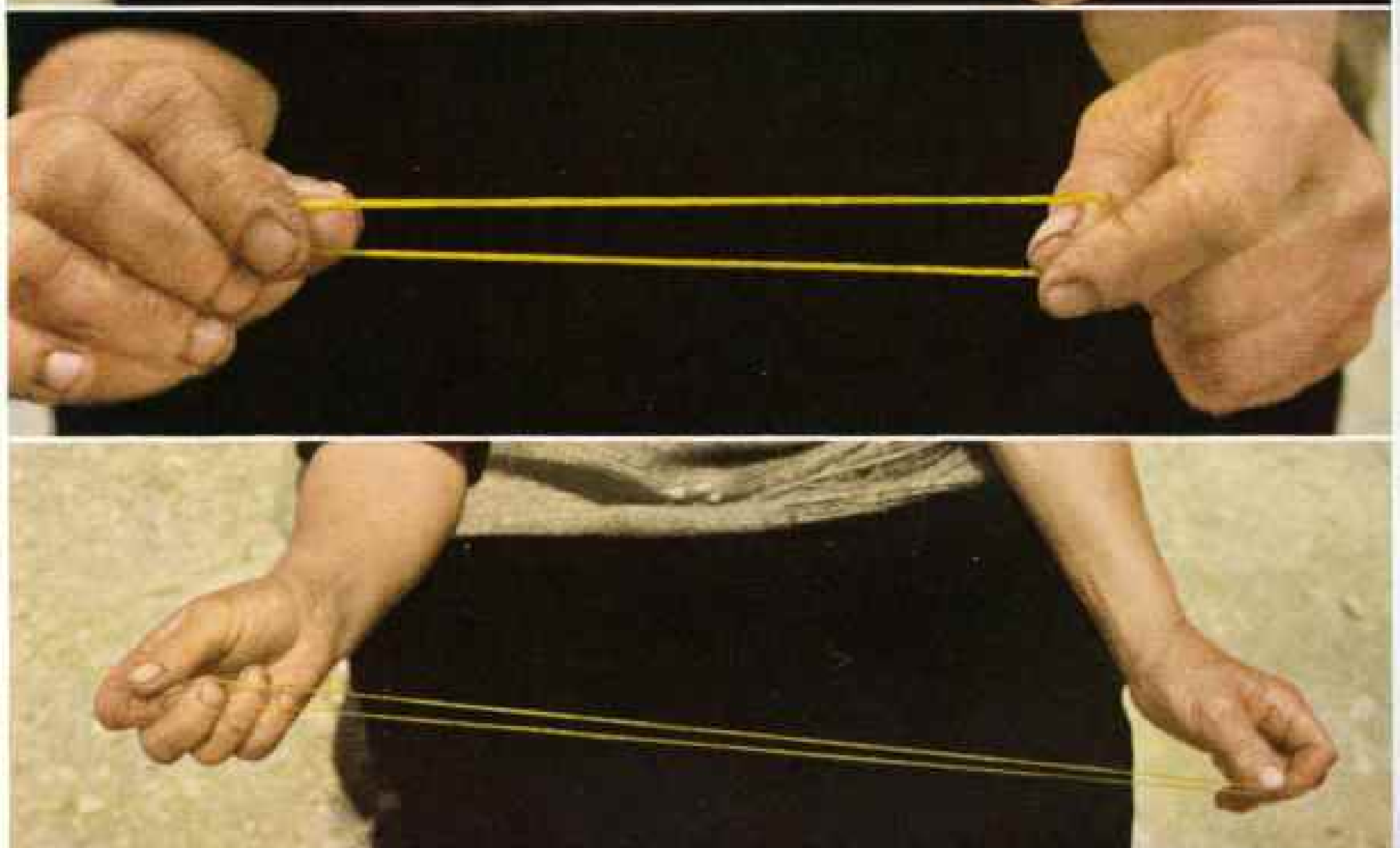
Kodachromes by Luis Marden

Work-etched Hands Stretch Silk Glands for Anglers and Doctors

Silk sacs, seemingly so fragile, possess an amazing tensile strength in the finished form. Gut strands range in length from 8 to 18 inches; they must be soaked for pliability. Nylon, gut's artificial rival, comes in continuous lengths and is naturally flexible. This countrywoman, who works with silk only in the spring, knows by long experience the exact pull which will stretch the filament to the utmost without breaking.

Opposite page: close-ups show opening of the worm, removal and washing of the sacs, and stretching of the two glands. Stained hands reflect the farmwife's work with the vinegar solution used to toughen silk sacs.





Kodachrome by Luis Marden

From Lowly Worms Comes Spun-gold Beauty. Drawn and Washed Filaments Dry in the Spanish Sun

When a woman has drawn her allotment of gut, she ties it in hanks, washes it (opposite page), combs it with fingers, and hangs it on a line. Later she ties strands from 700 silkworms into factory-bound bundles. Boiling soapy water removes the yellow outer skin. Sulphur fumes whiten strands further.

↑ 36,000 Strands of Gut Represent the Lifework of 18,000 Worms

Left: Orange gut as it comes from the silk farm and (second hank) the factory-bleached product. Yarn-wrapped bundles have been sorted, stretched, polished, and trimmed. Pierced diamonds, shaving off excess thickness, form the finest diameters.

↓ Fishermen Use 70 Percent of Gut; Surgeons Take the Remainder

These salmon flies are knotted to the heaviest gut, 21/1,000 inch; breaking point, about 17 pounds. Finer strands (not shown), some ½-pound test, catch trout. Sutures are sealed in tubes of distilled water. Stitches must be removed; the system does not absorb them.

Versatile Wood Waits on Man

By Andrew H. Brown

HIGH in Oregon's Cascade Range I watched two fallers set their saw to the base of a proud Douglas fir. Roots in shadow, crown in sun, the great tree thrust up straight and true, a mirror copy of hundreds of its kind crowding that verdant valley.

"Ever see a tall tree felled?" asked the logging boss who stood at my side. "Well, it's kinda sad, in a way. But, what with defense an' all, everybody's beggin' for wood."

Who wouldn't feel a pang or two, indeed, watching one of these 300-year-old patriarchs cut off in its prime! The fallers kept up their rhythmic strokes as the steel teeth steadily undermined the brown column. Suddenly overstrained tree sinews snapped. The saw's "siss-ss, siss-ss" stopped short.

Came the warning cry, "Tim-ber-rr!" Far up in the sky the green spire tilted, dropping faster every second.

"Five, six, seven . . ." I counted. The fallers had fled from the stump. "Eight, nine, ten!" An earth-shaking thud, a quiver of branches, and the superb tree, spanning 200 feet of forest floor, lay still.

As I watched the dust settle, questions came to mind.

What would happen to that log? What would happen to the millions of trees felled that year, and next year, and the next? Seeking the answers proved a fascinating quest.

Falling Is Wood's Birth to New Life

Felling and hauling are only the preface to bewildering magic whereby industry transforms Nature's biggest living things into a fabulous array of things for larger living. (page 110).

Fabricators and technicians now make from wood not just boards, beds, barns, and bookcases, but chemicals, clothing, and plastics; paper and paperboard cartons; structural and insulation panels; fillers, films, and fibers.

No wonder that in his lifetime the average American uses the substance of 400 trees!

All of us can reach out almost any time and touch something made from wood. One morning I picked up my telephone in Washington, D. C., and called the Western Electric Company in New York.

"Is there any wood in telephone equipment?" I asked Mr. C. L. Stong, information manager.

"The telephone instrument you're holding in your hand is half wood," Mr. Stong replied. "It's made of a phenol plastic 'filled' with approximately 50 percent pine wood flour. Every year we buy about five million pounds of this compound for molding handsets and other parts."

He further advised: "Go look at the telephone switchboard in your office. The switchboard itself is made of wood. Even the little bases of the switchboard lamps are wood."

"Anything else?" I asked.

"Yes, indeed!" Mr. Stong declared. "Telephone booths, poles, and crossarms used by the Bell System swallow enormous amounts of wood. Wood pulp and wood-fiber paper insulate the 140,000,000 conductor-miles of wire in telephone cables spanning the country. Paper also goes into our electrical condensers."

Plays "Straight" and "Character" Roles

Since Dawn man first reached for a club to tame his mate, wood never has faltered in men's service.

Wood, as Shakespeare said of man, plays many parts. Some are "straight" roles: furniture, fuel, and construction lumber; butcher blocks, toothpicks, tool handles, and rolling pins. But wood also stars in "character" parts, so disguised you'd never guess its forest origin.

Turn up the label on your silky necktie or on your summer dress or suit. There's a good chance it says "Rayon." Rayon is made primarily from wood cellulose (page 137).

The phrase "steaks from sawdust" overleaps the steps to achieve that transformation. Yet sawdust can be processed to yield molasses for supplementary cattle feed. This forest-born diet, though successful, so far is experimental in the United States.

Wood is a silent partner, I learned, in making products that contain no wood at all.

Hamilton Watch Company craftsmen use ten kinds of wood to turn out a precision product made of precious metals, alloys, and jewels! Hamilton puts to work boxwood, orangewood, beech, balsa, applewood, cypress, maple, pine, mahogany, and walnut. Their workers use them to polish tiny screw heads, open jewel holes, buff pinion teeth, and for other delicate operations.

One southern brickmaker casts wood in a "ghost" role. He mixes pine shavings and sawdust with clay in making firebricks. In the lava-hot kilns the pine waste burns out. This brick is lighter, and has heat-insulating properties not found in bricks of solid clay.

My wife reminded me of an illustrious wooden man.

110

Fresno Bee

A Mammoth Sequoia, Perhaps 2,000 Years Old, Joins the Nation's Lumber Pile

Americans pay 13 to 14 billion dollars a year for timber products (page 114). Our annual wood crop would ring the earth 379 times with a one-inch board a foot wide. Home building in 1950 reached an all-time high. These California lumbermen halve the 12-foot-thick log with a power-driven chain saw.

111 U. S. Department of Defense, official

A Branchless Forest Trains Pole Climbers; Spikes Wear Out the Timbers in a Month

Balanced with waist straps, students learn to work aloft at Francis E. Warren Air Force Base, Cheyenne, Wyoming. Several other open-air classrooms at the field contain 50 poles each (page 114).

"Have you got Charlie McCarthy down there?" she asked. "He must be history's most successful piece of wood."

The story of trees was old when man's was new. Teamed together, they've done the "impossible."

Noah's ark, freighted with the future's animal and human ancestors, must rate as the most precious wooden vessel ever launched. Troy fell because her people drew within the walls epic history's most famous steed—the Trojan horse, shaped in wood (page 115).

Log levers were the first machines. Tree trunks used for rollers may well have inspired the labor-saving wheel. Wood reduced to charcoal made smelting possible.

Wooden ships carried men to conquest of the Seven Seas. The first cargoes the Virginia Company venturers carried back from the New World to England were sassafras bark and pine and cedar logs. Our pioneers rolled west in prairie schooners built of wood.

Abundant forests, mighty asset to any nation, have enormously enriched America.

One doughty statistician computed that enough saw timber grows in the United States every 9 seconds to build a new home. Yet in productive forests we rank only fourth, after Russia, Brazil, and Canada. The U.S.S.R. boasts timber resources half again as vast as those of the United States and Canada *combined*.

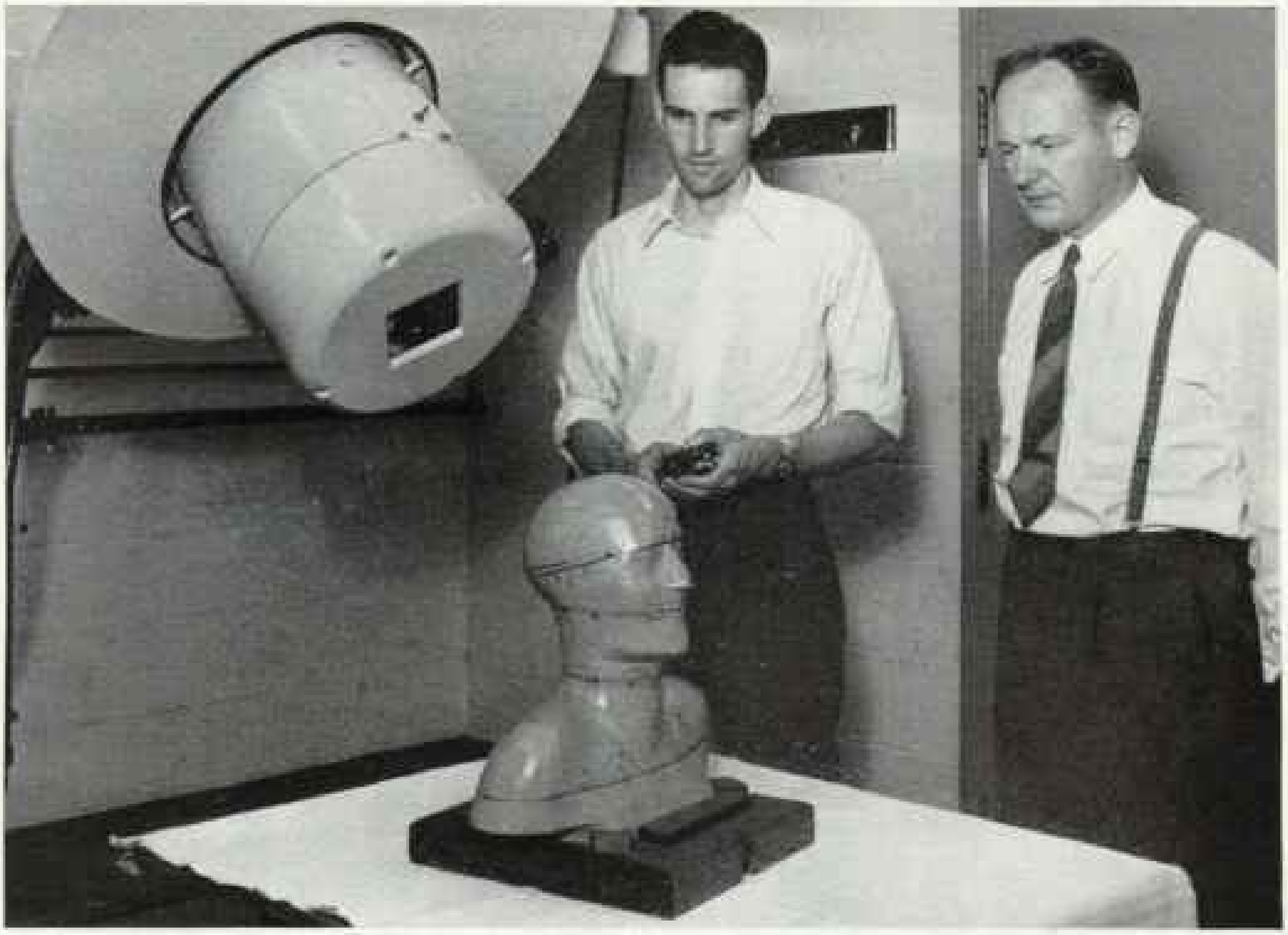
Wood a Mighty War Weapon

In World War II our industries based on wood were a bulwark of Allied strength.

For the armed forces, American industry produced myriad wood items—everything from rifle stocks to plywood planes, camp cots to life rafts, tent poles to tugboats.

The Parkwood Corporation of Wakefield, Massachusetts, for example, shipped plastic-impregnated, densified wood to the British. They shaped it into propellers for combat planes.

Side by side with the Navy's steel vessels fought hundreds of wooden ships—minesweepers, PT boats, subchasers, assault and crash



112 Rich Vultaas Engineering Corp.

Block-headed "Mr. Cruikshank" Plays a Brainy Role in Cranial X-rays

A stand-in for living man, Mr. Cruikshank has helped solve problems relating to X-ray treatment of deep brain tumors. His wooden noggin, sectioned to hold film, has the same X-ray-absorption properties as the human head. He poses before a two-million-volt X-ray generator in Massachusetts Institute of Technology. His name, picked at random, has no special significance.

boats, tenders, mobile dry docks, and many more. Our "five-ocean" Navy mustered more than 49,000 wooden craft!

Builders laid 120,000 board feet of teak to deck each of our largest battleships. (A board foot is a piece of lumber one foot long, one foot wide, and an inch thick.) The flight deck of every big *Essex*-class aircraft carrier was surfaced with two and a third acres of edge-grain Douglas fir three inches thick.

Wood Boosted Ersatz Output

Shortages "put the squeeze" on Germany to make all possible use of wood. Hitler's legions ate chocolate candy sweetened with wood sugar, and ersatz bacon which their laboratory Merlins conjured from wood chips.

Germany used food yeast from wood to fortify cattle fodder. Soldiers mixed the yeast in spaghetti sauces, biscuit dough, and soups, and sprinkled it on salads.

German scientists made synthetic tires from alcohol derived from wood. Wood gas drove trucks. Trees yielded lubricants and explosives. Nazi troops wore "wood wool" clothing.

The ill wind of war blew good to our peacetime economy in a rich legacy of wood-fabricating techniques. But the Federal Government, colleges, and private research groups still put wood through endless tryouts, seeking new ways to make it serve.

Leader in U. S. wood research is the Department of Agriculture's Forest Products Laboratory at Madison, Wisconsin. There I saw, smelled, and touched wood in every imaginable guise, from sap-scented logs and planks to paper pulp, alcohol, wood-and-resin laminates, and plywood.

I threaded a fantastic workshop where intent laboratory men bent, twisted, hammered, boiled, baked, crushed, dissected, squeezed, burned, soaked, dropped, and stretched wood to test its mettle.

In a fireproof annex I watched workers deliberately start a fire! Within the building they had erected a section of a house, complete with shutters, doors, draperies, rugs, furniture, and pictures. The lifelike "props" assured a realistic experiment.

At a signal, trained "firebugs" touched off an over-full wastebasket in the dummy house, just as if a careless guest had tossed in an unextinguished cigarette. I stood with observers who studied external thermometers and recording devices as the blaze spread. Other instruments had been placed within.

111 National Geographic Photographer B. Anthony Stewart

A Kentucky Folk Song Virtuoso Touches Up His Homemade Dulcimers

The oriental dulcimer was a forerunner of the piano (page 131). These instruments, made of native American woods, are its direct descendants. John Jacob Niles, who makes and plays dulcimers, uses spruce for the tops, curly maple for the sides, and walnut for the backs.

After window glass cracked and flames licked through the wooden walls, a water spray put out the fire. The technicians were studying combustion temperatures of structures, fittings, and furnishings made from wood.

This was just one of hundreds of tests under way that day in the Forest Products Laboratory, finest of its kind in the world.

Wood "Has Everything"

What are the qualities of wood that make it such a favorite?

Wood is made up of countless tiny tubes of cellulose, bound together and impregnated with lignin, trees' natural "glue." This fibrous structure gives great load-bearing strength, as in posts and piling.

Parallel to the grain, wood's resiliency and tensile strength are phenomenal. Think of the beating a diving board takes! Wood fatigues very slowly, and resists weather and decay like few other organic materials.

Most wood shows amazing resistance to shock. Like a good boxer, it "rolls with the punches"—essential where exposed to repeated impact, as in shuttle blocks and bowling pins. Wood appeals to human senses; its rich appearance and pleasing hue attract the eye.

That's not all! Unlike cold-feeling metal, glass, and stone, wood is neutral to the touch, a poor conductor. Many species have pleasant perfumes.

Wood is compact and clean, it floats (most species), and is easy to work. It takes stains, paints, and other finishes smoothly.

Several dense woods sink like rocks in water. By contrast, feather-light balsa floats like a cork, yet is strong enough to use in full-scale and model airplanes. Balsa allows clowns to lift "impossible" weights and collapsing "timbers" to leave actors' heads undented.

Two of the best things of all about wood are: it is still generally abundant; and it's a renewable resource. Some useful kind of tree will grow on almost any kind of land, save in regions of climatic extremes.

United States Is a Wood Workshop

"From sea to shining sea" the forest-blessed United States is a giant wood workshop.

Our forefathers found a wealth of oak and maple, birch and ash, white pine and spruce in New England, New York, the north-central States, and the southern Appalachians. They built mills that were the nucleus of today's furniture, implement, and flooring industries.

Pioneers, some seeking yellow metal, discovered "green gold" in the Northwest and northern California. Today we count heavily on those living riches, our virgin stands of quality softwoods—Douglas fir, ponderosa pine, redwood, western hemlock, white fir, sugar pine, and western red cedar.

These superb species, together with southern yellow pine, form our chief reservoir of construction lumber. Wood sawed from two average Douglas firs will build a typical American home.

Much Maine and Minnesota spruce and fir, and the South's young, fast-growing pines, are unsuitable for long-lumber. They yield newsprint, kraft (bag and wrapping) papers, paperboards, and wall- and hard-board products.

Trees of the South, seldom thought of as a great forest region, supply 47 percent of the Nation's pulpwood and 37 percent of its lumber, reports the American Forest Products Industries of Washington, D. C.

The timber industries contribute 13 to 14 billion dollars annually to the national income.

Turning out wood and wood-derived items worth this fabulous sum are about 60,000 sawmills (though a scant three percent of them produce more than half our lumber), 650 veneer and plywood plants, 325 shingle mills, 200-250 pulp mills, and many specialty factories.

In 1950 a record-smashing building boom gripped the United States. Home construction outstripped all past performance with 1,595,000 new dwelling units started, including some 200,000 farm homes. And four out of five houses are built of wood.

Housing and building by industry consume about half the United States' saw-timber cut, which is running about 50 billion board feet annually. Builders ordered boards, beams, and trim stock for everything from shingles and porch rails to huge timbers—linked by steel connector rings—for roof trusses of factories, gymnasiums, warehouses, hangars, and churches.

The lusty cry for lumber has given new life to portable sawmills, nicknamed "peckerwoods," "popgun mills," "ground rattlers," "coffeepots," and "jeep mills."

Homes from the Assembly Line

Postwar hunger for low-cost houses has spurred prefabrication and mass production. You can purchase land today and—with good luck—move into your new home in about a month. How? Buy an assembly-line house.

About 50 major U. S. manufacturers in 1950 turned out some 55,000 prefabricated homes, basically of wood; the 1951 target is 100,000!

Gunnison Homes of New Albany, Indiana, a leading "prefab" maker, has geared its conveyor-belt production line to turn out a complete house every 20 minutes and several hundred every month. They ship the various house components in packages for assembly on the site.

When you write out your down-payment check, you're assured a finished dwelling, complete to sidewalks, drives, landscaping—even flowers in the window boxes!

Oil, coal, and gas notwithstanding, even today the third largest use of our timber supply is for fuel. Yes, between a quarter and a fifth of the yearly wood crop goes up in flames (page 138).

Even a modern metropolis like New York City hasn't eliminated open fires. New Yorkers still watch flames flicker in 100,000 fireplaces. Two of these, both on the 80th floor of the Empire State Building, are the world's highest fireplaces above street level.

Logs Hold Up Wires, Rails, and Mine Roofs

Across our land millions of trees have lost life and limb, yet still stand straight and true as in the forest. These are the 86 million telephone, telegraph, and electric-power poles that play follow-the-leader up and down the 48 States. Crews erect 7,000,000 new poles every year.

Railroads haul a major portion of the Nation's wood products and rely heavily on wood to do the job.

Hurtling along at 85 miles an hour, the New York Central Railroad's crack 20th Century Limited flashes past 3,750 wood ties and 90 wood telegraph poles every minute. Speeding trains of America clickety-clack over rails bedded to more than a billion wooden crossties.

Although steel and conveyor belts are gradually replacing wood in mines, a huge quantity still is used for pit props, shoring timbers, track ties, and other mine wood.

In certain items the wood industry can match the Federal Budget for astronomical figures. Guess how many pencils Americans use each year, to scribble orders to the baby sitter, to keep the Canasta score, and to tot up the income tax?

The answer is one-and-a-half *billion*—more than 10 pencils apiece for every person in the United States! A line you might draw with that staggering number of pencils would reach to the sun and back 283 times.

Six-sided or round, most pencils are shaped halves of glued wood gripping the graphite-and-clay "lead." Fresh from the sharpener,

115 Bettmann Archive

Trojan Horse, Antiquity's Wooden Booby Trap, Accomplished the Fall of Troy

For ten years, according to mythology, the Greeks laid siege to Troy. Frontal assaults failing, they built a hollow horse, filled it with warriors, and left it outside the city walls. Their fleet and army then executed a pretended withdrawal. Jubilant Trojans, taking the bait, drew the trophy inside the city. When night fell, the hidden Greeks stole out and unlocked the gates to their comrades. Totalitarianism's Trojan horse, a fifth column working within an enemy's borders, takes its name from the Greek device. Henri Motte painted horse and walls as he imagined them.

they smell so nice because they're almost all made of incense cedar.

The average incense cedar from northern California yields 57,600 pencils—400 gross.

Eastern red cedar, mostly from Tennessee, once provided the bulk of our pencil wood. As it grew scarce, pencil people combed the countryside, buying up barns, cedar fences, log cabins, well sweeps, anything made of cedar. Then the western cedar "came in" to save the day!

The limited supply of eastern cedar still is sought for high-quality drawing pencils.

Tennessee cedar has a ruddy hue. Incense cedar saws out light tan. Bowing to tradition, pencil makers dye the western wood in the favored rosy shade!

'Way out West, a yearly log drive has furnished raw material for one of our smallest necessities, the humble but handy friction match.

Down Idaho's Priest and Pend Oreille Rivers the Diamond Match Company floats out the Idaho white pine logs that yield "lights" by the billion.

Diamond is the leading producer of all basic match types: wooden safety, wooden "strike anywhere," and book (paper) matches. The company's production line is as prolific as a bevy of anthill queens; it turned out 40 percent of the total 1950 national output of 485 billion matches of all kinds. Roughly three out of every five were wooden (p. 139).

In other operations Diamond saws, splits, and stamps hardwoods into chip-size but practical products, among them tongue depressors, meat skewers, floral sticks, forks and spoons, ice cream and candy sticks, clothespins, and toothpicks.

Bleachers Put the "See" in Ceremony

Americans do a lot of outdoor sitting. Wood is the nearly universal surface that sustains them.

For the 1949 inauguration parade of President Truman workmen erected "rubberneck" platforms and banks of bleachers along the two-mile parade route from the Capitol to the White House. They spiked together nearly a million board feet of lumber for just that one day's use! Builders who purchased the scarcely marred wood hauled off lumber enough to erect nearly 85 six-room houses.

Inauguration band music set a-quiver old timbers of the White House, now undergoing renovation. Contractors have found many

White House beams, dating from reconstruction after the 1814 fire, in surprisingly good condition.

The venerable White House has sheltered, among others, an honored President who owed quite a debt to wood. He learned his "figgers" by the light of wood-fed flames, using a wooden shovel for a slate; he split rails and cut posts to fence the land he plowed, and carved out an ox yoke with his own hands.

In country towns of Lincoln's day, cooper and wheelwright were key men in local economy. Every wagon needed wheels, and nothing served so well as a stout barrel for shipping flour, sugar, pickles, or pork.

Today, the making of wooden wheels is almost a vanished skill, except for country folks' buggy wheels, street-cleaning pushcarts, milk wagons, and some farm vehicles. Architects and builders buy a few for chandeliers and garden decorations.

The cooper's craft has fallen victim to specialization. Barrel assembly plants buy the staves and heading from some 400 small independent mills.

Despite competition from other packagings, the United States last year made about 30,000,000 kegs and slack barrels (used to store and transport solids). Distillers now own many of the largest factories turning out tight barrels (which hold liquids). For aging whisky they need quantities of barrels made of white oak, which seems to improve the liquor's flavor. Several plants in Louisville, Kentucky, Memphis, Tennessee, and other cities produce 1,000 to 2,000 barrels daily.

First Saboteur a Shoe Tosser

Many country folk in Europe still wear wooden shoes, called *sabots* in France and the Low Countries. By one account, the first *saboteur* was a malcontent French worker who tossed his sabot into machinery to cause damage. Another explanation draws a parallel between the clumsiness of walking in wood shoes and the willful carelessness of *sabotage*. English adopted both words (page 140).

Today shoes are made primarily of leather, but shoe lasts on which shoes are built are precisely shaped from choice hardwoods, usually hard maple *(Acer saccharum)*. The foot takes terrific punishment, so care in shoe structure is essential.

Manufacturers cut shoe parts from patterns and then build up the finished shoe on a last. Just five U. S. firms turn out all the rough last blocks, first step in shoeing 150,000,000 Americans. The same companies ship lasts by the thousands to foreign shoemakers.

Though wooden shoes are generally outdated in this country, Oscar Auestad of Portland, Oregon, still does a nice business in wood-soled shoes.

Employees of cheese factories, ice plants, and in other work where underfooting is slippery find his footwear just the thing. Telephone linemen like them on two scores: they're good insulators, and they're so tough that the men can scramble up and down phone poles all day and never feel the steel pole steps through the soles.

"Campuses of our Northwest colleges provide our biggest market," Mr. Auestad told me. "Most of the coeds keep a pair of our knockabout low shoes. We call them 'college woods.'"

Though wood shoes are the exception, most American women walk on wood heels, except for heavier-welt shoes, such as sport styles and low-heeled oxfords. Wood heel makers fashion wedge heels from softwood. For all others they use hard maple, the same tree that yields maple sugar.

First Wood Heels Raised Wearers Above Mud

Milady parading on Fifth Avenue probably is sublimely unaware that her raised wood heels originally were contrived to elevate the wearers' feet above mud and filth of medieval streets! In Marie Antoinette's day, both nobles and their ladies wore high wood heels, and, in general, the higher their station the higher were their heels.

About 50 manufacturers turn out most of the millions of wood heels that give American women their high standing in the world.

Foot troops in the Civil War, long before tanks and trucks, had support from wagon trains. Under every Union Army wagon hung a wood bucket filled with axle grease. Without that grease many a Northern drive must have faltered.

Holgate Brothers Company won the contract for supplying the armies of the North with those buckets. This woodworking firm, founded in 1789 to turn duster- and hearth-brush handles, today makes a famous line of wooden toys.

To help embellish Junior's Merry Christmas, wooden toys tumble in a bright cascade from ten or a dozen major toy factories.

Wood is ideal for toys; it's easy to saw, turn, sand, and lacquer. Wood toys even tempt the touch.

"Keep your hands *off* the wood and on the keys!" says the mother promoting her smudgy-fingered youngster from a toy piano to the real thing.

Much handwork of a different kind goes into

Idaho Loggers Battle a River

117 Ross Hall

A Burly Lumberjack on Nimble Feet "Hops the Toothpicks" in a Clearwater River Jam

Tom Kiiskila, a 240-pound veteran of 15 spring drives, speeds for shore on calked boots. Having unlocked the key log, he runs for safety. Some retired lumberjacks return to each year's drive just for the thrills.

Bunkhouse and Kitchen Tied Up to the Shore Are Home to the Men

Known as a "wanigan," the bunkhouse has cramped but comfortable quarters. At dawn the cook bellows, "Roll out!" and sounds the breakfast bell from the kitchen (rear).

This mobile headquarters, drifting day by day ahead of the Idaho log drive, is a floating palace compared with the old-time camp, where beds of poles were cushioned with hay or hemlock boughs. Bunks had no rated capacity, and as many men got into them as could.

In those days men awoke in the dark to the clang of the "gut hammer," a steel triangle pounded with a metal bar. Into boots and out for grub took but a minute.

Fed, the crew stumbled to work sites, huddled around fires, and waited for daylight.

Work stopped when eyes could no longer tell a log from a shadow.

These men set out by path and boat for the Clearwater's log jams. Boat crews will work the midstream (page 120). Ground forces will break up wing jams formed along the banks (page 125).

J. M. Reitter

Bobbing Islands of White Pine Clog the Surging Clearwater

Idaho contains the world's largest stand of western white pine. Since 1927 nineteen drives on the Clearwater have each yielded some 40 million board feet. Felled forests sail down the waterway to the 310-acre Potlatch millpond at Lewiston. Every eight hours the Lewiston mill saws enough lumber to build 40 average homes.

Logs cut a hundred miles upstream from the mill shoot down mountainsides in wooden flumes and plunge into the river. Drives begin when spring thaws flood the river.

In 1933 the drive lasted 85 days. Five years later the swollen river washed the logs to the mill in a few hours. The 1938 deluge burst the mill's log boom, flushing the mass into the Snake and down to the Columbia. The errant timber was finally trapped and sold to another mill at Hood River, Oregon.

Not all wood can be transported by water. Eastern oak, beech, maple, and birch float with difficulty unless specially prepared or rafted with lighter specimens. At times loggers let hardwoods dry for several months. With moisture partly removed, the logs can be floated for short periods. White pine floats readily.

Ross Hall

Log Drivers Commute from Camp to Jams by Motor Launch

The logger's ferry, a descendant of the old paddle-propelled bateau, requires skillful operation. Few rivermen can land the boat against a jam of churning logs and hold it steady while men leap out.

Equally difficult is a logger's leap from moving log to boat. Quick shifting of the current may send him overboard for an ice-cold dunking.

Yesteryear's brawling logger, the untamed terror of the Paul Bunyan era, has gone. But today's loggers are still real he-men who make no pretense of being angels.

Some aggressive young loggers now come from forestry schools. They study the veterans' methods and often improve them.

Only at nightly stove sessions is the forestry student squelched. There old-timers tell tall tales of the days when men lived on beans and salt pork for seven months. They worked in ice water from March to May and wound up the season with brawls in which they lost winter's wages in a single night.

Ross Hall

Lumberjacks Atop a Jam Pry Tangled Logs with Peaveys

Most dangerous part of the drive is jam breaking. Down the river stampede the logs, their roar audible a mile away. A lull in the rumble signals a pile-up. Massive logs, criss-crossed like jackstraws, may stack up for half a mile. As the river grinds them together, they creak and groan.

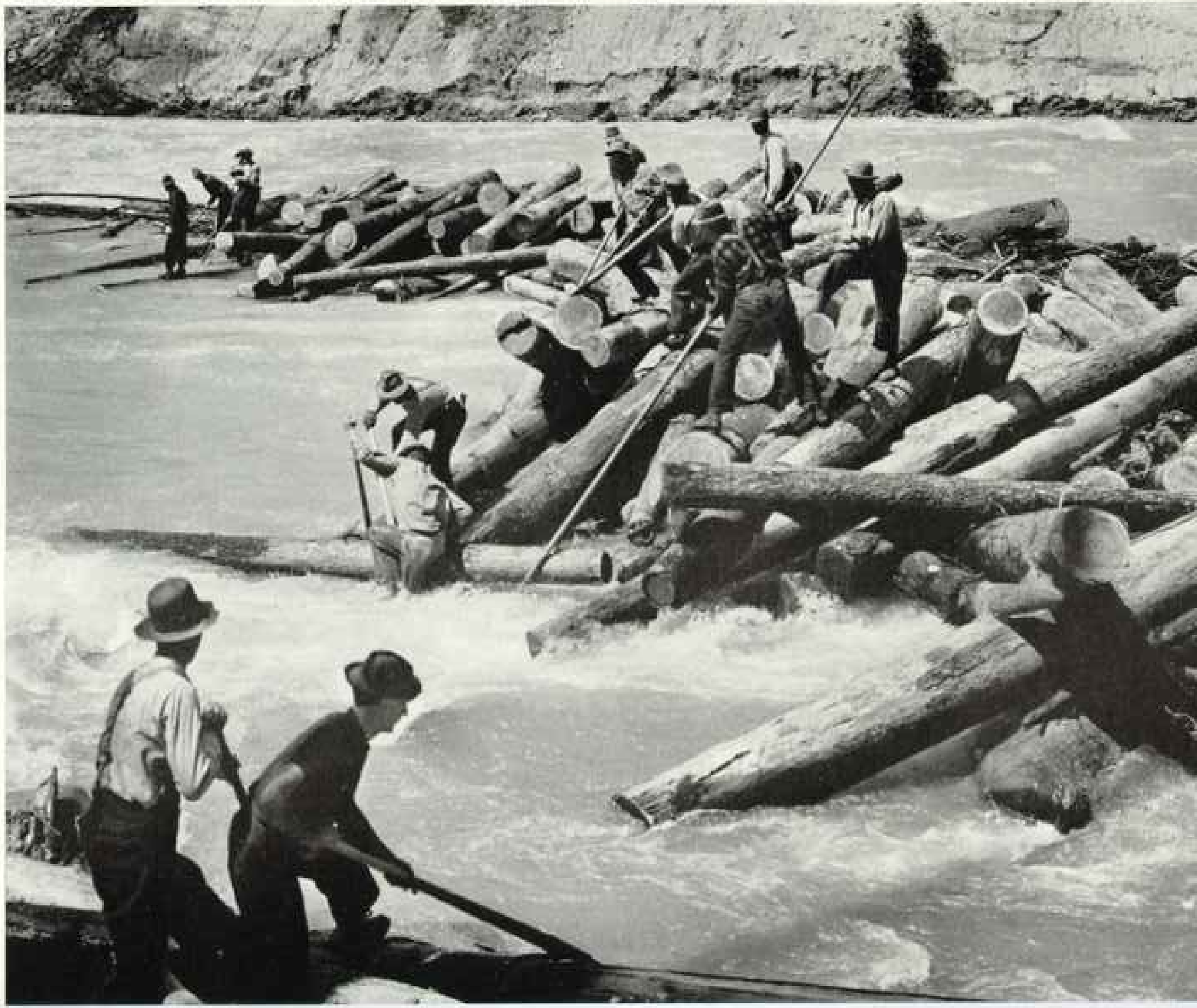
Behind the barrier the river backs up, at times overflowing. Peaveys clank; crew bosses shout orders. Men leap from log to log searching for the key, the single timber that must be moved before the jam can be broken.

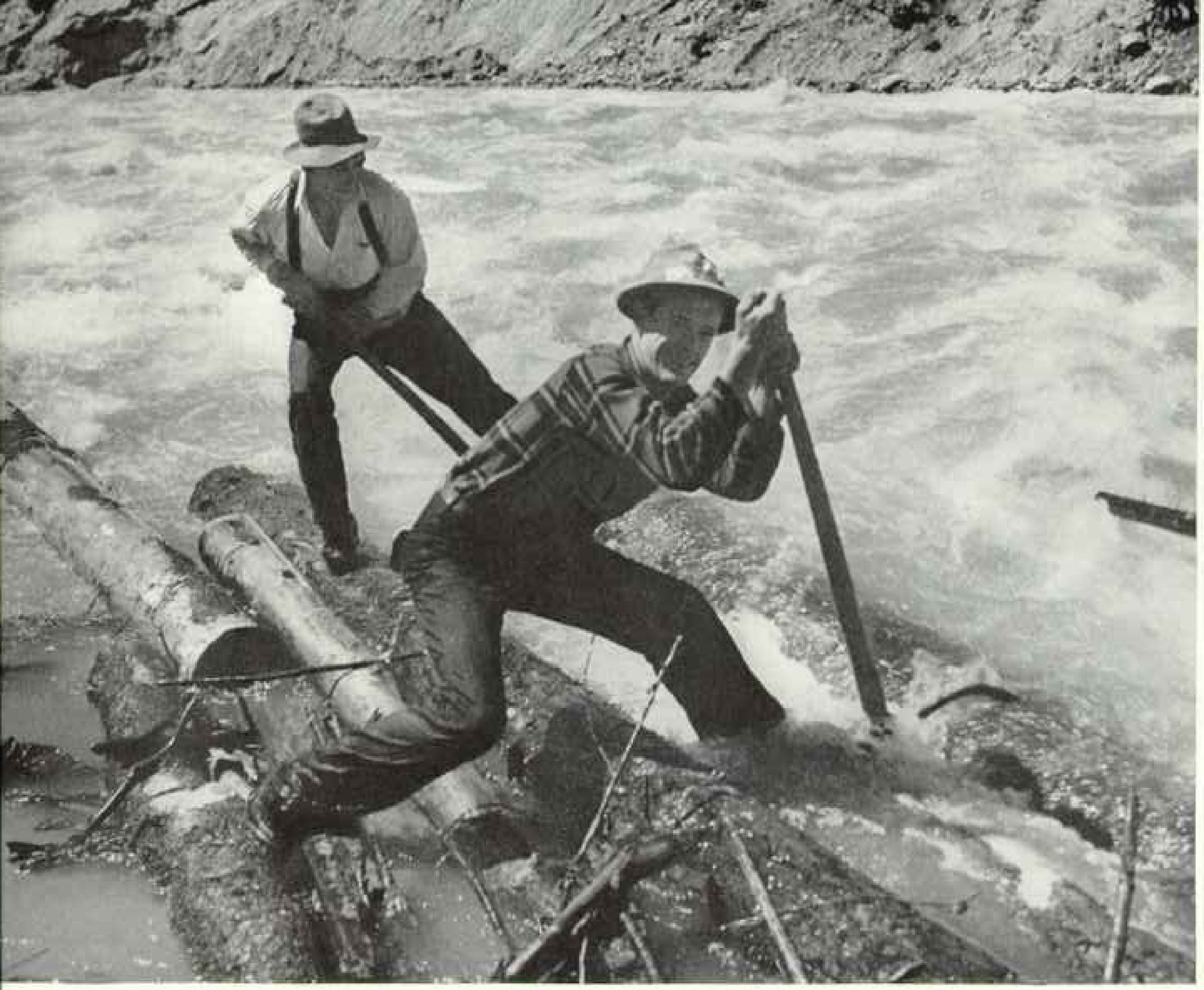
When a riverman finds the key log, he gives a warning cry. Twisted from its hold, the log rolls into the current. Drivers run for shore or leap for boats as the huge mass quakes and shifts. The surging current rips the pile apart.

Not all the men make shore or boats. Sometimes the pent-up river sweeps logs away instantly, leaving men to ride them out or swim for their lives.

Here a logger, having lost his footing, slips into the water (center). Fellow workers steady his log with peavey and pike pole.

Ross Ball





Off She Goes! Jacks Shove a Jammed Log into the Current

Logs must be moved to the sawmill while the spring thaw runs high or wait until the next year. To leave a drive dry disgraces the logger boss and every man on the crew.

Spectators on shore get a thrill as lumberjacks, balancing with peaveys, sweep past on logs.

Throw a bar of soap in the river; a good riverman can ride the bubbles to shore—so old-timers say.

In early logging days heavy floods sometimes swept log riders past the mill boom; many never came back.

The Clearwater's accident toll has been small. In 1950 an unusual jam occurred during a freeze-up near Lenore, Idaho. Locked logs stood upright like toothpicks in the ice-locked river. Creaks and groans of the breakup could be heard several miles. Bridges and the Potlatch millpond dam were saved by the quick action of expert rivermen using two-way radio.

Lumbermen brand logs when more than one owner uses the same waterway. They stamp log ends with numerals or characters mounted on sledge-hammer heads. Some operators dab paint on logs to indicate grade and size.

Ross Hall

The Follow-up Crew—15 Men Ankle-deep in Snow-cold Water—Grapples a Beached Log with Peaveys

Sand in the shallows often sifts into boots, rubbing flesh raw and causing "squeak heel." This team took 15 minutes—almost four man-hours—to roll the cumbersome log into the current. An equally tough job lies waiting on the right.

J. M. Buttler

124

A Dynamite Blast Shatters the Key Log, Anchor of the Jam

Rivermen blast reluctantly because shivered logs have little value. Once the key gives, other logs, freed, drift away.

125

J. M. Kettler

Wedged Logs Fly Apart in a Fountain of Spray and Splinters

Anglers abhor dynamite because it kills fish, but loggers contend the blast area is too small to harm many.

Ross Hall 126

Loggers Wash Up for Chow

Back in the '80's, sanitation was something to be endured only when in town. From October to April no one washed. A man wore one suit of underwear through winter.

Today's hungry rivermen clean up for breakfast (left). Water scooped from the river fills wash pans; refuse goes over the side. Each man uses his own towel.

Above: Joe Ross, Idaho's version of the late Will Rogers, combs his hair for the evening meal.

Hungry Loggers Meet Heaping Platters at the Breakfast Table

Modern kitchen crews are culinary masters compared with early logging cooks, who baked bread over open fires and cooked beans in ground holes. In those days the fare was always the same—salt pork, beans, bread and molasses, tea, and pie. The tea was black and strong enough to float a steel wedge, old-timers said. If a man could boil potatoes or bake biscuits, he was accomplished enough to be a camp cook.

During the '80's cooks announced mealtime with tin horns called "gabreels" (from Gabriel). These instruments grew with the expansive times, some reaching eight feet in length. Cooks vied in blowing the sweetest calls. They could be heard for two miles.

Outside the cookhouse the foreman bossed the camp, but the cook ruled within. If a man raised his voice, the cook had the right to slap him off his seat. Modern loggers still maintain mealtime silence. Some say this custom stems from cooks' desire to have the men eat their fill and get out quickly.

White-aproned cooks, and cookhouse crews known as "cookees," appeared in the '90's. Coffee and canned vegetables supplemented the monotonous diet.

Nowadays loggers eat wide varieties of calorie-balanced dishes. Breakfast menus include cereal, bacon, sausage, doughnuts, pie, and piles of flapjacks.

Ross Hall

"Have a Dip." Buddies Share a Snuffbox

Minnesota Swedes are credited with having introduced snuff into the logging camps. Holes have been burned in Swedes' lips, lumberjacks will tell you, by the thumbfuls of "snoose" taken since childhood.

Forty years ago woodsmen considered cigarette smokers to be worthless and effeminate. Today logging-camp stores sell more cigarettes than smoking and chewing tobacco combined. Diapers, lipstick, and hairnets are carried by these same stores.

Loggers had a language all their own, but it is disappearing along with the men who used it. To them a kitchen helper was a "flunky." Old-fashioned bunks crawled into over the foot were "muzzle-loaders." Blankets were "sougans." Employment agents were "job sharks" and their offices "slave markets."

Modern lumberjacks have their own jargon. To them, a caterpillar mechanic is a "cat doctor."

Ross Hall

Torn Softens His Boots with a Hot-water Rinse

While working on jams, drivers are constantly wet to their armpits. So, since boots are bound to get cold-wet in the river, they might as well start off hot-wet, logger philosophy proclaims.

As soon as the men return to camp, they remove wet clothing and warm up by the fire. Few catch cold on the drive.

Old-timers cared little how many hours made a day's work. They kept track of time by cutting notches in their boots. A small notch meant half a day, a long one a full day's work.

Canny foremen pitted crews against one another, offering small bonuses for record cuttings. Speed in felling a tree or breaking a jam rated a man. If he could lick every logger in the crew, the woodsman made a good foreman.

Ross Hall

Ross Hall

Razor-sharp Boot Calks Command Their Owner's Loving Care

In the evenings the men spend hours oiling and calking boots. They constantly inspect the spikes, which, gripping logs, prevent their tumbling into icy streams.

Square Pegs in Round Holes Hold a Bunkhouse Raft Together

Once watersoaked, the square pegs expand, gripping the cedar logs securely. Metal bolts might splinter logs rafted down rapids, as this platform is forced to do.

Lunch Finished, Crewmen Relax; to Sleep or Talk Is the Question

Underwear, socks, and pants are stout and heavy. Cuffs are torn off because they collect water and snag on logs. Loggers do their own housework, patch torn clothing, and sew on buttons. By 9 p. m. all hands are dead tired and ready for bed.

J. M. Rottler

Wholesome Food, Peaveys, and Boots: What Lumberjack Wants More?

Joseph Peavey, a Maine blacksmith, designed the peavey in 1858 after watching a river crew struggle to break a jam. It is a stout lever with a hinged spike used for rolling and shifting logs. Today's loggers find the invention indispensable.

Ross Hall

that wood-and-metal miracle, the fine piano.

"Apart from the cast-iron frame, wood still is the basic material of piano parts," Mr. Henry Z. Steinway, vice president of Steinway & Sons, told me. "Total tension on a piano is approximately 18 to 20 tons, supported at one side by steel pins gripped by a 5-ply tuning-pin block of hard maple.

"Our sounding boards are made from quartered spruce," Mr. Steinway explained. "We've patented a 'diaphragmatic soundboard,' tapering from less than a third of an inch at the center to less than a fifth of an inch at the edge. This shaping allows the sounding board to vibrate as a whole and throw off more tone.

"We build up our grand piano rims of bent maple laminations," he continued. "All case parts, such as top, desk, and keylid cover, are of laminated wood. Fine mahogany or walnut veneers finish off our instruments."

During the late war Steinway manufactured hundreds of wooden wings for troop-carrying gliders. But the famous firm still managed to produce about 2,500 diminutive "GI pianos"; some of them were played for undersea audiences—in big submarines.

Ever since the ancient Greeks strummed the cithara and blew the aulos, wood has been favored for musical instruments (page 113).

The National Symphony Orchestra of Washington, D. C., a typical major orchestral group, usually plays 73 wooden instruments. All the strings—violins, violas, cellos, and contrabasses (bull fiddles)—are wood. Maple and spruce, aged from 25 to 40 years, are preferred for their construction. Finger boards, pegs, and tailpieces are made of black ebony.

The pipelike wood winds—clarinets, oboes, English horn, and bassoons—are fashioned from wood, most often African blackwood and granadilla.

The harp's frame is spruce or maple, the xylophone's bars Honduras rosewood.

Bass drum and tambourine have shells and hoops of mahogany or maple. Players of the strings wield bows of Pernambuco wood, and the conductor one-two-three's with a maple or holly baton.

Sports Equipment Takes a Beating

Whether you sail, bowl, fish, shoot, or play baseball, tennis, golf, hockey, or croquet, wood implements your sport or game (page 135).

"Sporting goods get constant abuse from impact, torsion, abrasion, or all three at the same time," said J. N. Tynan of A. G. Spalding & Bros., Inc. "Our problem is to build equipment that will hold size, shape, and life for long periods."

Lamination imparts wiry backbone to rackets for all court games. Early rackets were steam-bent from a single piece of ash, hickory, or oak. Spalding workers shape their rackets from 8 to 12 sawed laminations of ash.

When a powerful tennis player hits a service blow, his racket may bend as much as two and a half inches. Shoulder overlays distribute the resultant severe strains from tip of frame to handle.

"In Spalding's frame-whacking test," Mr. Tynan told me, "we rotate two rackets at a time at very high speed. A special timing device drops a tennis ball that hits each racket in exactly the right spot as it reaches the top of the arc.

"The force of this whacking-machine blow is 70 percent harder than the most powerful man-made service," he added. "One hour's test is roughly equal to a season of hard court use. We've broken inferior laminated rackets in five minutes, while better frames have survived four hours' whacking without injury."

Bats Give the "Bang" to Baseball

One sunny afternoon in 1884, Bud Hillerich, a young wood turner playing hooky from his father's shop, was watching a baseball game in the Louisville, Kentucky, ball park. A groan went up as the home-town slugger, Pete Browning, broke his favorite bat.

Young Bud persuaded Browning to go to his father's plant and let the youth try to make a replacement bat. Wielding the new swat stick, Browning next day got "three for three"—and the Hillerichs were in the bat business!

Today the name Hillerich & Bradsby, makers of famous Louisville Slugger baseball bats, evokes all the tense thrill of America's national game. H & B's fame brings mail addressed simply to "The Bat Man," "The Bat Factory," or "The Bat People."

When Honus Wagner in 1905 agreed to use of his signature on Louisville Slugger bats, it was the first of a long line of baseball's immortal names to appear on H & B's autographed bats.

"Every single club in organized baseball, we believe, uses Louisville Sluggers," Jack McGrath of H & B told me. "We've made bats to the personal measure of every great star of the past 50 or 60 years. Babe Ruth notched one of our bats 21 times and another 27 times to record the home runs he hit with each."

Hillerich & Bradsby Co. easily leads the world in baseball and softball bat production. In 1950 the firm turned out more than three million bats. H & B makes bats from ash and hickory, with ash far ahead in popularity.

Chase National Bank Collection of Money of the World

Don't Take Any Wooden Nickels? She's Happy to Do So

Chase National Bank, New York, treasures more than 1,000 wooden nickels in a money collection totaling 75,000 pieces. Some displays are bill-shaped (right). Others resemble playing cards, oyster shells, or watermelons. An exhibit from Blaine, Washington, is the original wood nickel of the 1933 bank holiday. Most tree-grown cash celebrates special events.

About a tenth of the estimated $48,000,000 worth of fishing tackle (at manufacturers' prices) sold to U. S. anglers in 1950 was for wood and bamboo fishing rods.

Fly, bait, and salt-water fishing rods consume mile upon mile of strips of hard, springy Tonkin cane, a Chinese bamboo. Bamboo is a grass that yields wood at maturity. For rod butts and forward grips, makers also use quantities of hickory and maple turnings.

One firm alone made 1,110,000 wooden fishing lures last year.

Ski and Crutch Leadership Is Coincidental

Outdoor Americans have taken to skiing like jam takes to a small boy's face. The best wood for skis is hickory from the almost snowless south-central United States. All ski-making countries import it for their finest models.

The New Hampshire State Planning and Development Commission, proud of two truths about their State, firmly declared "no connection" between them: (1) New Hampshire is one of the country's top ski centers; and (2) New Hampshire produces three-quarters of the United States' output of wooden crutches!

Wood, seldom out of sight in some familiar use, also serves faithfully behind the scenes.

Intricate and ponderous steel structures that carry the huge weight of our industry and defense owe their perfection to wood. Steel, automotive, and airplane plants, as well as shipyards and ordnance works, buy quantities of wood for models, templets, patterns, and mock-ups. These are as essential to the end products as a bolt is to a lock.

At the U. S. Naval Gun Factory in Washington, D. C., chief quarterman E. C. Lynch led me around the patternmakers' benches. I watched woodworkers contour the wood "originals" from which molds are made for casting parts of naval guns, from 40-mm. antiaircraft types to giant 16-inch battleship rifles.

Mr. Lynch showed me a 20-foot-high gun-director turret, gray-painted like the finished maze of metal. Every bit of that meticulous mock-up was wrought from wood.

Gun Factory carpenters made the scale interiors of battleships that two cars of the Freedom Train carried all over America.* Mr. Lynch showed me the original wood carving from which was cast the plaque placed in the

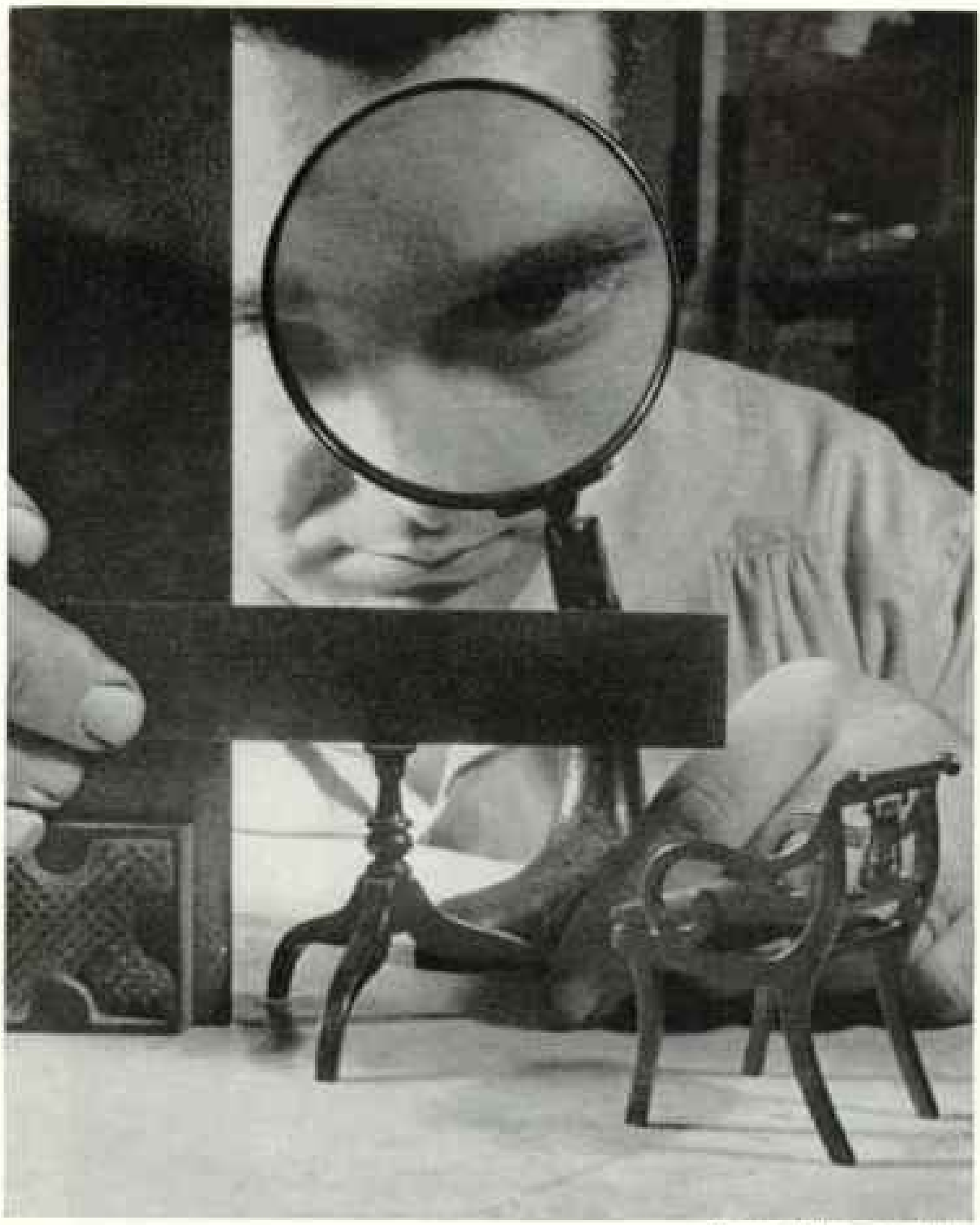
* See "Freedom Train Tours America," 16 ills., National Geographic Magazine, October, 1949.

deck of the battleship *Missouri* to commemorate the Japanese surrender.

Wood has a conspicuous record in certain bearings, where it outperforms steel, bronze, and other metals.

Quiet-turningpulleys of Venetian blinds are cut from lignum vitae, rich in a waxy, lubricating resin. At the other end of the scale this dense tropical wood serves in huge rollneck bearings in steel rolling mills. Shipbuilders still use lignum vitae for main bearings to cradle propeller shafts on many types of vessels. Stern-tube bearings of lignum vitae are preferred for submarines; their vibrations are less likely to be picked up by detecting equipment than those of metal bearings.

Lignum vitae still does service in a wide range of oilless bearings. Most wood bearings, however, are now made from northern hardwoods, mostly maple, impregnated with oil.



George Pickow, Three Lions

Toy Furniture Is Assembled Through the Magnifying Glass

Working in wood and ivory, J. Di Simone craftsmen in Jackson Heights, New York, specialize in miniatures. Their reproductions of classical furniture are so accurate that tiny drawers slide out, tilt-top tables tip, and desk lids open. This artisan levels a table pedestal. A lyre-back chair stands completed.

A man with an artificial leg may give no hint of his handicap, because a self-lubricating wood bearing in the knee joint smooths action of his ersatz limb. Dynamite makers guard against explosions by placing wood bearings in rollers supporting belts moving the inflammable ingredients. Screw conveyors handling sugar, flour, feed, chemicals, and other products susceptible of contamination depend on self-oiled bearings.

Wood bearings have functioned without attention for as long as 31 years.

Life Without Paper? Unthinkable!

Paper in countless uses buttresses our civilization. Some 93 percent of paper is made from wood.

The paper these words are printed on started life as trees growing on the hills of New England and eastern Canada. The logs were transformed into the bright coated sheets that contribute so much to the appearance of your NATIONAL GEOGRAPHIC MAGAZINE at the Champion-International Company mill in Lawrence, Massachusetts.

Our paper towels, napkins, and disposable tissues have their origin in the forest. Printed papers are our "tickets" on life's journey. Words on processed wood make our birth official. They form our schoolbooks, movie tickets, driving and marriage licenses, bonds and shares, documents and deeds.

Paper carries the printed word that instructs, informs, and entertains all of us. More than 12,000 U. S. newspapers annually cover about 4½ million tons of newsprint

E. I. du Pont de Nemours & Company

Thirsty Cellulose Sponges Can Sop Up Water 20 Times Their Weight

Trees provide four-fifths the cellulose used as chemical raw material; cotton linters account for the rest. Familiar cellulose-base products include rayon, photographic film, and tire cords. For certain purposes, cellulose sponges have advantages over sea sponges. They float; they may be boiled. These girls inspect a Du Pont product in Buffalo, New York (page 137).

(made from spruce, fir, and pine logs) with news and ads by the square mile.

Every year we print half a billion books—three and a third per citizen.

An early product of the paper age, however, was a concession to looks, not learning: Boston alone made 75 million paper collars in just a single year.

Each American man, woman, and child uses annually, on the average, somewhat more than twice his or her weight in paper and paperboard.

Almost half our paper output goes into paperboard. A single company, Container Corporation of America, shipped 864,000 tons of paper and paperboard containers and cartons in 1950. CCA leads the paper packaging field.

Wood boxes, crates, and baskets, however, still outstrip paper ones for carrying a huge volume of berries, citrus fruits, apples, tomatoes, and winter vegetables. Stouter types haul everything from tiny screws to heavy machinery and aircraft engines.

Plywood "Unreeled" from Big Logs

Familiar, Jack-of-all-trades plywood is among the top five consumers of wood in the United States. Layers of wood glued together with the grain of adjacent veneers at right angles give great strength in light, easy-to-handle sheets.

Plywood excels for furniture, cabinets, partitioning, doors, boat hulls, trailers, crates, and for manifold cutout uses from display panels to jigsaw puzzles, templets, and toys.

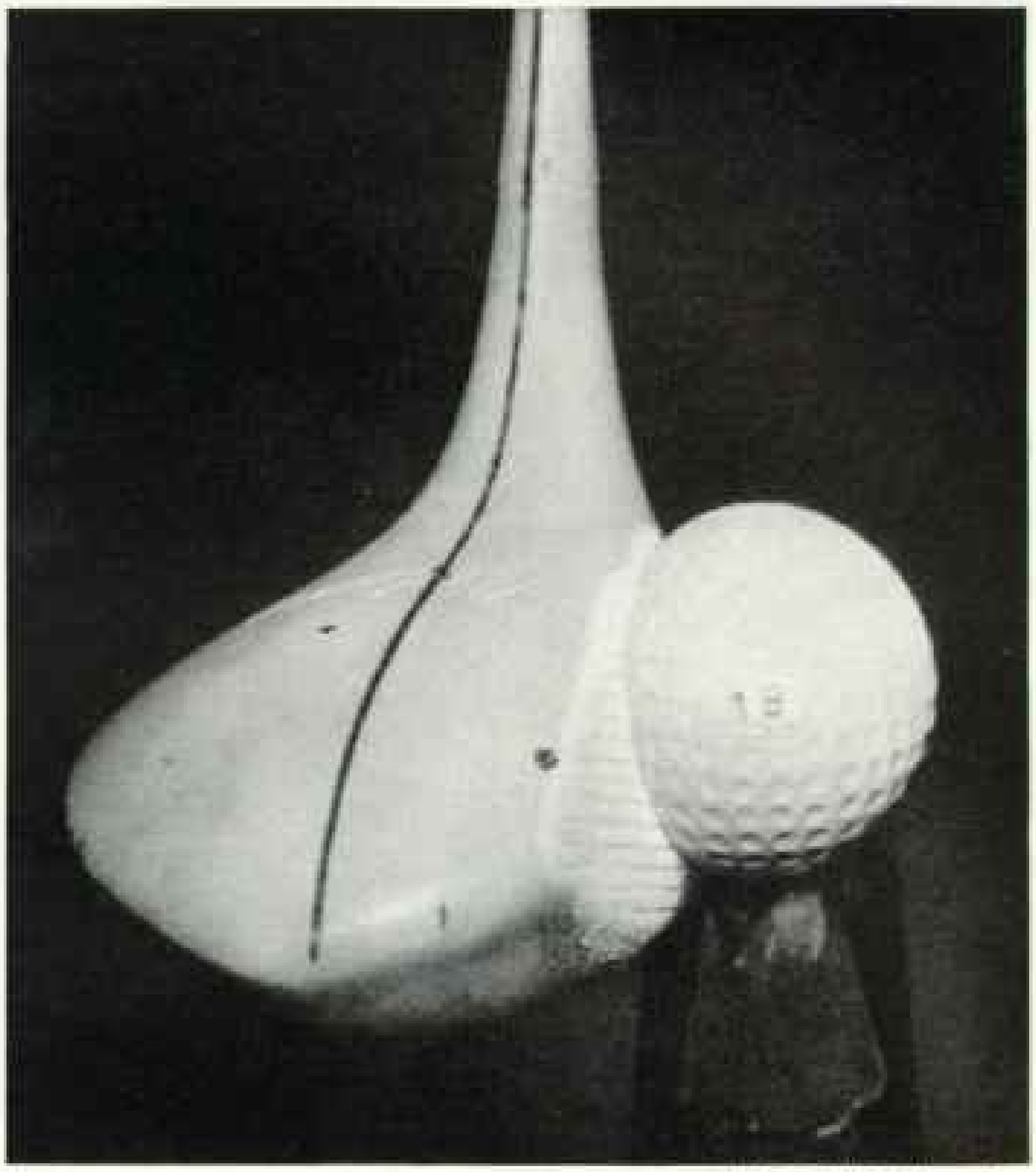
Huge virgin conifers of our Pacific Northwest, especially Douglas firs, pro-

vide the finest plywood "peeler" logs. Thousands of feet of veneer "unreel" from a single big fir bole turning against steel knives. Workers cut and dry the veneer sheets, then glue and hot-press them together, usually in odd-numbered groups of plies—three, five, seven.

Electrical engineers have contributed a foolproof technique for setting glues. In this so-called "high-frequency gluing" an electric current passes between electrodes embedded in each face of a press. Almost instantaneously the current heats the glue line and firmly bonds adjacent wood surfaces—the plies of veneer that make up plywood, for example.

Areas of uncured glue, weak spots in cheaper plywood, cannot occur, for the electricity reaches every molecule of the adhesive.

As choice peeler logs—old trees, three or four feet in diameter—grow fewer, fabricated panel boards and synthetic plywoods may cope with the dwindling supply. The U.S. Plywood Corp. is topping its huge "repertoire" of solid-wood and wood-and-metal products with a three-ply panel, Novoply, with wood-chip cores faced with layers of bonded shavings.



A. G. Spalding & Bros., Inc.

Wood Flattens Ball with a 2,000-pound Blow

Driver and ball at the climax of impact are caught by the high-speed stroboscopic flash. A split second later, the reaction will send the sphere rocketing 170 miles an hour. Laminated club heads are now in use, but solid persimmon wood remains the first choice of golfers.

Fine furniture exploits to the full the beauty of wood grain. Purchasers so often demand "the natural wood appearance" because it's instinctive in most of us to enjoy wood for wood's sake.

Rich Veneers, Furniture's "Make-up"

Furniture makers stress veneer for chests of drawers, tables, cabinets—pieces displaying broad, clear areas of wood. With expert care they apply thin slices of beautifully patterned wood to exposed surfaces of sturdy, but less costly, core stock.

Veneers add that "rich look" not only to furniture but also to radio, record player, and television sets. The Radio Corporation of America, for instance, in 1950 used 23,500,000 square feet of veneers in RCA radio and television cabinets.

A tropical wood, mahogany, and a domestic species, American walnut, compete for top honors as volume cabinet woods, for both solid and veneering uses. Other tropical woods grow increasingly popular, but the totals of all these "newer" exotic species combined do not approach the quantities of walnut and mahogany used.

Choice veneering woods, with dense and twisted "picture-making" fibers, have brought sky-scraping prices; exceptional mahogany logs have sold for as much as $15,000, walnut stumps for $6,000. Such precious specimens, of course, are as scarce as early issues of the NATIONAL GEOGRAPHIC.

"Despite its long journey from tropical forests, mahogany is not only the most widely used but also the least expensive of major cabinet woods, imported *or* domestic," said George N. Lamb, secretary of the Mahogany Association, Inc. "Four-fifths of mahogany veneer sells for less than 3½ cents a square foot. Not exactly a 'jewelry' wood, is it?"

156

Wide World

Philadelphia Unearths, Not Revolutionary War Cannon, but Old Wooden Mains

Tree trunks with 6-inch bores were laid as water conduits in days when iron and concrete were scarce. These cedar pipes were installed about 1815, abandoned around 1825, when 12-inch cast-iron pipe became available. They remained in good condition, but wrought-iron bands coupling the logs rusted away.

Three-quarters of all household furniture is made of wood, most of it hardwoods, the broad-leaved trees that in temperate latitudes mostly shed their leaves in winter. Quarter-sawn red gum holds top preference for solid parts of furniture. Workers often apply walnut, maple, and mahogany veneers to gum core stock.

"Grand Rapids" Means Quality Furniture

In the trade, "Grand Rapids quality" means high-grade furniture, wherever made. Grand Rapids, Michigan, has become, of course, virtually synonymous with furniture.

But there are many other centers of the industry, among them New York, Chicago, and Los Angeles; High Point, North Carolina; Rockford, Illinois; Evansville, Indiana; Jamestown, New York; Gardner, Massachusetts; and Sheboygan, Wisconsin.

In Washington, D. C., I visited the laboratory of the Timber Engineering Company, a commercial wood-products testing firm affiliated with the National Lumber Manufacturers Association. Joe Stearns of TECO's research staff was sitting on an office desk talking to me about the laboratory's current projects.

Stearns casually laid down a freshly lit cigarette on the gleaming desk to pick up a sample laminated bowling pin.

"Watch that cigarette!" I warned. "It'll burn your brand-new desk."

"No, it won't," Mr. Stearns calmly stated. "There's a thin sheet of aluminum foil bonded under the wood veneer of this desk top. The aluminum carries the 700 to 1,200-degree heat away so fast from the burning cigarette that the wood never gets hot enough even to scorch."

One of several office furniture makers now featuring these TECO-developed desk tops is the Myrtle Desk Company of High Point, North Carolina. They sand down walnut desk-top veneers of their Pacemaker line to bring the heat-drawing aluminum sheet as close as possible to the surface. A burn-proof varnish finishes off the job.

When the chemist in industry breaks down wood into cellulose and lignin, he's releasing

137 National Geographic Photographer Robert F. Hixson

An Operator Guides the Master Machine; Robots Simultaneously Copy Its Work

Albert Van-Stee, using a multiple carving machine, roughs out designs in six mahogany cocktail tables for the Widdicomb Furniture Company, Grand Rapids, Michigan. Despite its elegance, imported mahogany is the cheapest of all major cabinet woods. "Grand Rapids quality" is synonymous with excellent furniture.

key raw materials. Wood is approximately one-half cellulose and one-third lignin.

Lignin provides tannins and vanillin, and holds promise as an industrial chemical source. Lignin also is a base for hard, waterproof plastics, the stuff of radio cabinets, kitchen utensils, electrical equipment, combs and brush backs.

From Cellulose Come Rayon, Film, Sponges

Vastly more important for the present is cellulose. Cotton linters still are a source of the cellulose used as a chemical raw material, but four-fifths of our supply comes from trees. Hemlocks of the Northwest yield about 90 percent of wood-derived chemical cellulose.*

In one major use, technicians treat cellulose chemically to provide a syrupy liquid they force through tiny holes into a special bath. There fine filaments form and harden into viscose rayon, one of our basic textile fibers. Cellulose also is the raw material of acetate and cuprammonium rayon.

Mills weave rayon into all kinds of fabrics, from dress goods and underclothing to conveyor-belt materials and cord to strengthen auto tires. Three-fourths of the cellulose used in rayon last year came from wood pulp.

Photographic film, alike for Hollywood's costly motion picture cameras and for your inexpensive snapshot box, is made of cellulose acetate—so-called "safety film"—or from cellulose nitrate. Cellulose also is a base for plastics, including well-known celluloid.

Cellophane, glassine, and greaseproof papers spring from cellulose. They protect, and at the same time display, foods, blankets, lampshades, and hundreds of other items.

World-renowned E. I. du Pont de Nemours & Company of Wilmington, Delaware, uses enormous quantities of cellulose as a raw material in its ramified operations.

Six Du Pont departments make more than a dozen products based on this versatile material, officers of the firm told me.

Cellulose enters into Du Pont rayon, detergents and sizes for textiles, pyroxylin-coated

* See "Chemists Make a New World," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, November, 1939.

National Geographic Photographer J. Baylor Roberts

Using No Pigments, a North Carolina Artist "Paints" Portraits with Wood Chips

James B. Mason fashioned his Lincoln, Jackson, and Theodore Roosevelt with mosaics of tiny splinters, 50,000 or more to each picture. He achieved color detail by selection of natural hues. An overlay of finer fragments gave a third-dimensional effect. Pegs driven into plywood here outline a design.

fabrics for bookbinding and upholstery, nitrocellulose lacquers, and household cement. It provides the stuff of Du Pont photographic film, smokeless powder, cellophane, cellulose sponges, and plastics (page 134).

"Waste" a Challenge to Wood Users

Abundance of wood has made our people lavish in its use—and heedless, too. Every year we wastefully or extravagantly dispose of well over 100 million tons of wood, much of it burned as fuel for lack of better use (page 114).

About half this appalling loss occurs in the woods and half in processing. Every singing saw chews out from 20 to 25 percent of the wood in sawdust for each board it rips free.

The U. S. Forest Service states that only 43 percent of all the wood handled yearly in this country goes into merchantable products other than fuel. Twenty-two percent is burned as fuel, including much of the inescapable waste in wood manufactures.

Thirty-five percent is not used at all.

Yet in developing the know-how to achieve total utilization of wood, men already have bettered the butcher's boast of using all the pig but the squeal. Modern wood magicians can now use all the tree, *including* the bark! Dozens of uses have been found for bark.

George M. Hunt, until recently director of the Forest Products Laboratory, showed me big wood panels edge-glued together from small strips. He told me such stock-from-scraps has high priority these days.

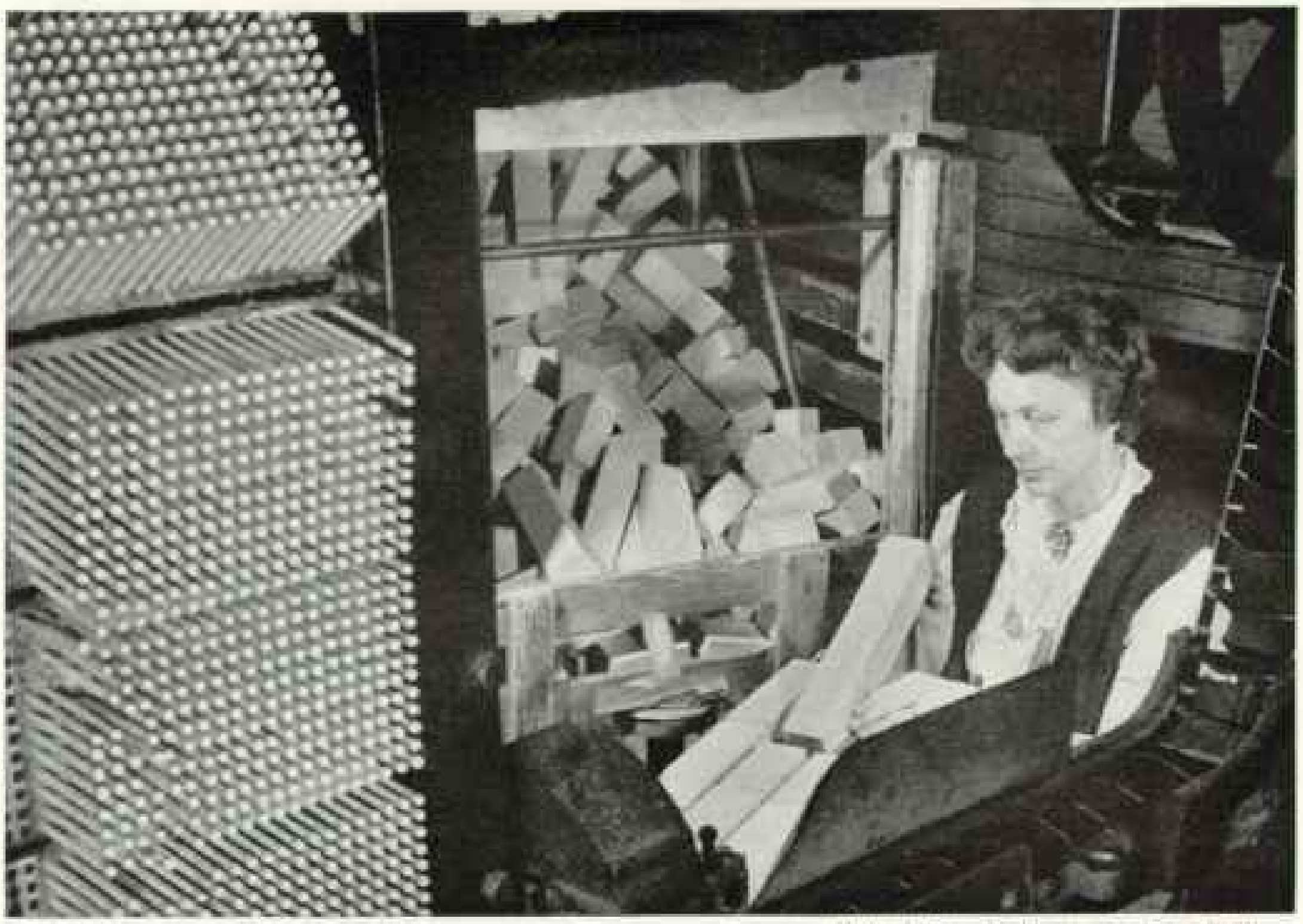
Fabricators keep a weather eye cocked toward the day when tall virgin timber may no longer be available in today's generous quantities.

Makers of panel, insulation, and hard boards are using former "wastes"—sawdust, slabs, chips, ends, and so forth—as raw material.

Exploded Chips Yield Dense Panel

Pioneer in hardboard from wood chips was the Masonite Corporation. In the Masonite explosion process technicians subject wood flakes to steam under pressure.

When they release the pressure, the chips literally explode into fiber. Compressed under heat, this pulplike substance becomes dense, smooth-surfaced fiber hardboard adapted to



National Geographic Photographer Robert F. Sisson

A Million and a Quarter Matches an Hour Flow from These Blocks

Diamond Match Company's high-speed machine cuts up billets of Idaho white pine, dips the heads in chemicals, and turns out 10 million lights each 8-hour day. Finished matches (left) ride to packing machines in Barberton, Ohio, one of Diamond's seven factory centers (page 115).

any number of structural uses in home and industry.

Masonite's parent plant at Laurel, Mississippi, still turns out far more hardboard than any other single factory in the world.

The Puget Sound Pulp & Timber Co. of Bellingham, Washington, was among the first to make alcohol on a commercial basis from pulp mill waste liquors. The firm distills approximately three million gallons of 190-proof ethyl alcohol every year from fluids formerly discharged through sewers.

Weyerhaeuser Shows the Way

America's largest single lumber producer is the Weyerhaeuser Timber Company, with headquarters in Tacoma, Washington. The company seal bears the wise motto, "Timber Is a Crop."

Weyerhaeuser's saw-, box, and pulp mills dot Washington and Oregon. At Longview, Washington, they run a huge plywood plant.

Weyerhaeuser saws trainloads of choice lumber from sky-scraping western softwoods on its 2,000,000 acres of tree farms. But the company has invested fortunes to develop ways and means of using not only the clear hearts of big saw logs, but every scrap of wood hauled out of the forest.

Leftovers and by-products from one mill frequently become raw material for another.

The company makes, for example, a fistful of products from Douglas fir bark, the "useless" 12 percent of a log. They market the bark, under the name Silvacon, as a plywood glue extender and as an ingredient in insecticides, plastics, and soil conditioners.

Silvacon blended with special cement makes a trowel-laid flooring almost as quiet and resilient as linoleum or rubber. It takes a slick polish like terrazzo.

In a House-That-Jack-Built routine, Weyerhaeuser's shrewd operators also recover chemical by-products from "unwanted" liquid effluents of their Longview sulphite mill. They burn solids concentrated from these waste liquors to give power to help run the mill. Then they convert char from the boiler furnaces to chemicals used over again to cook the chips that yield the solid wastes that burn to leave the char that makes the chemicals that . . .!

George Pickow, Three Lions

Off with Saddle Oxfords, On with Wooden Shoes! It's Tulip Time in Holland (Michigan)

Klompendans (dancing in wooden shoes) is part of the annual flower festival in Holland, founded by Dutch immigrants. The girl cushions hard footwear with sponge rubber. Her partner will wear baggy breeches (p. 116).

Round and round goes this "cyclic recovery process."

Since the recent war, wood has played a proud part in restoring normal relations between countries. Millions of board feet of North American lumber are helping rebuild Europe.

A heart-warming story of wood's role in making friends across the oceans concerns two tornadoes that swept paths of destruction 23 years and 4,700 miles apart.

On August 10, 1925, a freak tornado devastated little Borculo in the Netherlands. Generous gifts from the United States helped rebuild the town's two furniture plants.

A generation later, on January 3, 1949, "a big black cloud with a red funnel" lashed the sawmill town of Warren, Arkansas. The tornado wiped out 300 homes and destroyed the large Bradley Lumber Company mill.

Word of the disaster reached Borculo. City fathers, remembering American aid in the tragic days of 1925, backed a drive to send a gift of furniture to stricken Warren.

Merchants and farmers contributed flour, eggs, sugar, butter, and other ingredients from which Borculo women baked thousands of cookies and doughnuts. Volunteers sold the delicacies from door to door. Entertainers raised additional funds.

The proceeds paid for 40 black oak armchairs, four conference tables, four round tip-top tables, a hand-carved chest, and a chandelier, all from Borculo.

On behalf of the people of the Dutch town, Netherlands Ambassador E. N. van Kleffens presented the gifts to Warren, Arkansas, on December 8, 1949.

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDING
SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON 6, D. C.

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded sixty-three years ago, the National Geographic Society publishes the National Geographic Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 26, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

A notable undertaking in the history of astronomy was launched in 1949 by The Society in cooperation with the Palomar Observatory of the California Institute of Technology. This project will require four years to photomap the vast reaches of space, and will provide the first sky atlas for observatories all over the world.

In 1948 The Society sent out seven expeditions to study the eclipse of the sun along a 2,320-mile arc from Burma to the Aleutians. The fruitful results helped link geodetic surveys of North America and Asia.

The Society granted $25,000, and in addition $75,000 was contributed by individual members, to help preserve for the American people the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

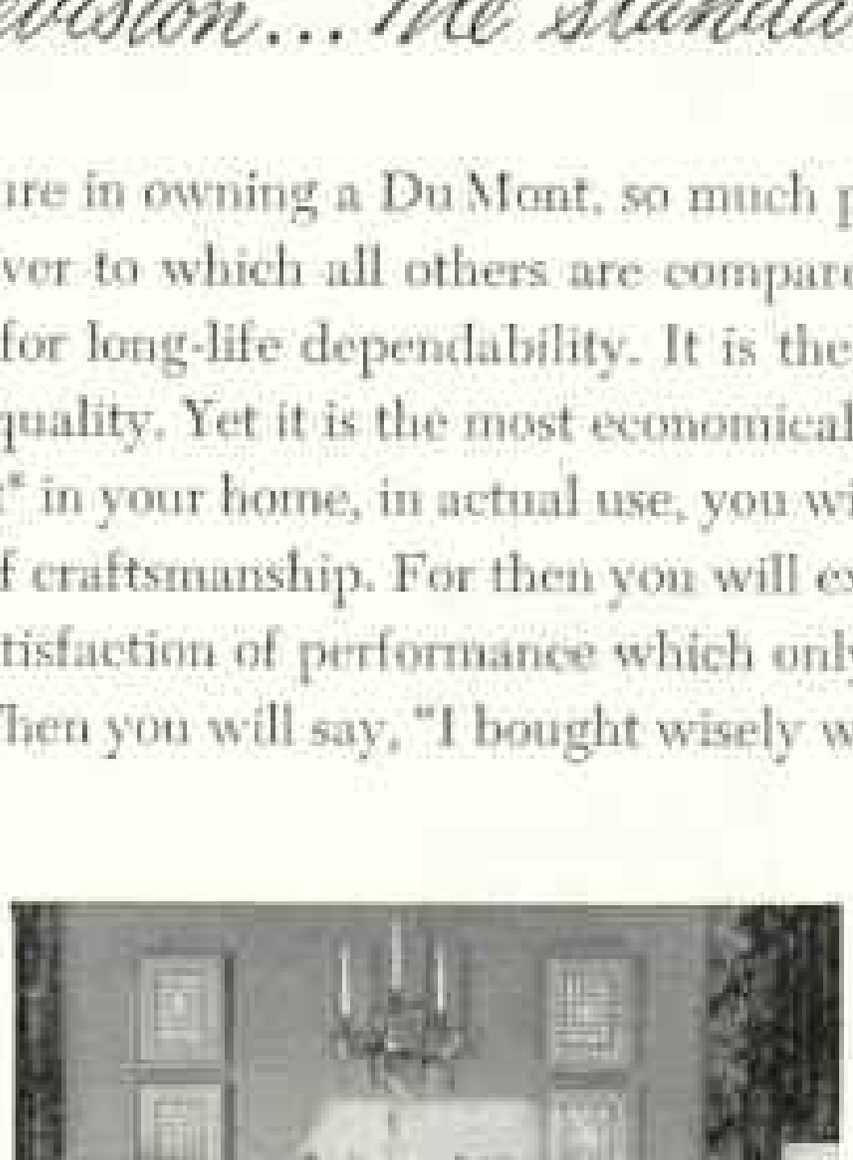
One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

Printed in U. S. A. Entered as the Post Office at Washington, D. C., as Second Class Mail Matter. Acceptance for mailing at special rate of postage provided for in Sec. 1103, Act of October 3, 1917, authorized July 1, 1918. Cover design and names registered in United States Patent Office. Marca Registrada.

Du Mont television... the standard of comparison

There is so much pleasure in owning a Du Mont, so much pride in knowing you have the television receiver to which all others are compared. For Du Mont is famed for finer performance... for long-life dependability. It is the very hallmark of superior television quality. Yet it is the most economical, for Du Mont costs *no more*. With a Du Mont Teleset® in your home, in actual use, you will know the *true* economy of owning a masterpiece of craftsmanship. For then you will experience the full enjoyment, the priceless satisfaction of performance which only Du Mont can offer. Then you will say, "I bought wisely when I bought a Du Mont!"

The Mr. Vernon, by Du Mont. 19-inch, direct-view tube; Lifetone® picture circuit; built-in, static-free FM radio; plug-in for record player. Cabinet designed by Herbert Rosengren.



DU MONT 20th YEAR AS PIONEER

first with the finest in Television

®Trade mark

Has his old man been hitting the coffee again?

1. Nervous father . . . boyish prank . . . flaring temper—and BANG! That's a sequence that happens too often—when a parent is tense, on edge . . .

2. Frequently—back of that edginess is the caffein in coffee. For many men and women, caffein results in sleepless nights and high-strung days!

3. What's to be done? Should you cut down on coffee—swear off entirely? Or is it true what people who have switched to Sanka Coffee say?

4. Every word's true! Sanka is real coffee—all coffee. Yet, it's 97% caffein-free. It can't get on your nerves or keep you awake. Try delicious Sanka Coffee today!

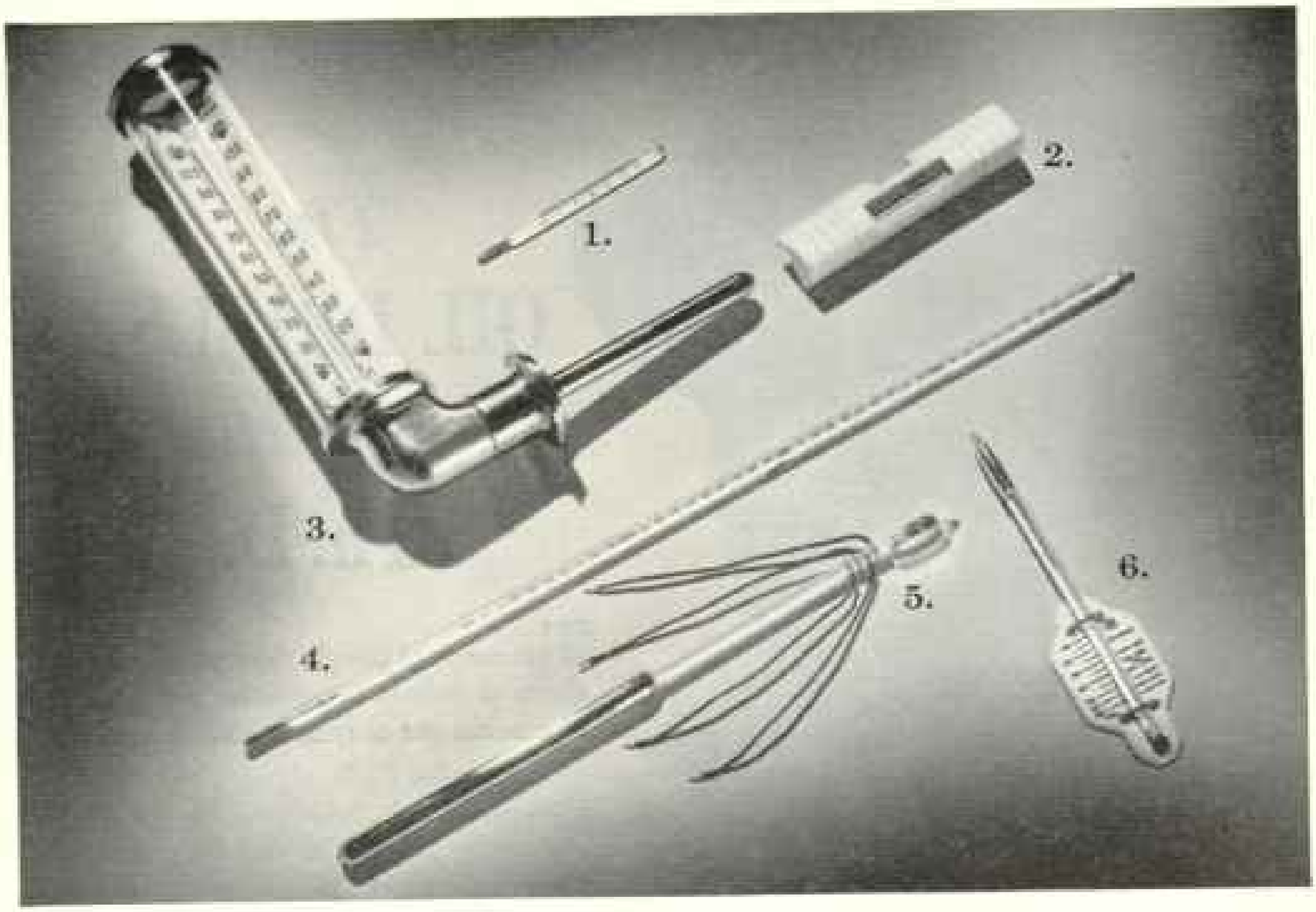
Product of General Foods

Sanka Coffee

Real coffee with the worry taken out. Drink it and sleep!

Get delicious, caffein-free Sanka Coffee in drip or regular grind—or in the convenient, economical instant form. A jar of instant Sanka gives you almost as many cups as a pound of regular—at about one-third less in cost. And remember—

Instant Sanka is the *only* instant coffee that's caffein-free!



Which takes the temperature of a battleship?

The thermometer with wires attached. (5)

It hangs in the powder magazine and long before the temperature there reaches the danger point, the mercury inside the tube makes an electrical connection and sounds an alarm.

The right-angle thermometer (3) is screwed in the side of a milk-pasteurization tank. It tells when milk has reached the proper heat for killing harmful bacteria. And the long thin one (4) is used by research chemists.

The stubby model (2), made to register only low temperatures, is to put in your home freezer. Poke the meat thermometer (6) into a beef roast in your oven. When the thin black line pushes up to "Medium Rare," you can take your roast out—sure the slices will be pink and juicy.

And everyone recognized the fever thermometer (1) which your doctor uses when you are ill.

These are only a few of the more than 1000 kinds of glass thermometers made from tubing manufactured by Corning Glass Works.

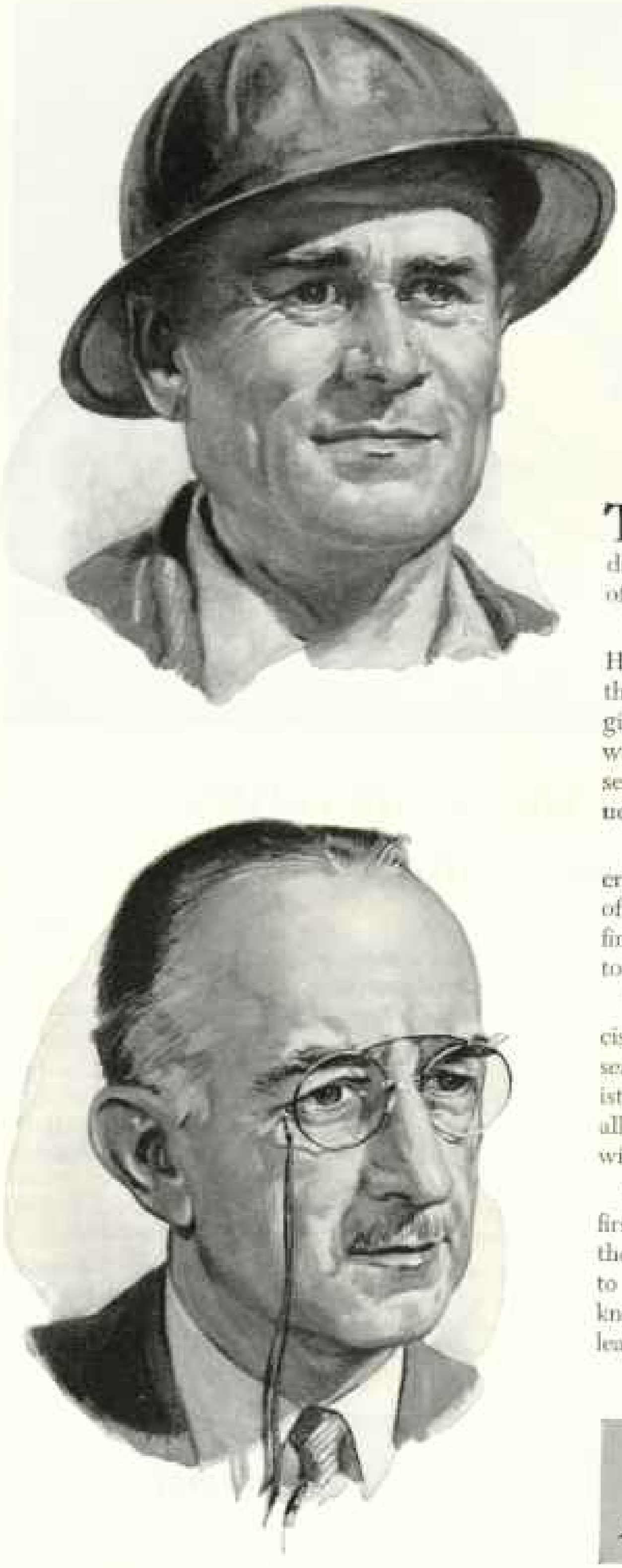
The accuracy of a thermometer depends to a great extent on the uniformity of the tiny bore which runs the length of the glass tubing. Making a short length of tubing with a bore ¼ the diameter of a human hair is difficult enough. But Corning turns out mile after mile of such precise and uniform tubing.

Thermometer tubing is but one of thousands of products that have resulted from *Corning's research in glass*—research to develop the right kind of glass for the job, research to develop new ways to make glass precisely by mass-production in order that it can be used for widespread product and process improvement.

If you are planning new products or processes, it will pay you to call on Corning before you reach the blueprint stage. Write Box N5, Corning Glass Works, Corning, New York.

CORNING
means research in glass

1851—100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL—1951



The OIL DRILLER *and the* Ph. D.

Thousands of people must combine hundreds of skills to bring you a single gallon of Sinclair gas or quart of Sinclair oil.

There's the Ph.D. at our laboratories in Harvey, Illinois, who took his degree in the higher regions of chemistry and engineering. His job: to figure out in advance whether a given project in petroleum research will provide a new and better product and pay off in dollars and cents.

. . . And the oil well driller, who gets crude oil out of the ground. A "doctor" of many trades, he has to be carpenter, fireman and electrician as well as cable-tool and rotary drill operator.

Then there are land-leasers, geophysicists, rig builders, pipeliners, railroaders, sea captains, engineers, stillmen, chemists, salesmen, and many, many more. In all, Sinclair has over 20,000 employees with about 400 different skills.

Together, these people give Sinclair first hand knowledge of every phase of the petroleum business, from oil-discovery to marketing. Their combined, broad knowledge is another reason for Sinclair's leadership in the petroleum industry.

SINCLAIR
A Great Name in Oil

SINCLAIR OIL CORPORATION • 630 FIFTH AVENUE • NEW YORK 20, N. Y.

See the Southwest Indian Country from

the Pleasure Dome

of the new

Super Chief

Indian Country gliding past the wide picture windows . . .

You see it all as you relax in comfort in the Pleasure Dome of this fine new Super Chief—the train that sets a new world standard in travel.

Enjoy new cradled smoothness in the ride . . . the distinctive Turquoise Room . . . private bedrooms and room suites . . . Fred Harvey food.

For reservations—just see your local ticket agent.

Daily Service Between
CHICAGO-
LOS ANGELES

Santa Fe

R. T. ANDERSON, General Passenger Traffic Manager, Santa Fe System Lines, Chicago 4, Illinois

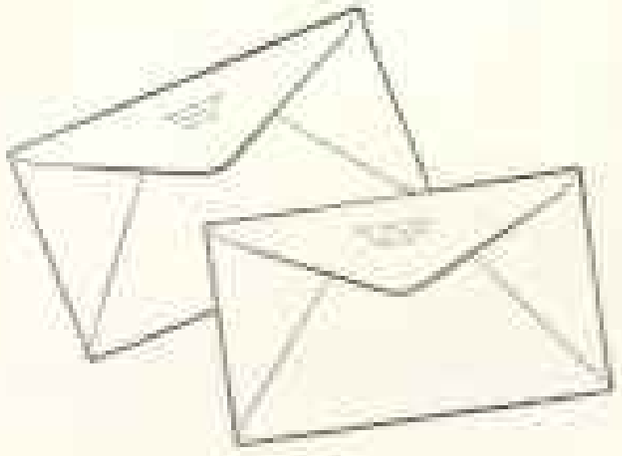
Saved...one hundred minutes!

...that is an extra bonus you receive with each Standard Package of American Stationery! Writing your name and address on 200 sheets and 100 envelopes would take approximately one hundred minutes of your time. Try it...

American Stationery's crisp, white rag content bond paper is neatly printed in rich blue ink. It is *correct* in color, weight and size. It is *quality stationery made inexpensive*. Where else can you buy 200 note sheets and 100 envelopes of rag content bond paper, printed, for only $1.00?...These are the reasons American Stationery has been used in America's fine homes for 35 years—for informal and household business correspondence.

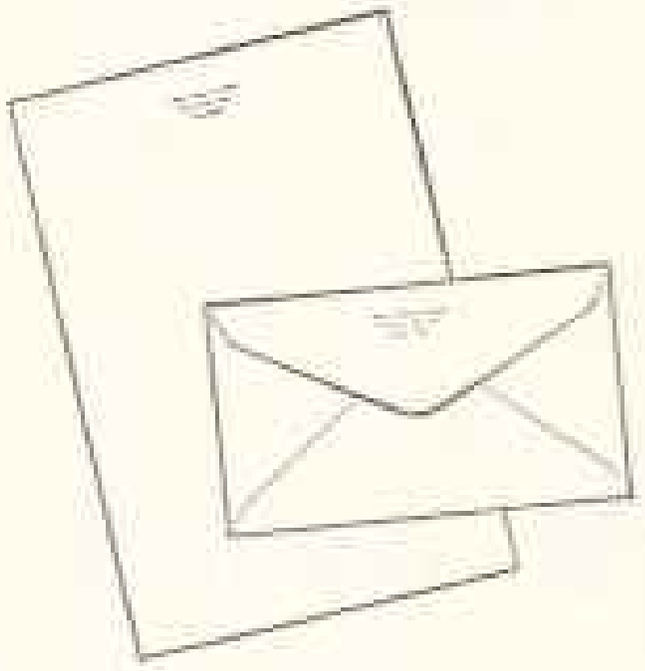
Order in quantities as listed. No "split-package" orders accepted. Maximum printing—4 lines, 30 characters per line. Remit with order. West of Denver, Colo., and in U.S. possessions, add 10% to prices. (No foreign orders.) We pay postage. *Satisfaction guaranteed.*

THE AMERICAN STATIONERY COMPANY
300 PARK AVENUE • PERU, INDIANA



ENVELOPE PACKAGE

200 ENVELOPES (same envelopes as in Standard Package). They seal *easily*. Perfect for mailing checks, etc. Printed with name and address **$1.00**



DELUXE PACKAGE

125 LETTER SHEETS (6¾ x 10½), 125 MATCHING ENVELOPES, in *heavier* paper. A distinctive correspondence stationery. Printed **$2.00**

AMERICAN STATIONERY

THE FINE STATIONERY
IN THE PLAIN BOX

STANDARD PACKAGE

200 Note Sheets
100 Envelopes **$1.00**

Printed with Your Name and Address

Memo to a perfectionist . . .

Wherever your photographic journeys may lead you . . . whatever your favorite subjects may be — the 2¼ x 2¼ HASSELBLAD Camera merits your interest. This is particularly true if you pursue your photographic work, and pleasure, with the practiced discipline of a perfectionist. For here is an instrument, precision crafted in Sweden, with built-in refinements that will bring a new range . . . a new sureness to your picture making. Interchangeable film magazines, interchangeable lenses, automatic controls, speeds to 1/1600 second, built-in flash — these are but a few of the features that make the HASSELBLAD a "must" for your personal inspection. Ask to see the HASSELBLAD at the finer camera stores.

PRICES — The camera, with 80mm Kodak Ektar f2.8 Lens and 2¼ x 2¼ roll-film magazine, $548. Accessory 135mm Kodak Ektar f3.5 Lens, $282. Prices include Federal Tax.

HASSELBLAD

THE NEW

SWEDISH REFLEX CAMERA

NATURALISTS
will appreciate the close-working sharpness of the matchless Ektar f2.8 Lens . . . focusing down to 20 inches without accessories . . . and to full scale with extension tubes . . . and with no worry about parallax.

PHOTO-REPORTERS
will be quick to exploit the dazzling 1/1600 top speed of the HASSELBLAD . . . excited at the prospect of freezing action at angles too difficult for slower shutters.

ILLUSTRATORS
will like the quick interchangeability of the roll-film magazines . . . permitting the use of different film emulsions, color or black-and-white, in one camera.

SPORTSMEN
will thrill at the "reach" of the Telephoto Lenses that bring distant, inaccessible subjects into working range . . . thanks to rapid interchangeability of the lenses.

Write for the descriptive HASSELBLAD booklet available through the American distributors —

Willoughbys

Dept. A A
110 West 32nd Street
New York 1, N. Y.

F.G.Gurley

President of the Atchison, Topeka and
Santa Fe uses a DICTAPHONE TIME-MASTER!

ONE OF AMERICA'S top executives, Mr. Gurley, President of the Atchison, Topeka and Santa Fe Railway System, says: "I am happy to join the many business executives who praise the TIME-MASTER for the remarkable, efficient machine it is. It's so easy to use, so handy to record thoughts the moment they occur."

Today more business people use the Dictaphone TIME-MASTER—with its new ONE-TIME recording medium, the *Memobelt*—than any other electronic dictating machine!

Most convenient medium ever developed. *Memobelt's* seamless, plastic belt is so small you can mail 5 at once in an ordinary envelope. So inexpensive you use it once and throw it away!

You get *more* done in *less* time at *less* cost.

Secretaries love TIME-MASTER's tiny, bell-clear Magic Ear. Light as a feather, it can't muss hair.

Learn how new TIME-MASTER and *Memobelt* get things done. Write for your free copy of Dictaphone's new booklet: "Time Itself." Write Dictaphone Corporation, Dept. H-71, 420 Lexington Avenue, New York 17, N. Y.

DICTAPHONE CORPORATION

GREATEST NAME IN DICTATION

"Dictaphone" is a registered trade-mark of Dictaphone Corporation

FOR YOUR SUMMER SAFETY

When swimming—be sure to take proper precautions when swimming or playing in the water, as drowning from these causes claims many lives each year. Do not swim alone—or too soon after eating. Obey all warning signs—especially those regarding diving or swimming too far from the shore. It is also wise to safeguard your children by teaching them how to swim early in life.

When sunning—remember that the sun is strong "medicine" and that sunburn causes an annual loss of several million work days. So, take the sun in small doses—about 10 minutes the first day, 20 the second. Sunburn usually can be prevented by applying a "sun-protective" preparation to the skin before exposure. However, to protect yourself against sunstroke or heatstroke, always avoid long, direct exposure to the sun.

When motoring—constantly watch other cars on the road. This may help you avoid an accident, even if other drivers do something wrong. By watching traffic carefully, it is often possible to anticipate situations that might lead to an accident. Take every precaution when you see others violating the rules of safe driving.

When exercising—make sure that you do not overdo any form of physical activity to which you are unaccustomed. The best rule, if in doubt, is to check with your doctor about week-end and vacation activities. He will advise you about the kind and amount of exercise that will be safe and beneficial. In any event, avoid excessive fatigue.

When camping—watch out for poison ivy, to which 2 out of 3 adults are sensitive. Remember the old adage—"leaves three, let it be." Also be on guard against other poisonous plants, such as poison oak and poison sumac. Be prepared for all minor injuries—such as cuts and burns—by including a first aid kit in your equipment.

When starting on a trip—make certain that your car is in good condition before starting on a summer outing. Brakes, steering mechanism, lights, tires and other vital parts should be thoroughly inspected. Remember, too, that the older your car gets, the more carefully it should be checked mechanically.

First aid courses are given in most communities by the American Red Cross. Taking these courses will help prepare you to act quickly and efficiently in case of accidental injury.

With a feeling of regret at the necessity for it, but also of pride in being assigned the responsibility, The Budd Company is rearranging its productive capacity to include the manufacture of *materiel* for the re-armament program. We are still working for our old customers in the automotive industry, but among future deliveries will be parts for tanks and jet engines, ammunition components, Army truck cabs, cargo bodies, wheels, hubs and drums.

Certain things, however, need no rearranging. These are the brains and imagination Budd employs to originate ideas that forge progress in transportation. And the skills which translate these ideas into steel. They have made The Budd Company a national industrial asset for making things that are needed, and making them better... whether for peace or war.

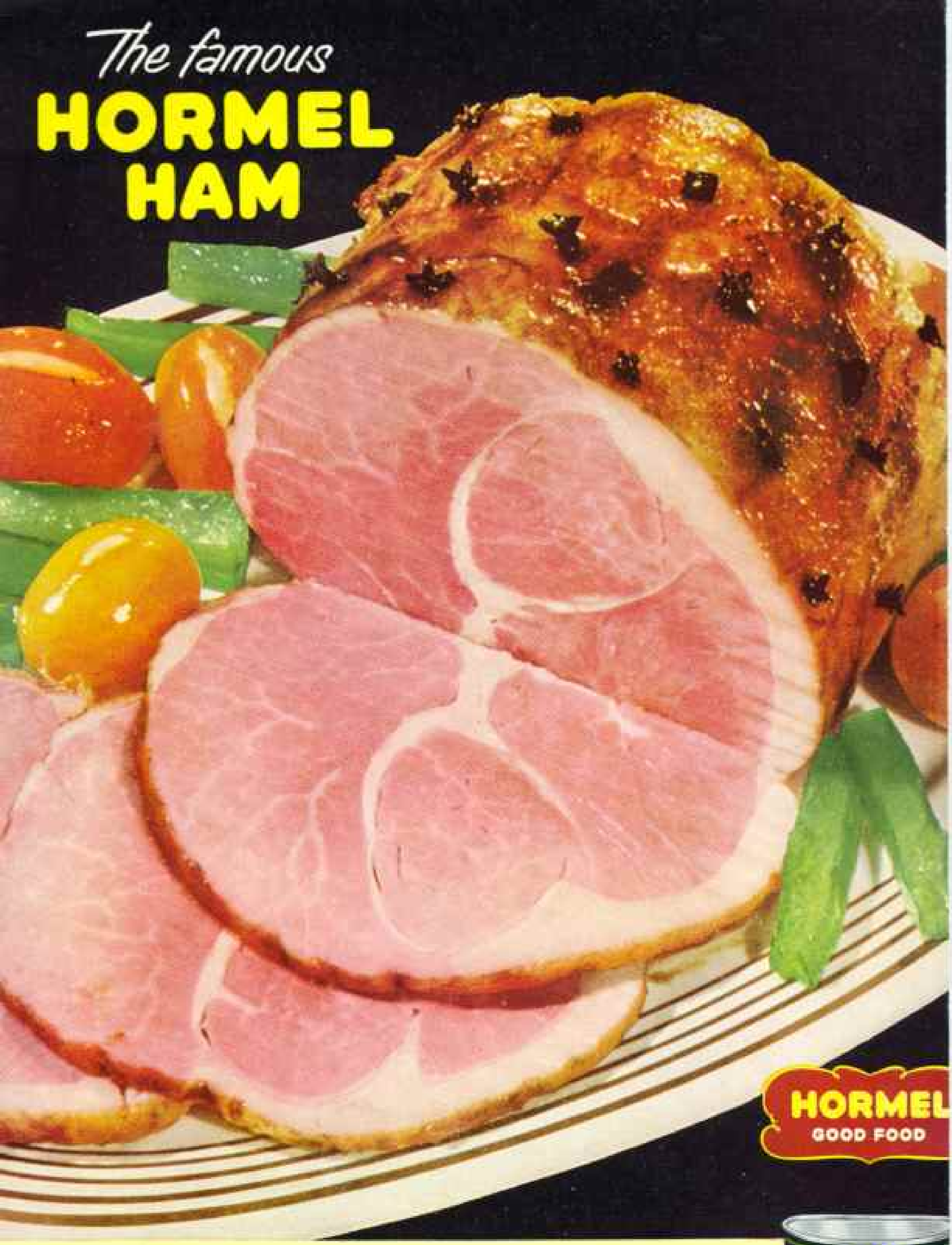
THE BUDD COMPANY
PHILADELPHIA • DETROIT • GARY

Budd

PIONEERS IN BETTER TRANSPORTATION

The famous

HORMEL HAM



Quarter size serves four Family-size version of that epicure's delight —whole Hormel Ham. Same tender pink meat, same delicious flavor. No bone, practically all lean, just enough fat. To slice cold, to bake, to fry. 1½ pounds. America's original—and finest—canned ham. Geo. A. Hormel & Co., Austin, Minn.

Hear MUSIC WITH THE HORMEL GIRLS . . . Saturday, CBS

Kodak
TRADE-MARK

You see it in color, and with your camera you can get it in color

If you have a box, folding, or reflex camera, you use Kodacolor Film for full-color snapshots—enlargements, too.

If you have a movie camera, you use Kodachrome Film for movies in gorgeous color.

If you have a miniature camera, you use Kodachrome Film and get beautiful color slides for home projection—for color prints and enlargements.

It's so simple! The color is in the film; you just follow the directions packed with every roll. And when your pictures come back—wonderful! They're gorgeous *color* pictures, and you can share your enjoyment of them with family and friends—on your home screen, or with extra full-color prints.

Eastman Kodak Company, Rochester 4, N. Y.

It's Kodak for Color

You'll be rested when arriving in COLORADO'S mountain-land

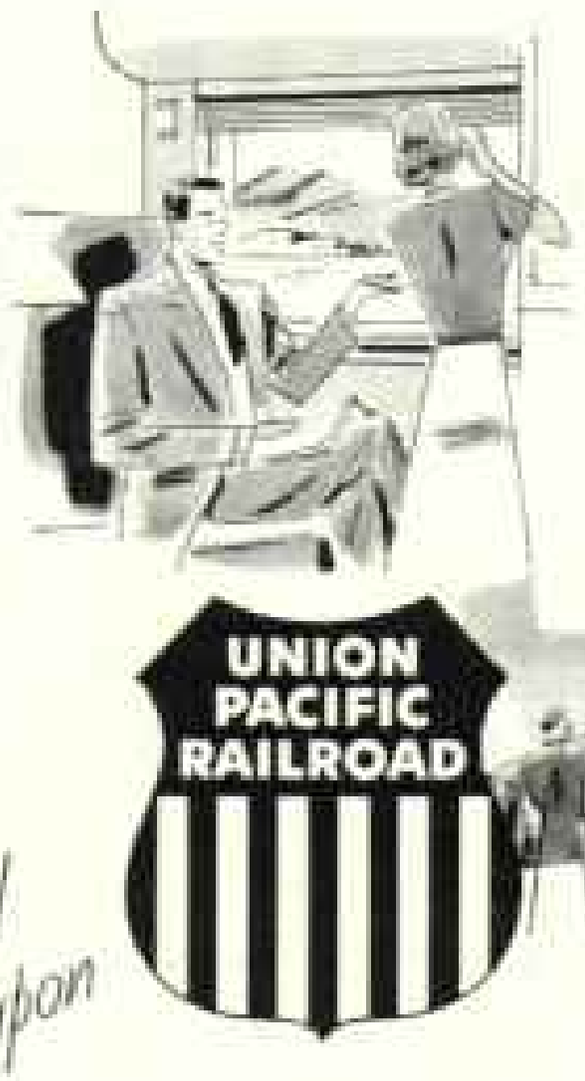
on Union Pacific Streamliners

"CITY OF DENVER"

Between Chicago-Denver

"CITY OF ST. LOUIS"

Between St. Louis-Denver



Looking across Bear Lake toward Longs Peak

● Start your Colorado vacation relaxed and refreshed . . . free from driving fatigue. Rest as you ride.

It's just overnight to Denver from Chicago—or St. Louis—on the Streamliners; also fine service from Pacific Coast. Spacious Pullmans offer complete comfort. For travel economy . . . restful, reclining Coach seats. And, as always, Union Pacific's "meals that appeal" are courteously, deftly served in attractive dining cars.

Ask your ticket or travel agent to route you "by Union Pacific"—west or east, to Colorado.

UNION PACIFIC RAILROAD

Mail Coupon

for free Colorado booklet.
Beautifully illustrated.

UNION PACIFIC RAILROAD
Room 438, Omaha 2, Nebraska
Please send free Colorado booklet.

Name_____

Address_____

City_____ State_____

Also send information about All-Expense Vacation Tours ☐
If student state age and special material will be enclosed.

Home Study

SCHOOL-AT-HOME

Kindergarten through 9th Grade

Calvert "School-at-Home" Courses give your child the same study plan used in the famous 50-year-old Calvert Day School in Baltimore, with guidance by the same teaching staff. Used by 90,000 children. Daily lessons, books, supplies sent by mail anywhere in the world. Calvert students transfer to other schools easily, often with advanced standing. Start any time. Unique new Crafts Kit. Write for catalog. Give age of child and school grade.

CALVERT SCHOOL

37 E. TUSCANY RD., BALTIMORE 10, MD.

LINGUAPHONE LANGUAGE INSTITUTE

At Home quickly learn French, German, Russian—29 Languages by Linguaphone Conversational Method. Million home-study students. Approved for Veterans' Training. FREE Book. **Linguaphone Institute, 2507 Rockefeller Plaza, N.Y. 20, N.Y.**

Coed Schools

CHADWICK SCHOOL Rolling Hills, California

Coeducational Country Day & Boarding School On Palos Verdes Peninsula, 20 mi. So. of Los Angeles. Grades 1-12. Fully Accred. Member Calif. Assn. of Independent Schools. Summer School July 5-Aug. 16. **Commander and Mrs. Joseph H. Chadwick, Dirs.**

DEAN JUNIOR COLLEGE & ACADEMY

SINCE 1865

LIBERAL ARTS—BUSINESS ADMINISTRATION, Merchandising, Secretarial, Medical Secretarial, HOME ECONOMICS, FINE ART, Advertising, Fashion Design and Illustration, Interior Decorating, Arts, and Eng. Drafting; COLLEGE PREPARATORY. Suburban. Complete GUIDANCE program, small classes, associate degree. All SPORTS, pool, beautiful campus, traditional atmosphere. One hour from historic Boston. Moderate rates.

For catalog: W. L. GARNER, Pres., FRANKLIN, MASS.

ELGIN ACADEMY

Prepares for leading colleges. Grades 7-12. Small classes. Excellent faculty. Coeducational. Well-balanced activity program. Gymnasium, pool, art gallery; music, dramatics. Sports for all. Near Chicago. Endowed. Est. 1839. Catalog. **E. P. Droste, 117 Academy Place, Elgin, Ill.**

OAKWOOD A FRIENDS SCHOOL

Grades 8-12. Accredited college prep and general courses. Coed. Supervised work program. Sports. Skilful guidance. Country location 70 miles N.Y.C. Moderate rates. 156th year. Catalog. **Wm. W. Clark, Prin., Oakwood School, Box 10, Poughkeepsie, New York.**

Girls' Schools

COTTEY COLLEGE

World-minded junior college for women. Fully accredited. Liberal arts, pre-professional courses. Individual counseling. Owned and endowed by P.E.O.; students from 36 states, 8 countries. Campus. Sports. Catalog. **Box C, Blanche H. Dow, Ph. D., Pres., Nevada, Mo.**

EDGEWOOD PARK

Accredited College prep. Advanced courses in cultural and practical arts, fine arts, secretarial science, real estate, medical asst., home economics, dramatics. Interior decoration, indep., kindergarten. Sports—riding, pool. Moderate rates. **Box N-10, Briarcliff Manor, New York.**

FAIRFAX HALL

An old Virginia school in the famous Shenandoah Valley. Accredited 4 years high school, 2 years college. Liberal arts, fine arts, secretarial, music. Happy social life. All sports. Pools. Private stable. **Wm. B. Gates, Pres., Box N-517, Park Station, Waynesboro, Virginia.**

GREENBRIER COLLEGE

For 123 years, a school for girls, in the southern mountains. 2 yrs. H. S. 2 yrs. Standard College work. Art, Music, Dramatic Art, Secretarial. Modern fireproof student residence hall. Address: **French W. Thompson, Pres., Box N-51, Lewisburg, West Virginia.**

THE KNOX SCHOOL

A School of American Ideals in a Country of American Traditions. Junior school, college preparatory, postgraduate courses. Secretarial science, household arts. Art, music, drama. Dances, winter carnival, aquacade, horse shows. Catalog. **Box N, Cooperstown, N. Y.**

LASELL JUNIOR COLLEGE

Prepares young women for living. 100th yr. 10 mi. Boston. Guidance. Liberal arts, sec'l, home ec., retail training; art, music, drama, pre-professional. A.A., A.S. degrees. Riding, skiing; pool. Catalog. **123 Woodland Rd., Auburndale 66, Mass.**

LINDEN HALL

Junior College and School for Girls. Cultural and Vocational. Music, Home Economics, Secretarial Studies. Fine and Commercial Art. Dramatic Art. Preparatory and General Courses. Beautiful Campus. All Sports. Riding. Swimming Pool. Moderate Tuition. **S. R. Horne, D.D., Box 67, Lititz, Pa.**

OAK GROVE A FRIENDS SCHOOL For Girls

Emphasizes Preparation for College and Gracious, Purposeful Living. Music, Art, Speech. Grades 7-12; Strong P.G. for H.S. Grads. Riding included. Joyous Outdoor Life. Beautiful fireproof Quadrangle. **Mr. and Mrs. Robert Owen, Box 140, Vassalboro, Me.**

SOUTHERN SEM. & JR. COLL.

Accredited Jr. College & H. S. for girls & young women. Blue Ridge Mts. Music, Art, Drama, Home Ec., Phys. Ed., Secretarial, Merchandising, Kindergarten Tr., Equitation, 5th Yr. **Margaret Durham Robey, Pres., Box 207-N, Buena Vista, Va.**

WALNUT HILL

Preparatory and general courses. Superior scholastic training. Music, art. Country life on 55-acre campus 13 miles from Boston. All sports, riding, skiing. Founded 1857. Write for catalog. **Hester R. Davies, Principal, 30 Highland Street, Natick, Massachusetts.**

Colleges for Women

CHRISTIAN COLLEGE

Accredited Junior College and Conservatory (A.A. degree). Terminal, transfer, pre-career courses. Music, Art, Drama, Secretarial, Nursing, Int. Dec., Costume Design, Home Mgmt. All sports, pool. 100th year. Catalog. **James C. Miller, Ph.D., Pres., Box D, Columbia, Mo.**

Colleges for Men

PENNSYLVANIA MILITARY COLLEGE

Combines the academic and military. Senior ROTC. Degrees in engineering, arts, sciences, business adm. Accelerated program: graduate in 3 yrs. Enter Sept. Catalog. **Dean of Adm., Dept. L, Chester, Pa.**

Vocational

Bryant COLLEGE

CAMPUS TO CAREER IN TWO YEARS with a B.S. Degree

90th Year. Offers a unique accelerated program of business and cultural courses leading to a traditional four-year degree in only two years.

BUSINESS ADMINISTRATION curricula include majors in Management, Accounting, Finance, Merchandising, Salesmanship and Advertising.

EXECUTIVE SECRETARIAL curriculum includes majors in Merchandising, Advertising and Medical Sec'l. Also one-year Sec'l. diploma. Degree in one year to College grads. Attractive dorms on campus. 23 lodges. Athletic, social activities. Inspiring faculty. Effective placement service. Coed. Write for catalog.

ENROLLMENT SECRETARY, PROVIDENCE 6, R. I.

FRANKLIN TECHNICAL INST.

Two-yr. Engineering courses: Mechanical & Machine Design, Structural Design & Architectural Drafting, Industrial Electricity & Electronics, Industrial Chem. Also Auto, Wiring, Photography courses. Catalog. **33 Berkeley Street, Boston 16, Mass.**

INDIANA TECHNICAL COLLEGE

B.S. degrees in 27 months in Aero., Chemical, Civil, Electrical, Mechanical, Radio engineering. Television. Drafting, 1-year. Earn board. Demand for graduates. Enter September, December, March, June. Ask for free catalog. **171 E. Washington Blvd., Ft. Wayne 2, Indiana.**

KATHARINE GIBBS

Outstanding secretarial training for high school, private school graduates, college women. Resident facilities. Catalog: **Assistant Dean, 90 Marlborough St., Boston 16; 51 E. Superior St., Chicago 11; 230 Park Ave., New York 17; Montclair, N. J.; Providence 6.**

TRI-STATE COLLEGE

B. S. Degree in 27 months in Civil, Elec., Mech., Chem., Aero., Radio and Telev. Engineering; Bus. Adm., Acct. Visit campus, see well equipped labs. Grads successful. Founded 1884. Enter June, Sept., Jan., March. Low cost. Prep courses. Catalog. **1471 College Ave., Angola, Ind.**

Aviation

AERONAUTICAL TECHNOLOGY

Best Serves Your Country and Yourself

Embry-Riddle SCHOOL OF AVIATION

The aviation industry urgently needs properly trained young men for essential civilian aviation positions. Embry-Riddle offers maximum training in minimum time. Complete 2-yr. Aeronautical Technology course—1 yr. master A & E mechanic, flight, combination courses. Thorough, practical instruction tailored to industry needs also aids rapid military advancement if called to armed forces. 25 yrs. experience training today's aviation leaders. Complete school campus—all sports. Reservations now being accepted for new class. Illustrated catalog, address: Registrar, Embry-Riddle, Dept. 8E, Miami 30, Fla.

TRAIN IN MIAMI—AIR CAPITAL OF THE WORLD

Boys' Schools

ADMIRAL BILLARD ACADEMY

Fully accredited. Prepare for Gov't Academies, College. Inquire re NROTC contract program. Naval training, cruises. Uniforms. Sports. Summer Session. Camp. Catalog. **Capt. George Peterson, USN (ret.), Box N, New London, Conn.**

ARCHMERE ACADEMY

Accredited boys' prep school under Norbertine Canons. High school only. Limited enrollment, resident or day. Sports, public speaking, social activities. Moral and spiritual guidance. Catalog. **Very Reverend Headmaster, Box 670, Claymont, Del.**

"TAKE IT TO THE BIG BOY"

AUGUSTA

★ MILITARY
★ ACADEMY
★ FT. DEFIANCE
★ VIRGINIA

Distinguished ROTC school. Junior and Senior schools. Accredited. All sports, including lacrosse and fencing. Large pool, gym. 1400-acre campus, 90th year. Students from 31 States and 5 Foreign Countries. Graduates in 60 Colleges. Rate $1150. Write for catalog N. **Col. Chas. S. Roller, Jr., Principal.**

BLAIR ACADEMY

Well-established Reputation for Thorough College Preparation. Small Classes. Experienced Masters. Grades 7-12. Modern Equipment on Country Campus, 45 miles from N.Y.C. Swimming Pool. Golf Course. Est. 1848. **Benjamin D. Roman, Headmaster, Box 17, Blairstown, New Jersey.**

BOLLES

Fully accredited. Distinguished academic record. Upper, lower schools, grades 6-12. New conference-type classrooms. Guidance, remedial reading. Varsity and intramural sports for all in healthful Florida climate. Year-round golf, tennis, sailing. Pool. Military or naval training. For illustrated catalogue, write:

Registrar, Box 9037-N, Jacksonville, Florida.

BORDENTOWN MILITARY

Fully accredited. College preparatory. Business and general courses. Outstanding record of college entrance. ROTC. Boys taught how to study. Junior school. 70th year. Summer session. Catalog. **Registrar, Box 657, Bordentown, New Jersey.**

CARSON LONG

Boys' Military School. Educates the whole boy—physically, mentally, morally. How to learn, how to labor, how to live. Prepares for college, life or business. 150th year. Rates $700. Extras, about $250. **Box 21, New Bloomfield, Pennsylvania.**

CARTERET SCHOOL

Supervised College Prep. Accredited. All grades to college. Separate Jr. School. Small classes. Personal supervision. Periodic Aptitude tests. Homelike dormitory. Large gym, athletic field. 40 acres atop Orange Mt. 20 mi. to N.Y. Booklet. **Carteret School, Box 7, W. Orange, N.J.**

CASTLE HEIGHTS MILITARY ACADEMY

R.O.T.C. High School, prep. for Service Academies. Jr. School—special instructors, housemothers. 12 modern buildings. Endowed. Swimming pool, golf, aviation. For "22 Points" and catalog, write: **Col. H. N. Armstrong, Pres., Lebanon, Tenn.**

COLUMBIA MILITARY ACADEMY

12 miles south of Nashville by U. S. 31. Gov't. Fully Accred. R.O.T.C. Preparation for Gov't Academies. Jr. School. All sports. New gymnasium with tiled pool. 26-piece band. Summer School & Camp. Write for catalog. **Dept. N, Columbia, Tennessee.**

CULVER MILITARY ACADEMY

on Lake Maxinkuckee. 8th grade. Thorough college preparation. Junior College. Leadership training. Develops physical, intellectual, moral stamina. Honor Advanced ROTC. Band. All sports. Catalog. **79 Pershing Drive, Culver, Indiana.**

DARLINGTON SCHOOL FOR BOYS

Fully accredited. Individualized instruction—high scholastic standards. Christian influence. Boys grouped by age and size for sports. Lake. Dairy. For catalog, address: **C. R. Wilcox, Ph.D., Pres., Box N, Rome, Georgia.**

FARRAGUT

College Preparatory — Naval Training

Two separate schools: Toms River, N.J.; St. Petersburg, Fla. Accredited. Preparation for all colleges, gov't academies. Junior School. **Accelerated program begins July 1.** Guidance, remedial reading. Sports, boats, bands. Specify catalog.

Admiral Farragut Academy, Box L, Toms River, N.J.

Fishburne MILITARY SCHOOL

Conservatively accredited since 1897. Grades 9-12. 72nd Year. Comprehensive individualized counseling. ROTC, highest Army rating. Varied activities programs for all. Non-profit. For catalog and "A Cadet Letter", address: **Colonel Morgan H. Hudgins, Box N-2, Waynesboro, Virginia.**

FORK UNION MILITARY ACADEMY

★ Our ONE SUBJECT PLAN of Study

★ Has increased number of Honor Roll students by 50%. Develops capacity to concentrate. Fully accredited. ROTC highest rating. 500 acres, 18 modern buildings, 2 beautiful, spacious gyms, pool; splendid environment, excellent health record, separate infirmary, 3 nurses. Upper School grades 9-12. Junior School 1-8, separate lodges and housemothers. All athletics, bands, glee club. For ONE SUBJECT PLAN booklet and catalog write:

★ **Dr. J. C. Wicker, Box 307, Fork Union, Va.**

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

GEORGIA MILITARY ACADEMY

Senior R.O.T.C. — Highest Gov't Rating — Accredited — Prep School — Junior College — Separate Junior School — Winter and Summer School — 8 miles from Atlanta — Write for catalog to **Col. W. N. Brewster, Pres., College Park, Georgia.**

GREENBRIER MILITARY SCHOOL

Also SUMMER CAMP. 140th Year. Fully accredited. Lower School, High School, Junior College. Trains for leadership. Remarkable record at Gov't Academies and elsewhere. All sports. White Sulphur Springs' Golf and Swimming facilities available to cadets. Modern fireproof connected buildings. R.O.T.C. Tested dairy herd on school farms. For catalog and "Evidence," address: **Colonel D. T. Moore, Registrar, Box N, Lewisburg, West Virginia.**

HARGRAVE MILITARY ACADEMY

Spiritual, physical and intellectual progress is assured by an experienced Christian faculty who adapt each boy's program to his needs. Accredited College Prep & Junior School. Tuition $600. Catalog. **Col. A. H. Camden, Pres., Box 307, Chatham, Va.**

HOWE MILITARY SCHOOL

Thorough academic training in spiritual environment. Accredited college prep, business courses. Potential achievement rating gives each boy a goal. Jr. school. Sr. ROTC. Sports. Episcopal. Est. 1884. Catalog. **B. B. Bouton, 971 Academy Pl., Howe, Ind.**

IRVING SCHOOL

114th year. Sound preparation for college and life. Grades 9-12. Individual guidance. Remedial reading. Small classes, cultural field trips. Boys taught how to study. Write for catalogue. **W. Gray Mattern, Jr., Box 371, Tarrytown, New York.**

KEMPER MILITARY SCHOOL

High School and Junior College. 105th year. Accredited education with military training. ROTC. Small classes. Varied cultural program. Sports for all. Pool. New stadium, gym. Catalog. **Dir. of Adm., 1071 Third St., Boonville, Mo.**

KENTUCKY MILITARY INSTITUTE

A school with a winter home at Venice, Florida. Preparation for college under ideal climate conditions all year. Oldest Private Military School in America. For catalog, address: **Col. C. B. Richmond, Pres., Box N, Lyndon, Ky.**

LA SALLE MILITARY ACADEMY

Fully accredited Catholic military school under Christian Brothers. Accredited college preparation. Grades 7-12. Small classes. Senior ROTC. Beautiful 160-acre campus. 60th year. 60 miles from New York City. Catalog. Write **Box G, Oakdale, Long Island, New York.**

MANLIUS

New York's oldest independent boarding school for boys. Grades 7-12. Accred. Prepares for all colleges. Military. After 2 years graduate normally granted advanced standing in college R.O.T.C. Band. All sports. Summer session. For catalog, address: **Robert N. Weekes, Manlius School, Manlius, New York.**

MARION INSTITUTE

109th YEAR. Accredited Junior College, 4-year High School. Special preparation for Annapolis, West Point. Senior R.O.T.C. Unit. Sports. Accelerated program. Summer semester. Catalog. **Col. J. T. Murfee, Pres., Box N, Marion, Alabama.**

MASSANUTTEN MIL. ACADEMY

Preparation for College and Christian Citizenship. Friendly supervision and study guidance for each boy. Small classes. R.O.T.C. All sports. Gym, Pool, Riding, Junior Sch., 5th grade up. Catalog. **Col. H. N. Benchoff, Woodstock, Virginia.**

McDONOGH

One of the nation's best equipped college prep schools for boys. Also business and vocational preparatory. Grades 1-12. Small classes. Endowed. Semi-military. Separate dorm for younger boys. Sports. 10 horses. 800 acres. 12 mi. Baltimore. Catalog. **Maj. L. E. Lambert, Box 106, McDonogh, Md.**

MERCERSBURG ACADEMY

GRADES 9-12. Graduates outstanding in college. On every U.S. Olympic team since 1906. All classes in new bldg. Public speaking, remedial reading. 300 acres. Summer session. Est. 1893. Catalog. **C. S. Tippetts, Ph.D., Box N, Mercersburg, Pa.**

MILLERSBURG MILITARY INSTITUTE

In the Heart of the Blue Grass. Fully accredited. 37th Year. College Preparatory and separate Junior School. New gymnasium. For catalog, address: **Colonel W. N. Nelson, Superintendent, Box 1651, Millersburg, Kentucky.**

MISSOURI MILITARY ACADEMY AND SEPARATE JUNIOR SCHOOL

4th grade thru high school. Fully accredited. R.O.T.C. Friendly and inspiring teachers. Complete guidance program. All sports. Riding. Golf. 9 acre lake. 5 athletic fields. 200 acre campus. Catalog. **Col. C. R. Stribling, 971 Main St., Mexico, Mo.**

MORGAN PARK MILITARY

Complete development of every boy. Fully accredited college prep. High academic standards. ROTC. Sports. 15 miles from Chicago's advantages. Lower School. 70th year. Catalog. **Col. C. L. Jordan, Box 771, Morgan Park, Chicago 43, Illinois.**

NYMA

The School of Distinction

develops your boy's mind, body, character, leadership. Graduates successful in all leading colleges. Experienced faculty; individual attention. Varsity and intramural sports; swimming pool, tennis, golf. Infantry, Cavalry, Artillery, Band. Junior School. Send for illustrated catalogue and View Book.

Established 1889 - ROTC

New York Military Academy

22 Academy Avenue

Cornwall-on-Hudson, N. Y.

NEW MEXICO MILITARY INSTITUTE

Jr. and Sr. College. A.B., B.S. Balanced program of academic, military, physical training. Outdoors year-round. 3700-ft. alt. All sports. Armored Cavalry. ROTC. Graduates in O.R.C. Catalog. **Box F, Roswell, N. M.**

NORTHWESTERN MILITARY AND NAVAL ACADEMY

Distinguished college preparatory school at Lake Geneva, "The Switzerland of America." Accredited. Best north. Unique small classes. Fireproof bldgs., modern facilities. ROTC. Sports. Summer camp. Catalog. **57 Lake Shore Rd., Lake Geneva, Wis.**

OHIO MILITARY INSTITUTE

Basics and the best in your boy. Large faculty, small classes. Lower School for boys 7-11. Upper School Certifies to Colleges. Wooded 2-acre campus. High, healthful location. 120th yr. All sports, music. Write: **5553 Belmont, College Hill, Cincinnati 24, O.**

ONARGA MILITARY SCHOOL

Individual College Preparation. Fully Accredited. Teaches How to Study. Free tutoring. Business Courses. Vocational Guidance. Character first! 7th gr. up. Gym and pool. 65 miles S. of Chicago. Catalog. **Col. L. W. Bittinger, Box W, Onarga, Illinois.**

EDUCATIONAL TROUBLE SHOOTERS

Individualized Plan — Each Student a Class

For those with educational problems — successful college preparation and general education. **Our tests discover causes of difficulties** and we (1) devise individualized program to overcome difficulties; (2) make up lost time; (3) instill confidence; (4) teach effectively art of concentration, sense of study. *Faculty 12; Enrollment 65. 45 years' experience.* Write Edward R. Knight, Ph.D., Headmaster.

OXFORD ACADEMY

Box G-95, Pleasantville, N. J.

PEACOCK MILITARY ACADEMY

A Distinctive School since 1956. All-round development. Fully accredited. Ages 12 to 19. Limited enrollment. All sports, riding. Small classes. Address the **Superintendent, 204 Peacock Ave., Woodlawn Lake, San Antonio 1, Texas.**

PEDDIE

An endowed school. Boys thoroughly prepared for college and for life. Fully accredited. Jr. School. Small classes, individual guidance. Public speaking course required. Sports. Two gyms, golf, pool. 200 acres. Summer session. 47 miles NYC. 67th year. Write for catalog. **Dr. C. O. Marong, Box 7-N, Hightstown, N. J.**

PEEKSKILL MILITARY ACAD.

Accredited preparation for all colleges. Small classes. 129th yr. Highest Govt. rating. Athletics for all. Swim pool. Sr. & Jr. Schools, grades 5-12. Mention grade and interests when writing for catalog. **Headmaster, Box 307, Peekskill, N. Y.**

THE PENNINGTON SCHOOL

For Boys — Accredited College Prep and Jr. Sch. 8th Grade up. Small classes with daily help of friendly Masters. Remedial reading. Music, crafts. All sports, gym, pool. Near Princeton. 118th yr. Catalog. **Ira S. Pinn, D.D., Box N, Pennington, N. J.**

PENNSYLVANIA MILITARY PREPARATORY

Fully accredited college prep. Small classes. Guidance program. Senior ROTC. Highest Gov't rating. Varsity and intramural sports. Swimming. Band. 106th year. On Main Line Penn R. R. Catalog. **C. R. Mell, Dept. 5, Chester, Pa.**

PILLSBURY ACADEMY

Accredited preparatory school with national reputation. Boys 12-19. Endowed. Modern equipment. Reasonable rates. Small classes. Supervised study. Military training. Sports. Separate dorm, younger boys. 58th yr. Catalog. **G. R. Strayer, Box 571, Owatonna, Minn.**

RANDOLPH-MACON ACADEMY

MILITARY ACCREDITED 60th Year

Prepares for college through intensive study methods. At northern entrance to Skyline Drive, 70 miles from Washington, D.C. Fireproof buildings. Superior equipment. All athletics. Gymnasium, swimming pool, band. For catalog and "Your Boy" folder address **Colonel John C. Boggs, Principal, Box E, Front Royal, Virginia.**

RANSOM SCHOOL

Now serve on Biscayne Bay, Florida. Prepares boys 10-19 for all colleges. Emphasizes on scholastic attainment. Sports, dramatics, glee club. Hobbies. Guided trips. Sailing. Resident nurse. Est. 1903. Catalog. **D. Pierre G. Cameron, Coconut Grove, Miami 33, Florida.**

PLEASE FILL IN BLANK BELOW, DETACH, AND MAIL TO THE SECRETARY

Recommendation for Membership

IN THE

NATIONAL GEOGRAPHIC SOCIETY

* *The Membership Dues, Which Are for the Calendar Year, Include Subscription to the National Geographic Magazine*

To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest, Washington 6, D. C.: _____ *1951*

I nominate _____
PRINT NAME OF NOMINEE

Occupation _____
(This information is important for the records)

Address _____
PRINT ADDRESS OF NOMINEE

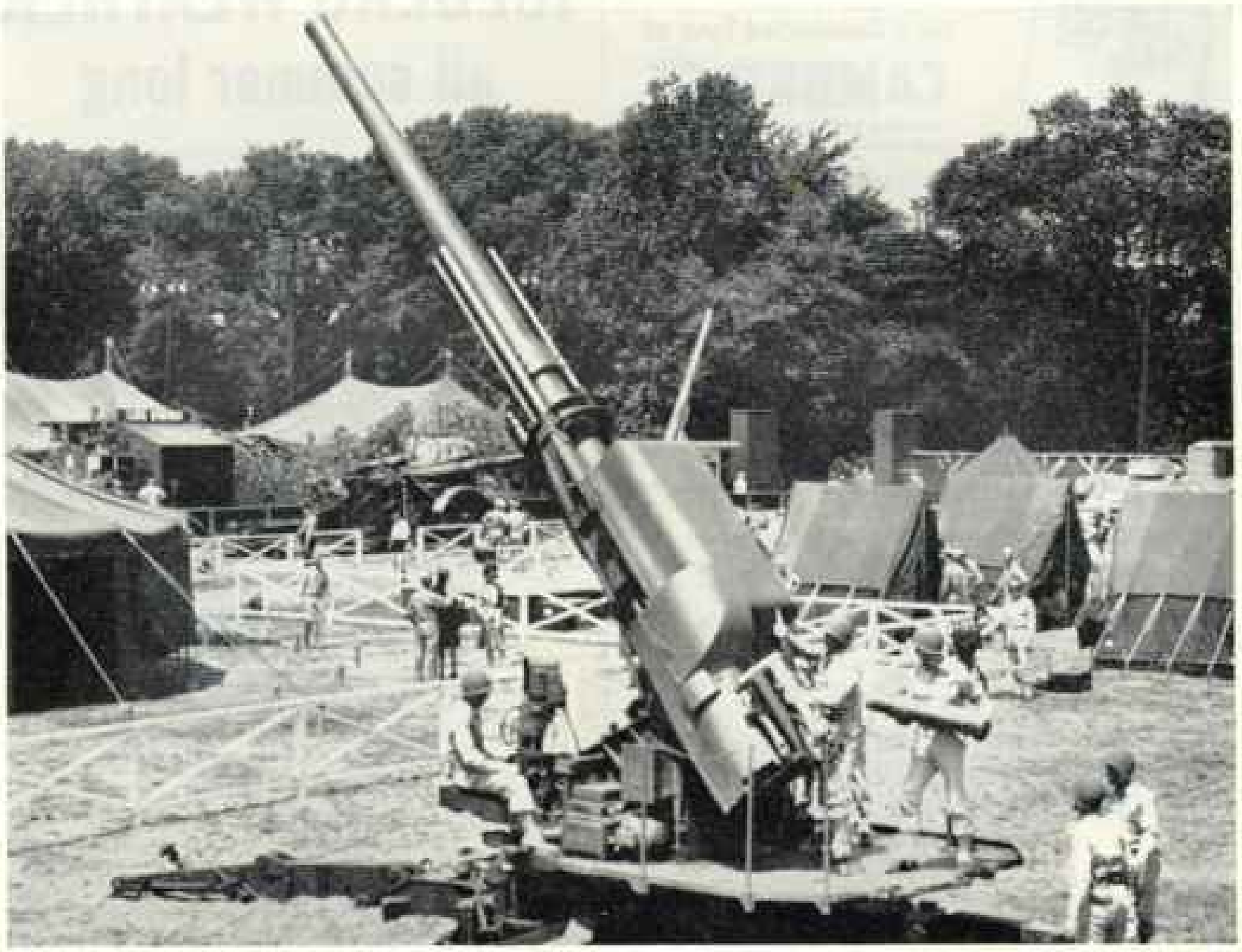
_____ *for membership in The Society.*

Name of nominating member _____
PLEASE PRINT

Address _____

* DUES: Annual membership in United States, $4.00; Canada, $5.00; abroad, $5.00. Life Membership $100.00 U. S. funds. Remittances should be payable to National Geographic Society. Remittances from outside of continental United States and Canada should be made by New York draft or international money order.

2-51



Bell Telephone Laboratories' New "Electrical Thinking Machine" Aims Anti-Aircraft Guns Like This One. *It's even more effective than the Bell Laboratories' famous Electrical Gun Director that proved such a factor in the last war. . . . The radar equipment locates hostile planes, day or night, and feeds continuous information concerning their location into a computer or "electrical thinking machine." . . . At the same time, data relating to wind velocity, velocity of the shells, temperatures, etc., are given to the computer. The machine then calculates where a shell should explode and aims the guns, continuously and automatically, to bring the planes down.*

New Gun Director Is Good News for the Country

Call to Arms. Once again the research and manufacturing of the Bell System are mighty weapons in the defense of the country.

More than twelve hundred projects for the armed forces were completed in the last war. Many new assignments are now being rushed to completion. This new Fire Control System is already in production.

Skilled Teams at Work. The Bell System's ability to serve the armed forces comes not only from its unique qualifications in the field of electronics, but from the way it is set up and equipped to do the job.

The Bell Telephone Laboratories, who do the research and development, work hand-in-hand with the Western Electric Company, the Bell System's own manufacturing unit.

Service and Security. This close association of research, development, and manufacture has helped to give this country the best telephone service in the world. It is now helping to give the nation the world's best fighting weapons.

BELL TELEPHONE SYSTEM

You are looking inside the world's most remarkable business machine . . . the IBM Electronic Calculator. It solves accounting and research problems faster than any other commercial calculator in general use.

GETTING YOUR ANSWERS

. . . at electronic speed!

IBM's vast engineering know-how is helping business, industry and the Armed Forces get the answers...fast. Through its leadership in applying electronic principles to calculators and other types of punched card business machines, IBM has given greater speed, accuracy and economy to the nation's vital processes of calculating and accounting.

Already thousands of IBM Electronic Business Machines are in everyday use. We are continuing to manufacture them in quantity . . . as fast as quality production will permit.

IBM

INTERNATIONAL BUSINESS MACHINES

590 MADISON AVENUE • NEW YORK 22, N. Y.