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Special Map Supplement of the White Mountains

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With 25 Illustrations and Map

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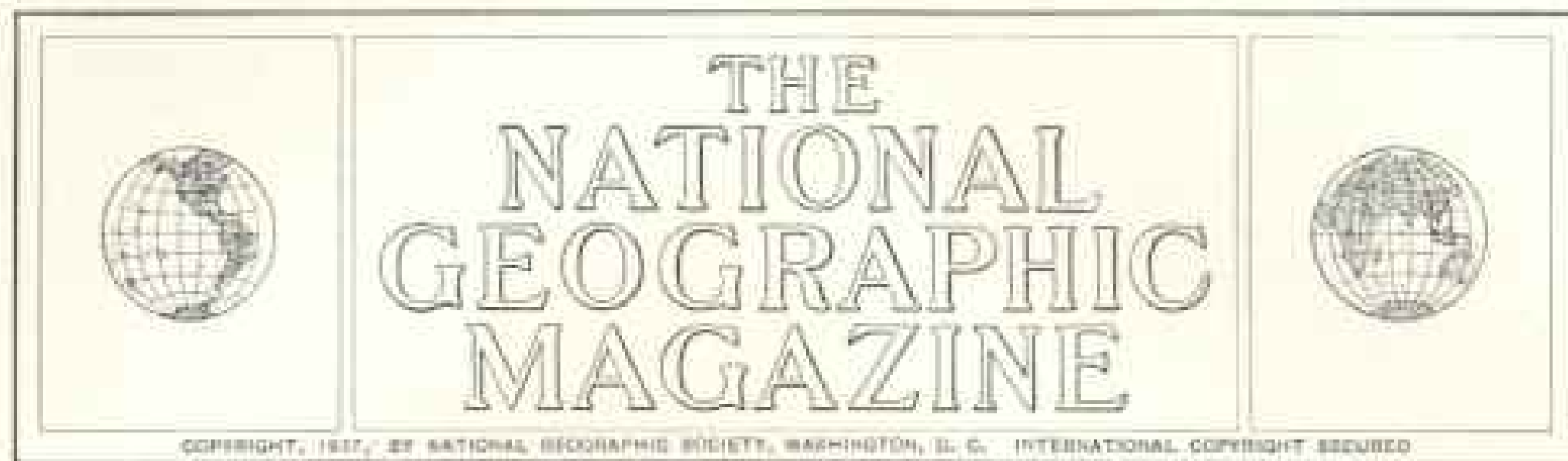
With 25 Illustrations

FRANK and JOHN CRAIGHEAD

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ON GOES WISCONSIN

Strength and Vigor Mark This Midwestern State, With
Its Woods and Lakes and Its Blend of
Sturdy Nationalities

BY GLANVILLE SMITH

AUTHOR OF "MINNESOTA, MOTHER OF LAKES AND RIVERS," IN THE NATIONAL GEOGRAPHIC MAGAZINE

THERE are some things that everybody knows about Wisconsin. The mere mention of the name brings thoughts of cheese and politics, woods-holidays and lakes. But what do its long shores look like? Why is it famous for the arts of government? What is the character of its many cities?

First, for a comprehensive view, why not a swift air journey around its borders?

The natural starting point for this breezy excursion will be Kenosha (map, pages 6 and 7). Halfway between Chicago and Milwaukee, this city is squarely in the State's most accessible corner. Besides, it was the first community in Wisconsin to establish a free public school, and so is an appropriate place in which to begin our learning.

Taking off from Kenosha, then, we go skimming like an inquisitive sea gull up the shore of Lake Michigan.

A GULL'S-EYE VIEW OF WISCONSIN

It is a long, straightish, sandy shore. The beautiful patchwork of green fields ends at a dark woodland fringe—then a streak of pale gold—then green water. Now and again a river winds out from the hinterland and empties into the lake. In many cases the river mouth has been made into a harbor, and at each harbor is a city.

These cities follow one another along the lake shore like a row of buttons up the front of a green overcoat: Kenosha, Racine, Milwaukee, Sheboygan, Manitowoc. Factory chimneys bristle in all of them. And from the boldly planned artificial harbors the ferries that carry freight cars across to the Michigan ports are putting out, with other lake traffic.

Now we must make a long hairpin bend to follow the finger of Door Peninsula. What luck! The cherry orchards are in blossom, white as popcorn. And right through them runs the glistening streak of the Sturgeon Bay and Lake Michigan Ship Canal.

At the finger's tip the beachy outer shore meets a rising and often cliffy inner shore.

Green-bowered Ephraim, with its white gables and steeples nestled at the foot of some of those first hills, looks like a bit of New England—though actually it was founded by Moravian immigrants from Norway.

Pleasure craft dash about like waterbugs in the cove, and across it, an incredibly green bald spot in the dark woodland, is a cliff-top golf course with people trudging about in sweaters that bring specks of gay color to the picture. This evidently is a headquarters for holiday fun.

And so down Green Bay, which (finger-

shaped, too) points to an upland continuation of itself, huge Lake Winnebago. The hills that began at Ephraim run on southward past this lake; and to it, up the Fox River, steams a barge fleet laden with coal, no doubt headed for industrial Appleton or Oshkosh (Color Plate XIV and page 26).

Straddling the river where it empties into the bay is the checkerwork of roof tops and tree-lined streets of Green Bay, one of the Midwest's oldest cities (opposite page).

Another hairpin turn here! And after cruising up the bay's west shore—a shore of yellow shallows and staring green meadowlands, obviously a duck hunter's paradise—we come to Marinette, on the Michigan line.

LAND OF PAPER, PINES, AND LAKES

Now we turn inland, following the Menominee River, and soon are over the North Woods. The paper mills at Niagara remind us of Wisconsin's industrial importance; but mostly we see a lonely forest country, where young pines lift shadowy boughs.

There are lakes aplenty. Here is big Lac Vieux Desert, key landmark of the interstate boundary. Here are the Manitowish Waters, 14 lakes in one chain—what a place for a boat and a basket of lunch!

Ahead now is the pale cold blue of the largest of all American lakes, Superior. Ore trains from Hurley and the Gogebic iron mines in Michigan snake along briskly below us, on their way to the docks at Ashland (Color Plate XVI).

After circling Chequamegon Bay, here we are over Bayfield Peninsula and the Apostle Islands. You would expect the Apostles to be an even 12 in number, but these are unbiblically numerous. Weather-beaten fishing villages protrude from the green of cedar groves on some of them.

And so away to Superior, Wisconsin's lake-head port. Near its harbor entrance are the docks from which vast quantities of Minnesota's Cuyuna iron ores are shipped to the East.

Superior is especially noteworthy, too, as a busy receiving point for water shipments of eastern coal. And to its docks and towering elevators, from west and south, curve the railway tracks that bring the grains and produce of mid-America.

Now inland again, half the journey done. Almost at once we catch a glimpse of Manitou Falls, highest in the State, draping their long white fringes down the pine-shaggy

rocks of Pattison State Park. And crossing the jack-pine highlands that here divide the Great Lakes and Mississippi Basins, we swoop down over the St. Croix.

This famously beautiful river, at St. Croix Falls, sinks into its most famous reach, the Dalles, where the water swirls in potholes in the ruddy basaltic rock. The white squares of picnic cloths spread on the grass are a reminder that Minnesota and Wisconsin, some forty years ago, here established Interstate Park.

FATHER OF WATERS IN LAZY MOOD

Below Hudson the deep valley of the St. Croix sweeps into the deep valley of the Mississippi; and soon their joined waters widen into Lake Pepin.

Here the Father of Waters is at his grandest. Like an old king of a peaceable people, who has grown fat and cheerful, he spreads out between the ramparts of the hills, and naps in the sunshine.

This nap ends where the Chippewa River enters. In fact, that hurrying stream brings down the gravel that dams the greater valley, and so causes the lake to be.

Below those gravelly shallows we see the Mississippi take on the character it will maintain all the way to the Illinois line, mile after mile. Weaving in gleaming skeins among an unending series of islands, it fills the valley floor. Now and again a long concrete dam stretches across, to hold water levels sufficient for navigation.

The hills, as a rule, march down to the edge of the outermost skein of water. But La Crosse, Wisconsin's western gate, is built on flat ground. This was the *Prairie de la crosse* of the old days, when the Indians played their game of lacrosse on it, 500 men at one time often participating in the good-natured rough-and-tumble contest.

Down from the hills behind La Crosse wind the coulees Hamlin Garland made famous in his *Middle Border* books—small, fruitful, wonderfully pretty valleys.

Prairie du Chien, too, is built on a riverside flat place. This is historic ground. It was a neutral trading center in Indian times. A battle of the War of 1812 was fought here. On the bank we can see the broad-beamed house where Jefferson Davis wooed Zachary Taylor's daughter.

Here is the mouth of the Wisconsin River, wide and stately. Here is Cassville, one of the most charming of the little river towns. And now we must turn, and finish



HEART OF POLITICAL-MINDED WISCONSIN IS ITS HIGH-DOMED CAPITOL

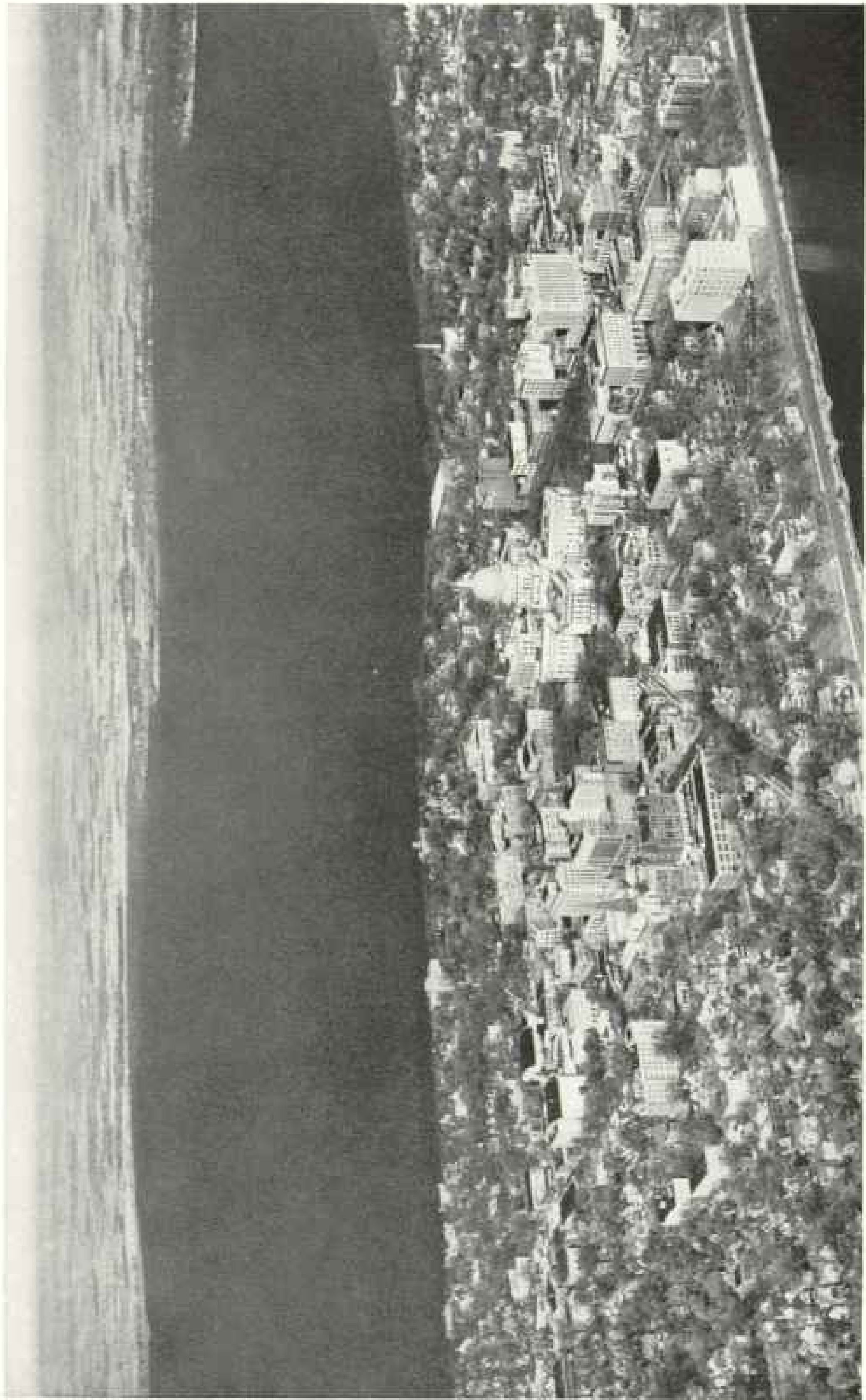
Here in Madison centers much of the interest in progressive government which has characterized the State since its early days when many liberals of Europe emigrated to Wisconsin (pages 4 and 25).



Photographs by B. Anthony Stewart

GHOSTS OF WISCONSIN'S PAST INHABIT ROI-PORTIER-TANK COTTAGE AT GREEN BAY

There linger the shades of Joseph Roi, a French voyageur who in 1776 built a cabin by the Fox highway for his roving canoe; of Jacques Portier, judge, teacher, and fur trader, who bought it from him; of Nels Otto Tank, Moravian missionary from Norway, and of Madam Tank, high-born lady from the Netherlands, who filled it with china and other treasures. Her picture hangs between the doors, above the melodeon on which she played hymns. The old rocker was her favorite chair.



© Chicago Aerial Survey Co.

WISCONSIN'S CAPITOL AT MADISON STANDS IN THE MIDST OF TALL, CLEAN BUILDINGS, ON A NARROW STRIP OF LAND BETWEEN TWO LAKES

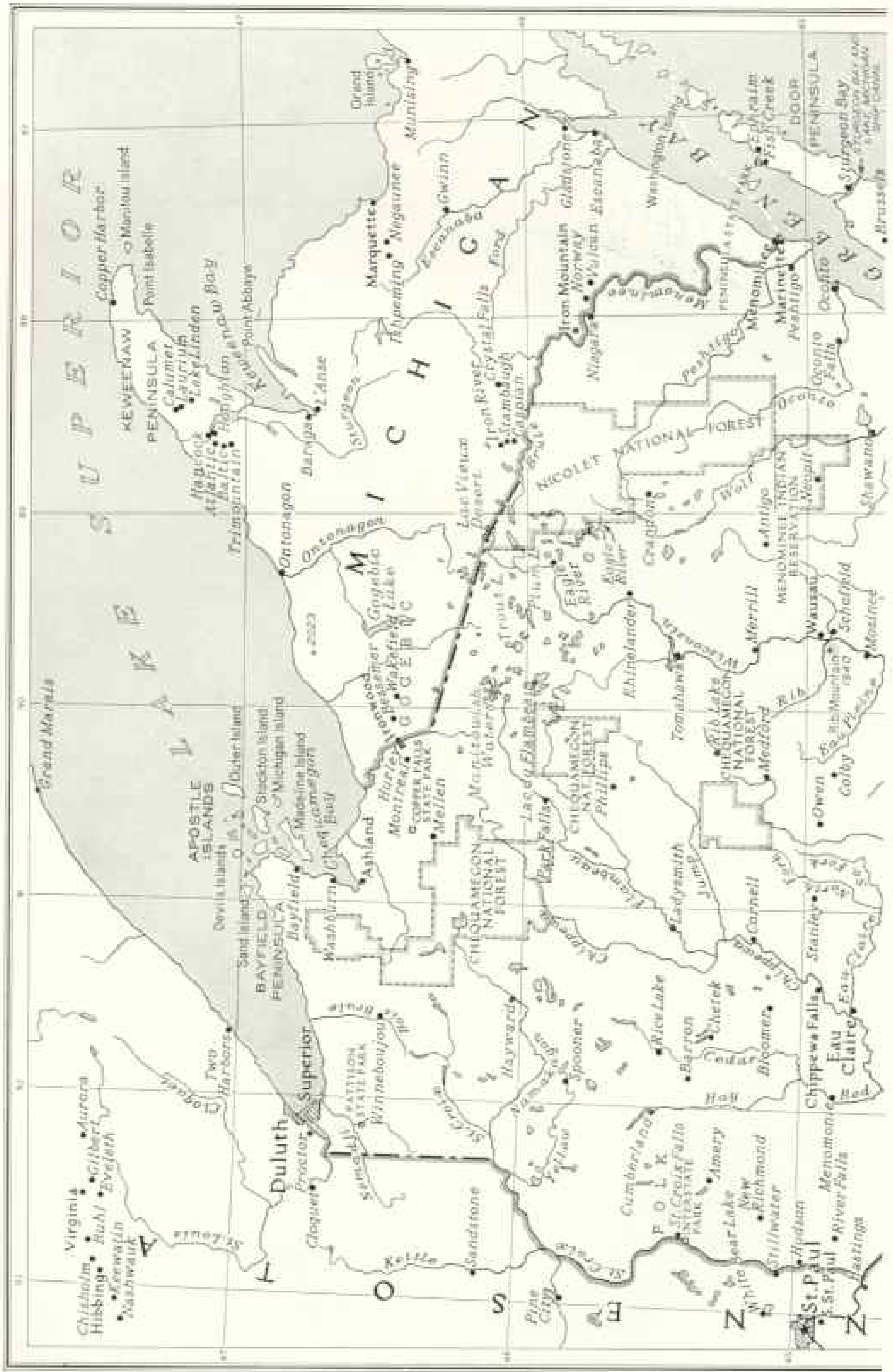
At night the dome is illuminated, a beacon for boaters on Lake Monona beyond, or Lake Monona in the foreground. Madison, named for the Nation's fourth President, was a made-to-order capital (p. 16). It is the heart of a rich agricultural area, and its manufactures range from horse-collar pads to hospital furniture and lawbooks.

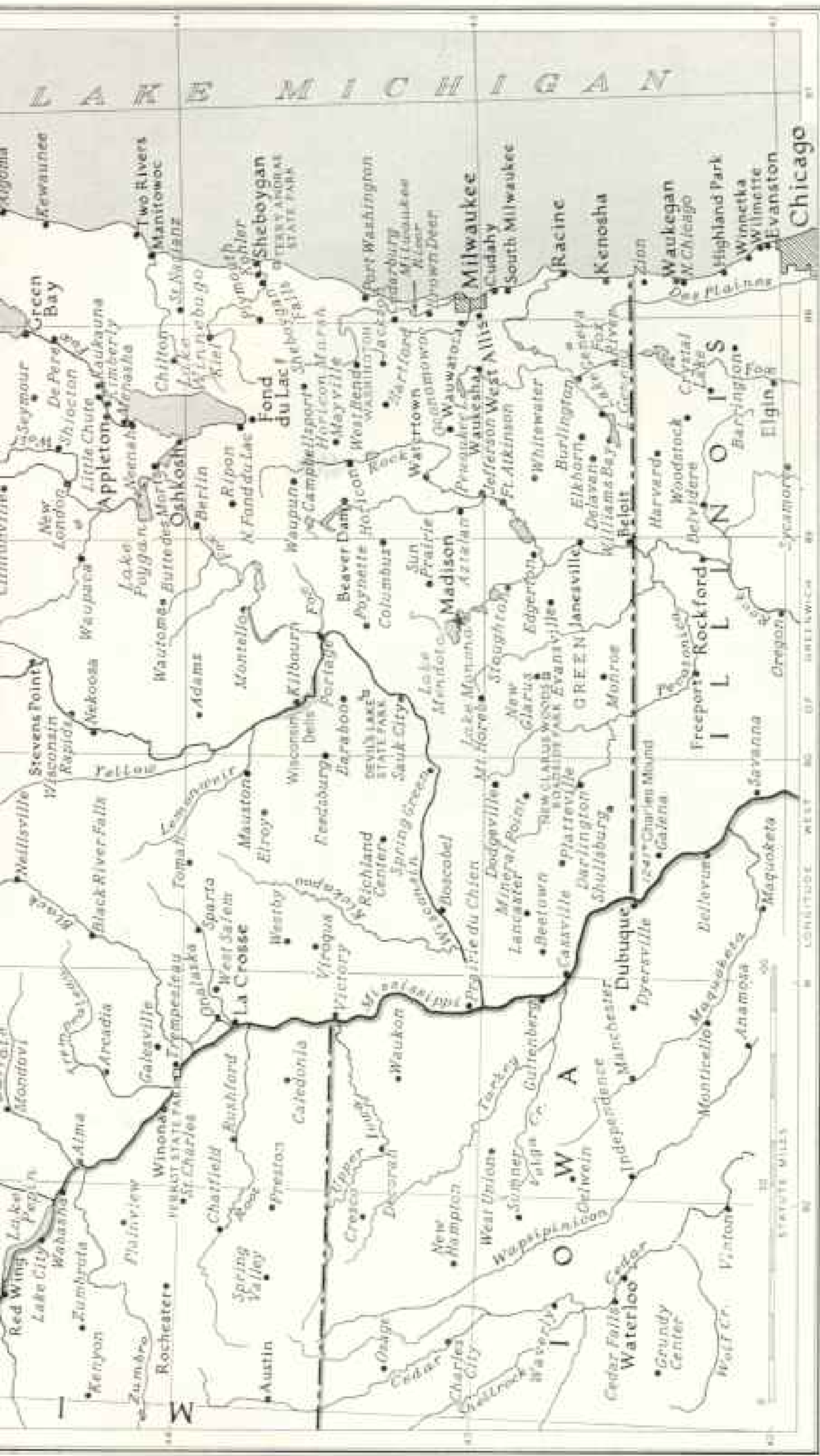


© Chicago Aerial Survey Co.

MUCH OF MILWAUKEE RISES FROM RIVER BOTTOMS THAT FIFTY YEARS AGO WERE WILD-RICE MARSHES AND TAMARACK SWAMPS

Juneco Park, on the Lake Michigan shore in the foreground, bears the name of an early trader who established his post near here. Through the park runs Lincoln Memorial Drive, which leads into Wisconsin Avenue, the city's main street, seen at the extreme lower left corner. Only a small part of the business district is shown in this aerial view (page 9). In the middle distance the Milwaukee River wanders out toward its rendezvous with the lake.





Drawn by Ralph E. McAlm.

WISCONSIN, STATE OF LAKES AND FORESTS, FARMS AND CITIES, SUGGESTS A MITTEN IN SHAPE

As if worn with honest use, it has tumbled at the tip into the loose threads of the Apostle Islands in Lake Superior. The thumb—Door Peninsula—is even more tattered, but is easy to recognize, poking into the clear, green waters of Lake Michigan. The entire mitten is green. Its hue varies from that of clover and pea fields at the wrist end, through the flower-dotted meadows of the palm to the deep greenery of somber pines in the upper part. Down the middle of the State, from top nearly to bottom, flows the amber-colored river which gave Wisconsin its name. Beside it at Waussau rises Rib Mountain, the State's highest ground—a lump of rock almost in the mitten's palm. Throughout the lake-sprinkled Commonwealth, parks, monuments, streams, and camping grounds beckon vacation visitors.



Photograph by Marnard Owen Williams

EVEN ON A PICNIC DISHES MUST BE WASHED

But Grandmother doesn't seem to mind the task. Over her head hangs a bough of ripening apples, a typical scene in Peninsula State Park at Fish Creek. Buster teases for another glass of lemonade—and may get it!

our flight in an eastward beeline along the Illinois boundary.

At Shullsburg, among the rolling hills, we catch a glimpse of zinc and lead mines (p. 15). Then mile on mile of peaceful dairy country. The brown of Brown Swiss, the black-and-white of Holsteins, taking an evening browse in the pastures, tell plainly that this is a land rich in milk. Big white barns with twin silos repeat the milky theme.

Now beneath us twinkle the lights of Beloit, where weighing devices are made by Fairbanks-Morse. And above Lake Geneva, at Williams Bay, like an astronomer's brow-

thoughtful in the starlight, the 90-foot dome of the Yerkes Observatory makes a moony landmark (page 30).

Finally, with its harbor lights dancing reflected, Kenosha again—and welcome slumber in Simmons beds made here.

DOWN THE RIVER THAT GIVES THE STATE ITS NAME

Since our air journey has shown what the State's edges are like, it is only natural to wonder about the interior. A canoe trip down the Wisconsin will bring us past typical towns and landscapes.

Its start, and ours, is at Lac Vieux Desert, on the Michigan line. The State's greatest river, these first few miles, is at its smallest: we have some wading, pushing, and

portaging to do. Beaver dams of aspen logs neatly chewed make an interesting obstacle.

On either hand pine groves and spruce bogs slowly revolve; here the cranberry grows, and the reindeer moss stands in spongy tufts. From the forest shadows comes the drumming of grouse, or the mad evening cry of the whippoorwill. Here are deer tracks very plain on the bank; around the next bend perhaps we shall see a doe or a fawn.

Even the cities—Eagle River, Rhinelander, Tomahawk—remind us that we are in the North Woods, and that this is a vacation land for thousands. Shop win-

dows are gay with outing togs, swimming suits, and picnic supplies. The prize-pike-of-the-week is laid out nobly on a bier of cracked ice, with fishing tackle in a glinting display about him.

Wausau, our next landing place—after Merrill, with its neat riverside parks—brings us to the beginning of a new phase. Two of the State's chief agricultural products, malt and milk, are combined here in one of the country's largest malted milk factories.

Wausau, however, is chiefly a forest-products center. Lumber, fine millwork, near-by paper mills, make it so—and the modern counterpart of Wisconsin's oldest forest industry, fur farming.

In point of present-day use, the State's most valuable minerals are its stones. Of these the red granites of Wausau and Montello are favorites of long standing, while the sleek black gabbro of Mellen is an already nationally used newcomer. Thanks to its luster and noble deep color, "Wausau Red" almost attains to the quality of semi-precious.

HOW WISCONSIN GOT ITS LAKES

Wausau, in fact, lies at the foot of a mountain of granite—Rib Mountain, the State's highest point (1,940 feet). Isolated and austere, this huge lump of rock perhaps



Photograph by Aero-Graphic Corporation

BIG AND EFFICIENT IS MILWAUKEE'S CIVIC CENTER

Occupying an entire block, the Safety Building in the foreground houses offices of the city and county governments. Beyond is the Courthouse, its stately center entrance looking down West Kilbourn Avenue (page 5).

looks its grandest when snows streak its flanks and lie deep in the surrounding shaggy, slate-colored woods.

But one fine summer's day, so the story goes, old Paul Bunyan was inspired to try diving from its summit into the river.

Oh, what a splatter! And the event was of prime importance in Wisconsin's legendary history: the State's thousands of lakes date their existence from that splash!

Geologists, however, say the lakes were formed by the glaciers which invaded the United States as far south as the Ohio and Missouri Rivers—*except* a triangular piece



Photograph by B. Anthony Stewart

STEAMING WOOD PULP RUNS BETWEEN HEAVY ROLLERS, PASSES THROUGH HOODED DRIERS—AND ULTIMATELY COMES OUT PAPER

Presses of a Park Falls plant here turn out a yellow stock. To make the pulp, dry wood is cut into small chips and dumped into vats filled with a sulphite acid solution. Wood fibers fall apart and form a pasty mass such as the man takes out of the box. Wisconsin paper mills, housing huge machines, loom above small towns and villages like Gullivers in Lilliput (page 32).

of the Wisconsin map. At the top corner of that "driftless area," as if there those generally so domineering sheets of ice had been flawed and split, is stubborn old Rib Mountain.

Away we paddle again, through the Driftless Area. Fields and woods alternate on the banks: oftentimes the fence between field and field will be made of the tangled silvery skeletons of pine stumps. Polish settlers have cleared these acres. Mrs. So-and-so-ski, vigorously hoeing her garden, pauses to wave to us, a square kerchief tied over her hair.

By the time we have left Stevens Point behind, and Wisconsin Rapids, we have emerged from the pineries and are in the State's central plain.

Now we paddle through the famous Wis-

consin Dells. Once these reaches were perilous going, but a hydroelectric development has dammed back the racing river; we proceed in peace (page 29).

PORTAGE MARKS A TURNING POINT—IN GEOGRAPHY AND HISTORY

Now at Portage comes the decisive turning point in our river. In an enormous curve it swings to the southwest, and cuts a picturesque and strangely lonely valley through the Mississippi highlands.

Very easily the story might be different. At that Portage turning point only a levee prevents the river from overflowing a narrow strip of meadow and so discharging a part of its waters eastward into the Fox. And the Fox flows into Lake Michigan.

At just this point, the waterways of the



Photograph by B. Anthony Stewart

PILLARED ROCKS OF DEVILS ISLAND WERE CARVED BY THE RESTLESS BLUE WATERS OF LAKE SUPERIOR.

Since white men first visited here, one bit of land—Steamboat Island—has been completely worn away. Many of the Apostle Islands are girt with brick-red cliffs as the Bayfield Peninsula is—red cliffs, green woods, and the rush and toss of white-fringed blue lake water making a memorable picture of northern color. A lighthouse on Devils Island guides shipping into Superior and Duluth.

Mississippi and Great Lakes Basins very nearly join. It is easy to guess how the city built there got its name, "Portage."

Where oxen used to pant through the meadow mud, hauling the boats, supplies, and fur packs of pioneer times, a dreamy little canal nowadays connects the Wisconsin and the Fox. The leafy city that nods reflected in canal and river, with its shadowed streets, cinnamon roses, and white jigsaw eaves and dormers, shows a third phase of the State's character.

After the solitudes of the North Woods, and the brisk new cities of the upper valley, here we are in Old Wisconsin.

This friendly old city, where kittenball games create a good-humored uproar on the school grounds after supper, and Main Street is cleared for tag, band music, and

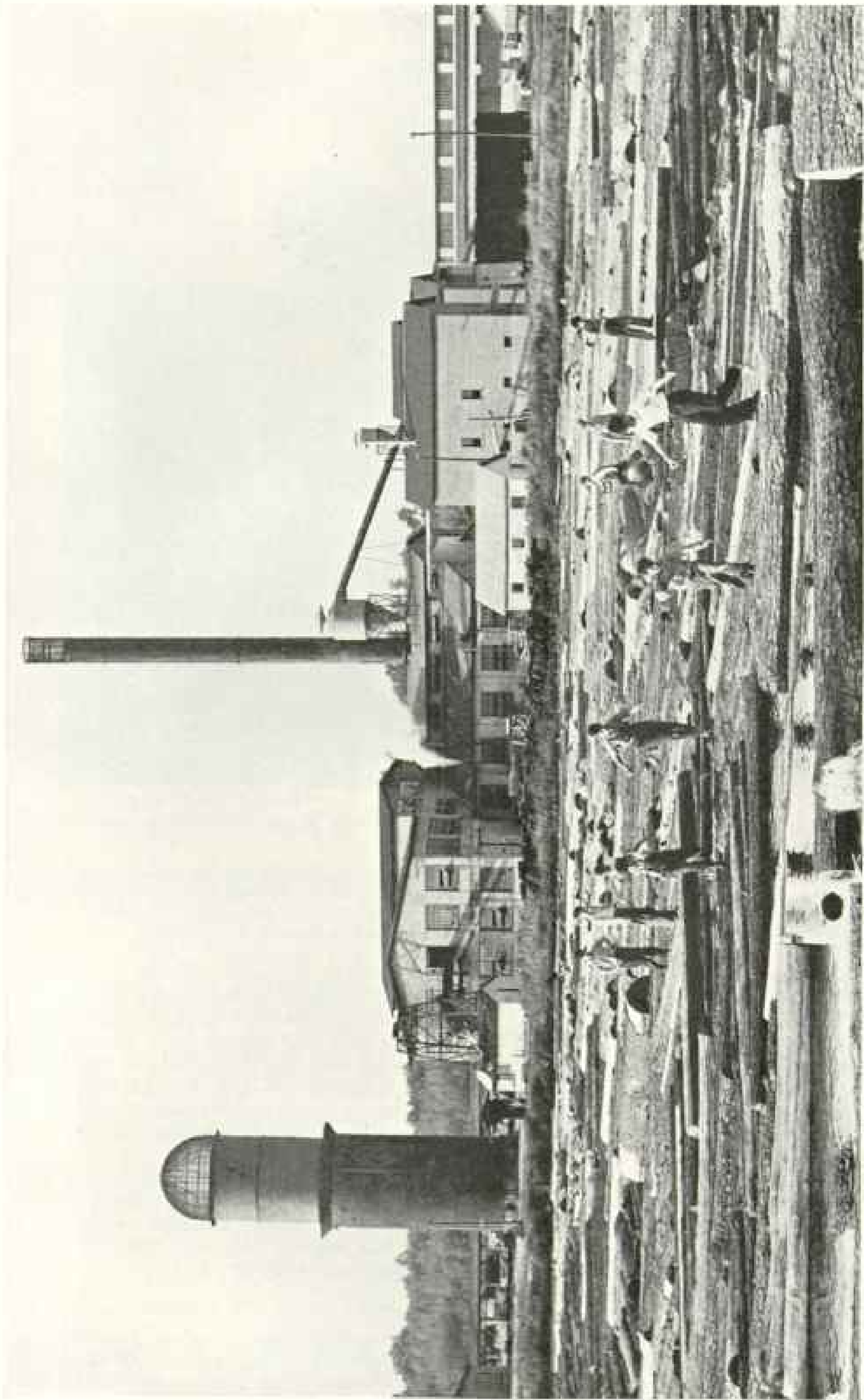
dancing every Wednesday night, is the "Friendship Village" of Zona Gale's stories.

The State's classic book, Juliette Kinzie's *Wau-Bun*, also was written by a Portage woman. In the parlor of the old white Agency House Mrs. Kinzie played the first piano ever heard in that wilderness, while Indians pressed wondering noses on the windowpanes.

Here the Winnebagoes camped, and young Jeff Davis, after rafting the logs through the Wisconsin Dells (a difficult feat), superintended the carpentry when the Portage fort was being built.

FIRST CAME THE FRENCH

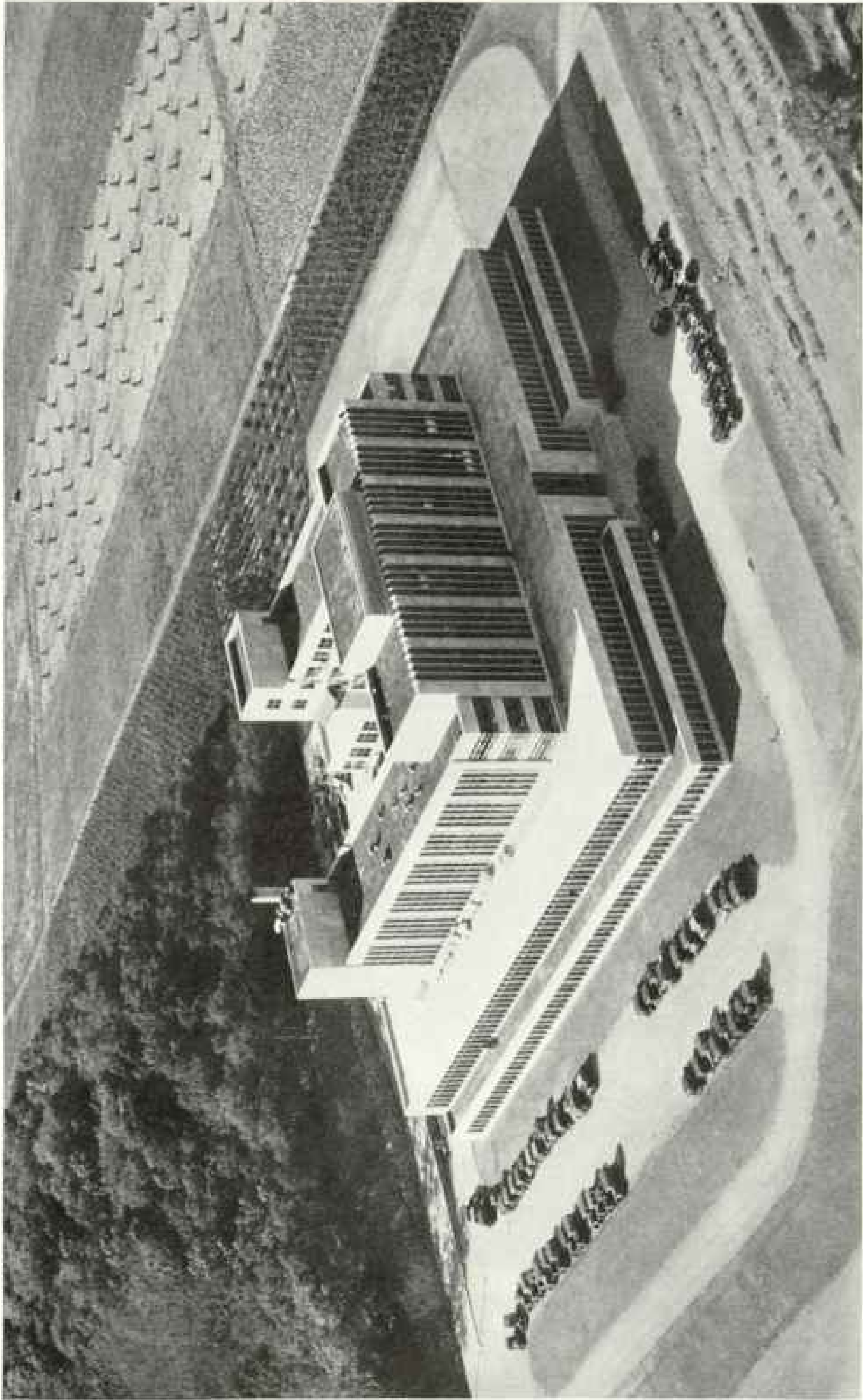
But who were the Wisconsin pioneers and immigrants? What arts and opinions did they bring? How did they fare in the



Photograph by B. Anthony Stewart

PLEET-FOOTED YOUNG INDIANS RACE OVER LOGS AT THE MILLPOND OF THE MENOMINEE RESERVATION

As good as a vaudeville skit is the logging done by these nimble, brown-skinned boys—a jolly lot who swim like beavers. The mill at Neopit and extensive timberlands are held as common property by the tribe. Workmen receive wages and a share of the profits. Screens atop both the incinerator (left) and the tall smokestack reduce danger of forest fires. In many old mill towns the incinerator generated steam which was piped to dwellings, churches, and schools, heating the entire community.



Photograph by U.S. Forest Products Laboratory

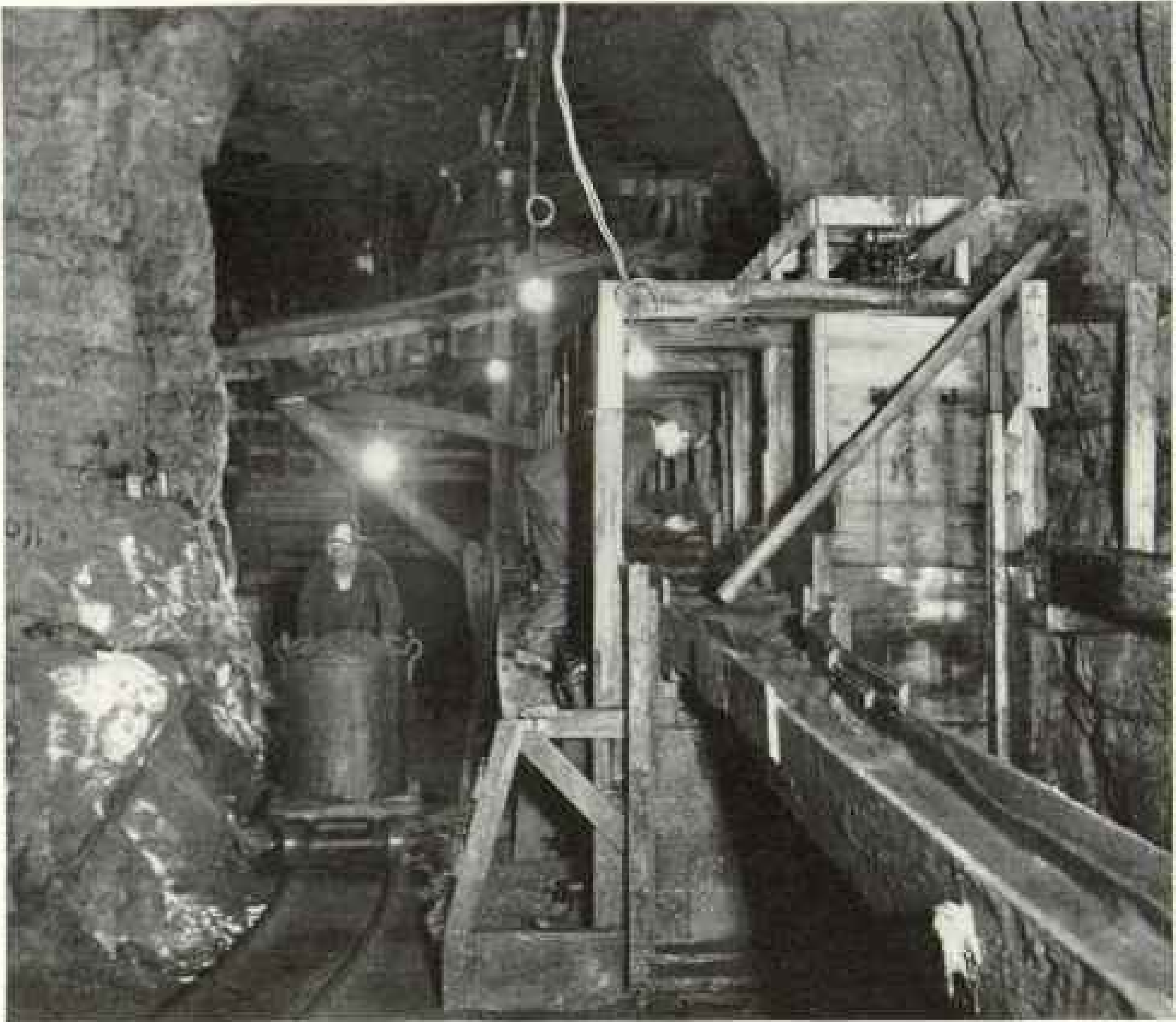
IN THIS FINE NEW HOME OF THE FEDERAL FOREST PRODUCTS LABORATORY AT MADISON, EXPERTS DEVELOP NEW AND MORE ECONOMICAL USES FOR THE NATION'S TIMBER

A recent achievement was the discovery that lignin, the cementing matrix around the cellulose fibers of wood, which was formerly wasted in papermaking, could be used in the production of plastic wood. The laboratory is the only institution of its kind maintained by the United States Forest Service, and functions in cooperation with the University of Wisconsin, whose experimental acres lie beyond.

Photograph from *Wide World*

FIGHTING FRESHMEN BREAK AN OLD TRADITION AT BELOIT COLLEGE

Much to the chagrin of haughty sophomores, first-year men succeed in hauling down the pennant hung atop a high greased pole. Last October was the first time a first-year class had succeeded in this slippery undertaking. Famous men who have taken part in such roughhouse fun at Beloit include the explorer Roy Chapman Andrews and the cartoonist J. N. ("Ding") Darling. Besides the big University of Wisconsin, at Madison, and Marquette University, at Milwaukee, the State has many smaller institutions, such as Beloit, Ripon, Lawrence, Carroll, and a number of teachers' training colleges.



Photograph by B. Anthony Stewart

MINERS SEPARATE ZINC AND LEAD FROM THE ROCK 108 FEET BELOW DAYLIGHT

In these diggings near Shullsburg the ore-bearing rock is crushed by heavy rollers, then fed into jigs, or wooden boxes that constantly jiggle up and down (right). Water is forced through the apparatus, and minerals sink to the bottom where they are removed through taps. Surplus water, laden with waste materials, runs off at the top in the long trough. A near-by underground lake, so large that workers travel across it by boat, serves as a convenient dump for tailings.

new land of their choice? A storybook place like Portage teases the mind with such questions.

Theodore Roosevelt, when writing his *Winning of the West*, made use of the State Historical Society's library in Madison, celebrated as the finest collection of books on Mississippi Valley affairs. Perhaps we had best abandon our canoe and follow T. R.'s trail to that library.

Very soon, there, amid its leathery smells, the Wisconsin map that we have been exploring in airplane and canoe begins to come alive. Door Peninsula, for example, like a real door on its hinges, swings back to make Green Bay the original main entrance to the State.

Down the bay comes Nicolet, Wisconsin's discoverer. Indians are paddling his

leaky bark canoe. On the shores the wilderness is unbroken. The year is 1634. Yet—most extraordinary!—this son of a Paris letter carrier is dressed in a gorgeously embroidered Chinese robe.

News, it seems, had come to Quebec that on a lake at the sources of the St. Lawrence was a colony of "people from beyond the Great Water." This was news indeed. The "Great Water," no doubt, was the Pacific! (Nobody in 1634 realized how very far away that "Great Water" was.) And of course the colonists from beyond it must be Chinese!

Champlain, the governor, at once dispatched Nicolet to make a treaty with these Orientals. Unfortunately, he could speak no Chinese—nobody could, in Quebec; however, he was tactful enough to take a

Chinese robe with him so that he could greet the colonists in the garb of their native land.

But when, after the long journey, he was guided to the colony, not a pagoda, not a mandarin, was to be found. The "people from beyond the Great Water" were nothing more than breech-clouted Winnebagoes.

WISCONSIN HISTORY OPENED WITH A BANG

Striding forward on the beach, however, like a man strayed a thousand miles from the nearest fancy-dress ball, Nicolet saluted the wilderness and its savages with a skyward volley of pistol shots.

This colorful episode at the Green Bay main entrance was followed by the arrival of French Jesuits at the State's postern gate, Chequamegon Bay on Lake Superior. It was a likely field for missionary endeavor; the bay region's unrivaled supply of berries, game, and fish made it "the metropolis of the Indians." To this day Bayfield is a berrying and fisheries headquarters (Color Plates IV and VII).

With the missionaries came the fur traders. One famous missionary, Marquette, joined with an equally famous explorer, Joliet, in exploring the Fox-Wisconsin water route from Lake Michigan to the Mississippi; they were the first white men to see that river in its upper reaches.

The route they had followed at once became a chief artery in the fur trade. The State's two oldest cities—French settlements both—lie at the two ends of that route. These old towns, Green Bay and Prairie du Chien, were links between the New France of Quebec and the French in Louisiana.

Even after Canada had been acquired by the British, and Louisiana had been sold to the United States, Wisconsin remained French in speech and spirit. The voyageurs in their red caps and sashes still sang *La Belle Rose* and *A la Claire Fontaine* to the rhythm of their paddles, and cast their garments into Lake Winnebago as an offering to the saints for a favorable breeze. The Code Napoléon was administered in Green Bay even after Wisconsin was organized as a territory.

THEN CAME AMERICAN PIONEERS

Thus it is that a State now full of German and Scandinavian descendants is peppered with such place names as Racine, Eau

Claire, Fond du Lac, Lac du Flambeau, Butte des Morts, "coulees" and "prairies."

After the War of 1812, Old Wisconsin—that is, the triangular part of the State south of the Fox-Wisconsin water route—began to fill with American settlers. Oddly enough, the western corner of that triangle, now a land of Arcadian fields and quiet towns, was its liveliest part in the early days.

Up the Mississippi came southerners to stake claims and work the lead diggings of the region. Lead for shot was essential to the frontier enterprise of taming the wilderness.

But with the retreat of the frontier to a country far richer in lead than Wisconsin was, mining lapsed. Mineral Point, metropolis of the diggings in their heyday, like a grand old lady full of character and anecdotes, now dreams humorously of her past.

Meanwhile the eastern counties of Old Wisconsin were being converted from grove and grassland to an industrious farm country. Where trading posts had flourished at the Lake Michigan river mouths, towns sprang up. By 1848 the Territory was populous enough to be admitted to statehood.

A MADE-TO-ORDER CAPITAL

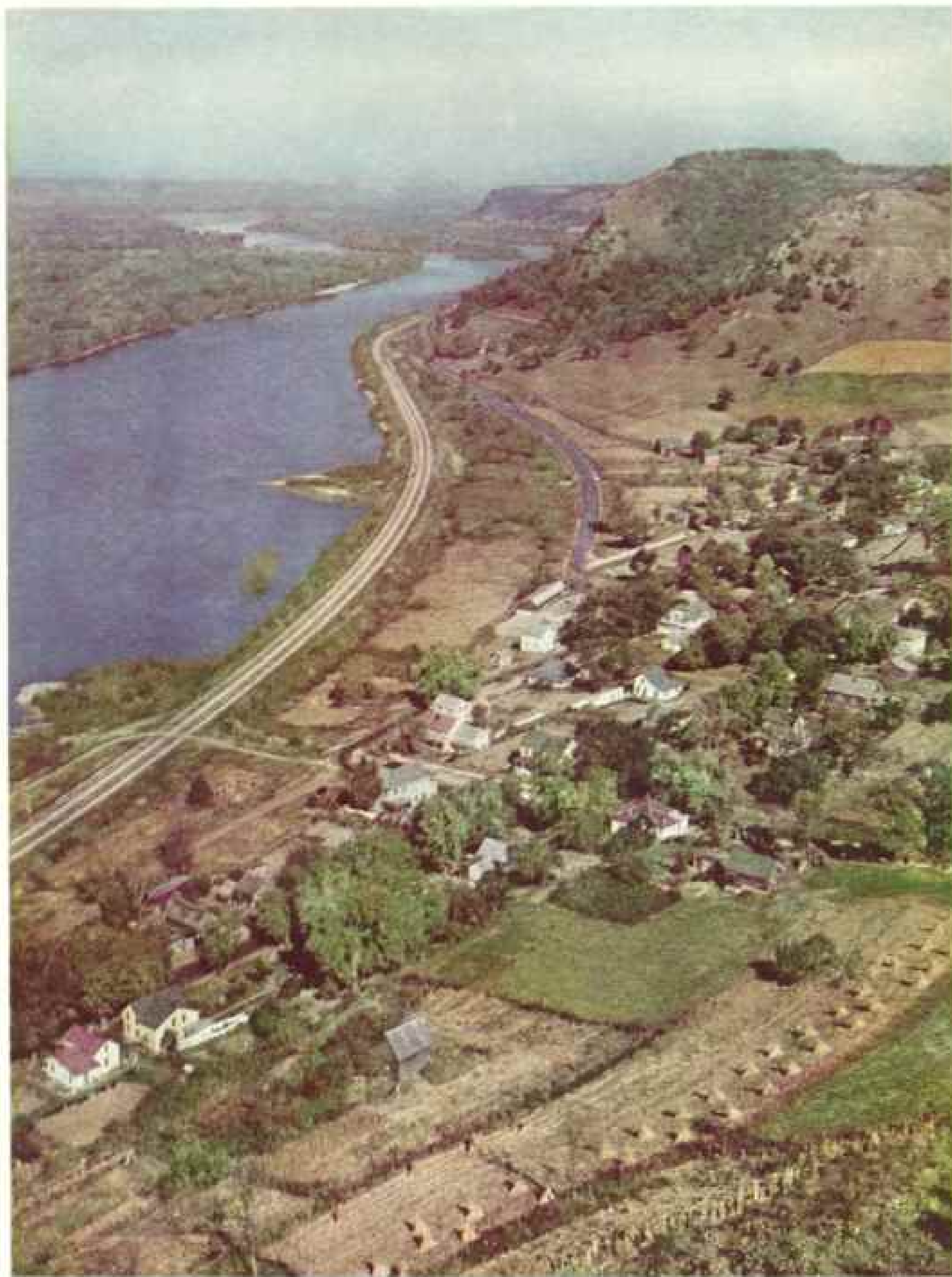
Thereupon arose the problem of choosing a site for the capital. The populous diggings and the up-and-coming eastern counties had quite a scrap over the matter. But then some genius (who happened to own the land involved) proposed a site in the intermediate wilderness. The compromise won.

Thus Madison was established as State capital when there was nothing but wigwams on the ground. Like Washington, it was laid out to serve as a seat of government, and government is its chief business to this day, great though it has grown in size and commerce (pages 3 and 4).

No wonder the people of Wisconsin think proudly of their Madison! Its site is superb. On an arching isthmus between two clear blue lakes the capitol dome soars up grandly—from park paths we can see it shining upside down on the calm waters of Lake Monona.

On the shore of the other lake, Mendota, is the State University, famed for its valuable contributions to agricultural methods, and for the freshness of its ideas in the

LIFE'S COLOR IN WISCONSIN

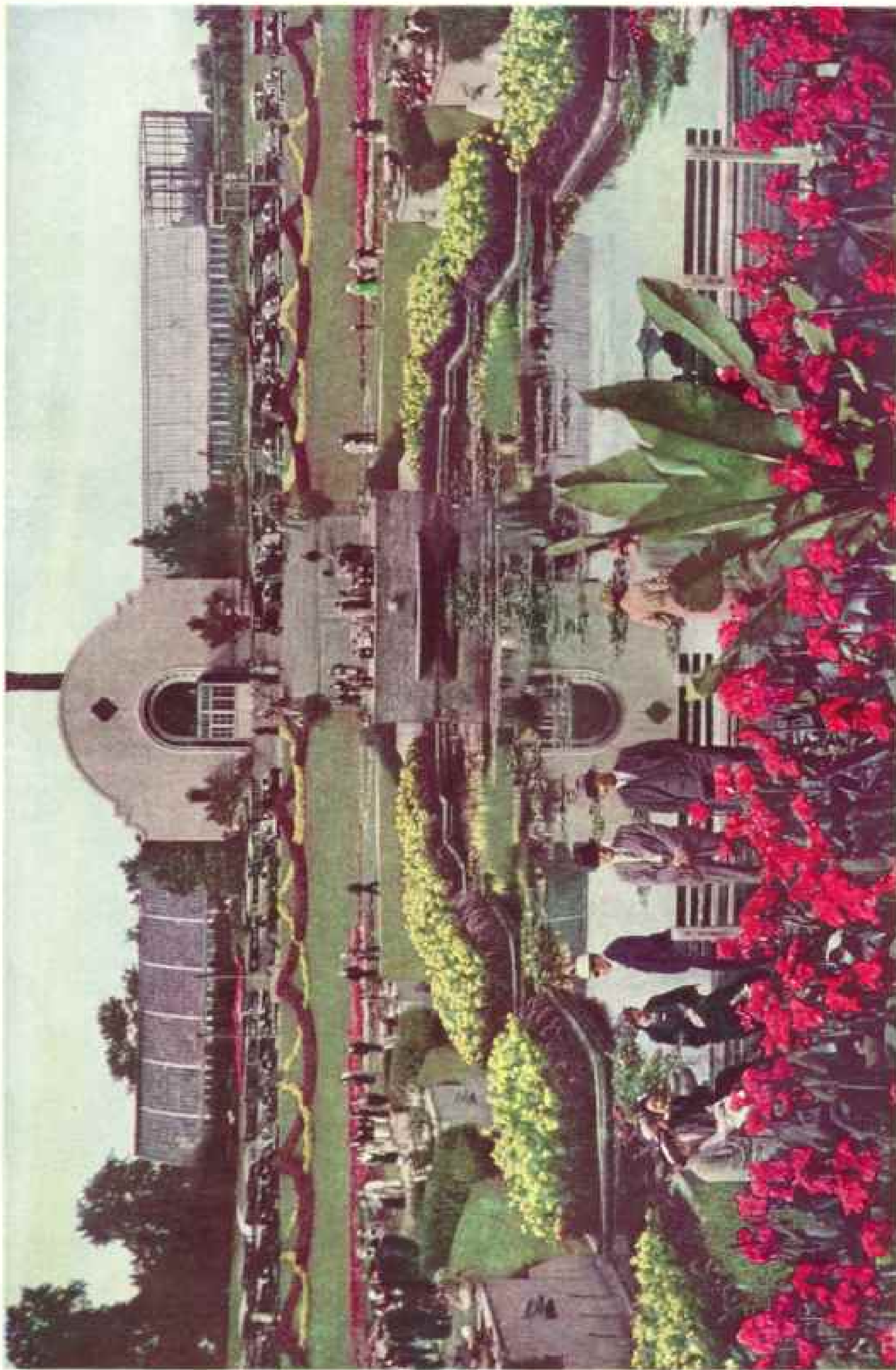


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Finlay Photograph by B. Anthony Stewart

PEACEFUL TODAY IS THIS LITTLE TOWN, NAMED FOR VICTORY OVER THE INDIANS

Red men and white fought for these pleasant lands along the winding Mississippi, and near here, in 1832, the Sauk, under Chief Black Hawk, were crushed in the encounter that ended the Black Hawk War. Jubilant, the whites named this settlement Victory. With the Indian menace gone forever, Wisconsin cities sprang into life. "Oxcart" farmers raced to the new frontier and staked out homesteads in the wilderness. Within a generation Wisconsin became a State and its population grew from 3,000 to three-quarters of a million.



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RED AND YELLOW CANNAS FRINGE A LILY POND IN THE SUNKEN GARDEN OF MITCHELL PARK, MILWAUKEE.

In the spacious greenhouse beyond, the city holds its annual chrysanthemum show throughout November. Milwaukee parks and playgrounds cover nearly 2,000 acres, where youngsters whet appetites playing baseball or tennis, and older folk wander amid the wealth of carefully tended blooms.

Friday Photograph by D. Anthony Stewart.



© National Geographic Society

FROM BABYHOOD HE RAISED THIS ORPHAN

The little goat is a special pet of a Swiss herdsman who lives at Monroe, in Wisconsin's Green County. To this region, famed for its cheese, many Swiss have been attracted (Plate V).



Friday Photographs by B. Anthony Stewart

PRIZE-WINNING DAHLIAS GROW AS BIG AS YOUR HEAD

Bulbs of "champion" plants sell for \$10 to \$25 each. These new varieties, displayed at Milwaukee during an exhibition of the Dahlia Society of Wisconsin, include the Jessica Dragonette (lower center).



BAYFIELD'S HARDY STRAWBERRY PLANTS YIELD FRUIT UNTIL SNOW FLIES

Breezes from chilly Lake Superior retard the Bayfield crop and cause it to ripen after the normal season's peak. From then until winter sets in, farmers can get a good price for their big, firm berries, which, like cherries, apples, cranberries, and other fruits, thrive in Wisconsin soil.



© National Geographic Society

Finlay Photographs by B. Anthony Stewart

KETTLES ARE DIPPED IN GAY-COLORED PAINT TO MATCH ULTRAMODERN KITCHENS

Gone are the days when the pot could call the kettle black. In a bath of red pigment, at Sheboygan, the staid old utensil takes on a fiery hue. Austrian artisans brought the enameling industry to this Wisconsin town more than 50 years ago.

LIFE'S COLOR IN WISCONSIN



GREEN COUNTY SWISS: THE GIRLS, THE COSTUMES, AND THE CHEESE

Thoroughly American, but proud of their ancestry, Monroe folk dress up in old-country attire for "Cheese Day," a festival held every five years. Wisconsin's 2,100 cheese factories produce seven-tenths of the domestic Swiss consumed in the United States and three-fifths of the cheese of all varieties.

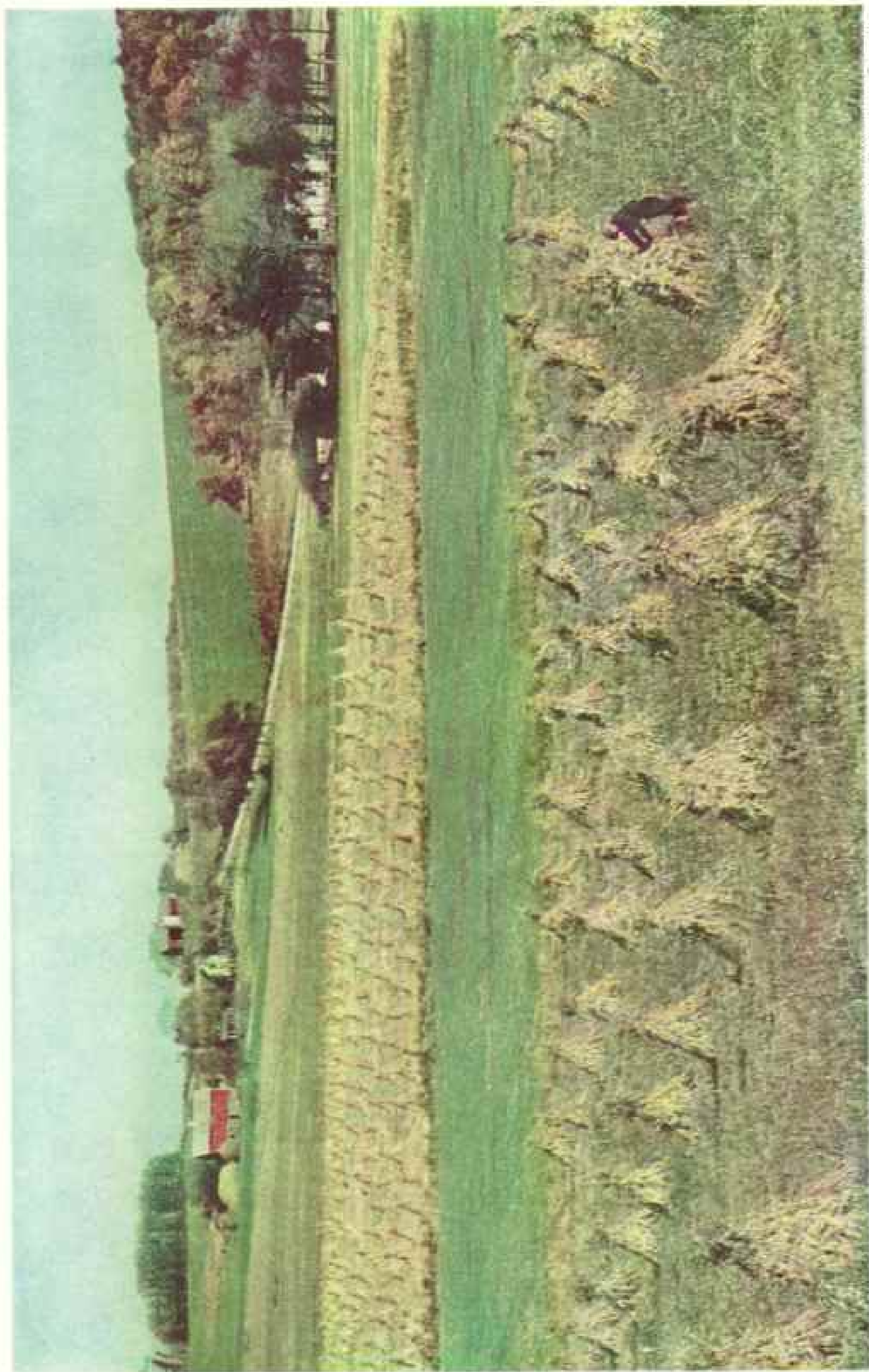


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Finlay Photographs by E. Anthony Stewart

GLAZED PAPERS OF RAINBOW HUE WILL DECORATE SHOP WINDOWS

From laminated glassine, another material manufactured in this Rhineland plant, up-to-date lamp shades are fashioned. Candy, cigarettes, toys, and novelties go to market packaged in a bewildering variety of transparent, greaseproof wrapping papers also produced here.



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Finlay Photograph by B. Anthony Stewart

WHERE ARE THE COWS THAT RULE THIS RICH REGION OF MILK AND BUTTER, CHEESE AND CREAM?

The answer is that up-to-date farmers get more milk and greater profits by keeping their herds in small quarters and feeding them special rations than by letting them pasture freely. Hence, bovine aristocrats browse only an hour or two in the cool of the day—and that for exercise! Typical of Wisconsin's dairy country is this scene near Portage—rolling fields of hay and corn, neighboring farms with orchards, wood lots, well-kept houses, silos, and barns.



Finlay Photographs by D. Anthony Stewart

"TO MEND A NET, YOU KNOT IT SO"

The young fresh-water sailor picks up the art from a Norwegian herring fisherman of Bayfield, Wisconsin, who once sailed a square-rigger out of Hammerfest. Another of the old salt's arts is smoking fish in Scandinavian style.



© National Geographic Society

THE LUMBERJACK STILL WIELDS HIS AX

Gone is the era of ruthless cutting in the Gargantuan manner of Paul Bunyan, and Wisconsin's thoughts today are turning more to reforestation. Yet, in the northern part of the State, the romantic logging camp survives, and leather lungs yell "Come and get it!"



PLEASURE AHEAD FOR PIE LOVERS

"Cherry Orchard of the World," natives sometimes call Door County Peninsula, where encircling waters of Lake Michigan temper the climate. One hundred thousand trees bloom in spring transform the entire area into a gay fairyland. In summer, ripened fruit sets canning factories humming.



© National Geographic Society

Finlay Photographs by B. Anthony Stewart

A VISIT FROM THE GRANDCHILDREN CALLS FOR APPLE COBBLER

This jolly grandmother, who lives in a Belgian community near Brussels, Wisconsin, remarked to the photographer: "I have been in this country all my life, but I do not speak much English . . . Do you ever see President Roosevelt in Washington? We hear him on the radio."

realm of politics and the social sciences:

The students who are drinking chocolate sodas on the Union's flagged terrace, and arguing, who sing one of the country's best college tunes, *On, Wisconsin!* to the music of a zippy band, who paddle canoes lit with paper lanterns in water festivals, and lug armloads of books up the walks of shady University Hill, seem to be neither hayseeds nor rumple-headed Utopians, however (Color Plate XI).

STATE ATTRACTED LIBERALS AND LOVERS OF FREEDOM

The new State, with its new capital in the woods, was eager to attract more settlers. The method it took of advertising itself is important.

In Europe it was soon widely known that America had a beautiful frontier State in which an immigrant intending to become a United States citizen could vote after only one year's residence. And, once a citizen, he would be eligible to any State office despite his foreign birth.

These were liberal terms! To them, in part, Wisconsin owes its reputation for a citizenry devoted to politics and the arts of government. Such terms lured not only the Old World peasant dissatisfied with the rigid systems that kept him "in his place," but the thinking man, who, if he was to settle in a new homeland, wanted to share as soon as possible in shaping the government that would rule him.

The year of Wisconsin's admission to statehood was marked in Germany by the failure of a great popular liberal movement. German liberals, denied a voice in their own government, emigrated to Wisconsin in a flood. News was sent back of the fertility and beauty of the new land, which brought more immigrants on the hustle. The southeast quarter of the State soon was a New Germany, with Milwaukee its mart.

The effect of this movement was felt in more fields than that of politics. German ingenuity and thrift exerted a powerful stimulus on industry. Backyard shops in Milwaukee grew into giant factories.

GERMANS BROUGHT THE KINDERGARTEN

Song festivals and gymnastics, German dishes, German beer, came along as a matter of course. America owes many of its Christmas customs to these Christmas-loving people.

In Wisconsin villages and city parishes to this day the original of our Santa Claus, Saint Nikolaus, appears first on his own eve, December 5, with a whip for bad children, and apples, candies, and spicy cookies for the good. Quavering an "Our Father" for him, they peep through their spread fingers, then bashfully rise, and tell what toys they hope he will bring on his return visit, Christmas night.

And, speaking of children, one of the new ideas the early Germans brought was that of the kindergarten—a pioneer school of this kind was established in Wisconsin, at Watertown.

SCANDINAVIANS CAME, AND MANY MORE

Second only to the Germans in importance are the Scandinavians, who dominate the northwest quarter of the State and its buttermaking and fisheries. Winter sports, *lutefisk* suppers in Lutheran churches, such names as Ebba Larson, Hilding Bergquist—these are some of the signs of their presence.

Nor is it Norwegians and Swedes only that bring Viking blood to this lake-girt State. Polk County on the St. Croix is a little Denmark. Racine, too, has a strong Danish tinge. Washington Island, to which Door Peninsula points, is settled by Icelanders.

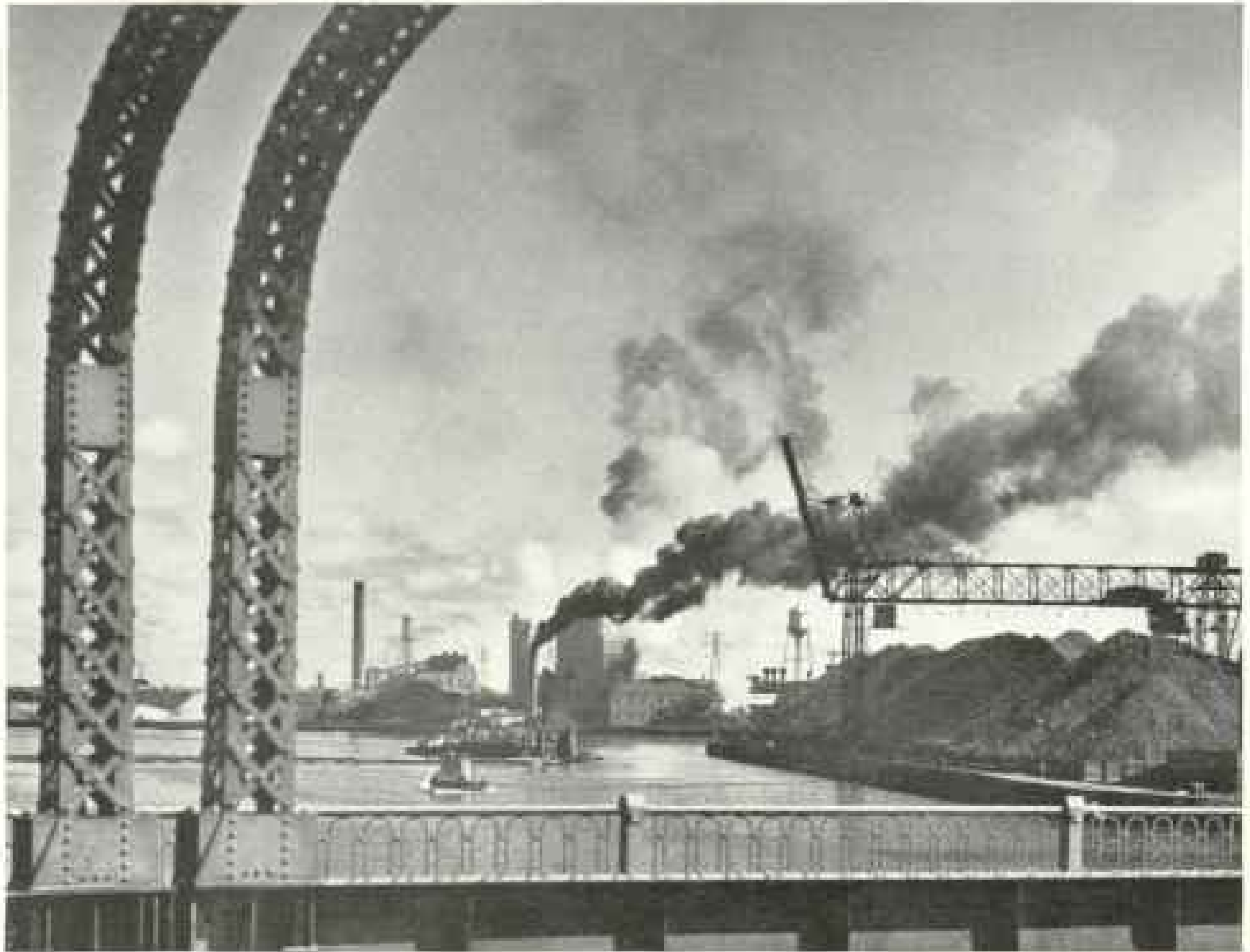
Meanwhile other groups were pouring in.

There were the Irish, the Welsh, the Dutch of the Fox Valley. John Muir's *Story of My Boyhood and Youth* pictures a British migration: a perpetual wanderer to the future naturalist, born in island Scotland, was the heaped-up, tumbled-up, massy cloud-land of Wisconsin's mid-continent skies.

When the Belgians came, French was still commonly spoken in Green Bay. This led them to settle near by; it was a homelike touch. Homelike, too, were the names they gave their villages, as Brussels, Rosiere (Color Plate VIII).

The Poles have settled chiefly in the cities. A visitor to Milwaukee's south side would think himself in Warsaw if he judged only by the names on shop fronts or church pews. Kisielewski's statue of Pulaski towers there in a park named in honor of the Polish hero of the American Revolution. The Kosciuszko Guard is the city's crack military unit.

A recent group of newcomers hails from our own southern mountains. These "Ken-



Photograph by B. Anthony Stewart

SINCE PIONEER DAYS, THE FOX RIVER HAS BEEN A BEARER OF BURDENS

Snorting boats and barges shuttle in and out of Green Bay Harbor, some bringing coal to mountainlike heaps on shore. In early days the settlement marked the beginning of an important water route between the Great Lakes and the Mississippi Basin. Today, historic, versatile Green Bay is known incidentally as the home of a leading professional football team, the Green Bay Packers.

tucks" have settled principally on the cheap cutover land of the Crandon region, where they keep the local game wardens and charity boards busy. But they are much loved. Their rifle guns and scatter-guns, faithful hounds, log cabin shanties, and light-hearted ways make them a storybook lot.

COMMUNITY ENTERPRISE IS TYPICAL

The Kentucks' rugged individualism by its contrast, however, brings out the typical Wisconsin way of life, which is one of community enterprise.

To a remarkable degree the State was settled not by individuals but by organized groups:—the Swiss of New Glarus, the Baden Catholics of quaint St. Nazianz, the New Englanders of Beloit, whose characteristic first care was to found a college; the Norwegian Moravians, and no end of others.

Significant among such groups was the

Phalanx of Ripon, organized according to a plan enthusiastically endorsed by Horace Greeley. All property was held in common. Everybody lived in one long house and ate at one long table.

The oddest thing about this enterprise was that it was a financial success. Indeed the Phalanx in a few years had grown so rich that the urge was irresistible to disband and divide the profits. Living all in one house, too, had proved thorny.

The energies of the disbanded Phalanx were diverted to new tasks. Ripon College was founded, one of those small, sound, not-expensive, much-loved schools, typically American. And in the town school building the Republican Party had its beginnings, in 1854 (page 30).*

* Both Wisconsin and Michigan claim the birthplace of the Republican Party. Some authorities give Ripon priority, despite the homespun informality of its meeting, while others regard as the proper beginning of the party's life its formal organization at a Michigan convention.



Photograph courtesy Milwaukee Journal

C. C. C. BOYS MARCH INTO CAMP NEAR WASHBURN

Symbol of new hope for cutover timberland in northern Wisconsin, these young men replant forests, clean out undergrowth, and build roads through the tracts. During the first three years of their work, 48,318 Wisconsin men built three thousand miles of telephone lines for fire control, developed hundreds of acres of camp grounds, and planted ten million fish and fingerlings.

This cooperative ability, this readiness to pioneer in social and political ways, help to explain how it was that Wisconsin cradled the direct primary, and was the third State to ratify the equal suffrage amendment.

It gives a clue too, to Milwaukee's reason for being famous not for art galleries or costly churches, but for its vocational school and highly efficient police.

HOW WISCONSIN EARNS ITS LIVING

The State's first industry—the fur trade—is still very much alive. But fur farming is the rule of the new day. Wisconsin fur farms supply American furriers with more silver fox and mink pelts than any other State.

At Poynette the State maintains an Experimental Game and Fur Farm where fur-bearing animals are studied. It is a zoo with a purpose.

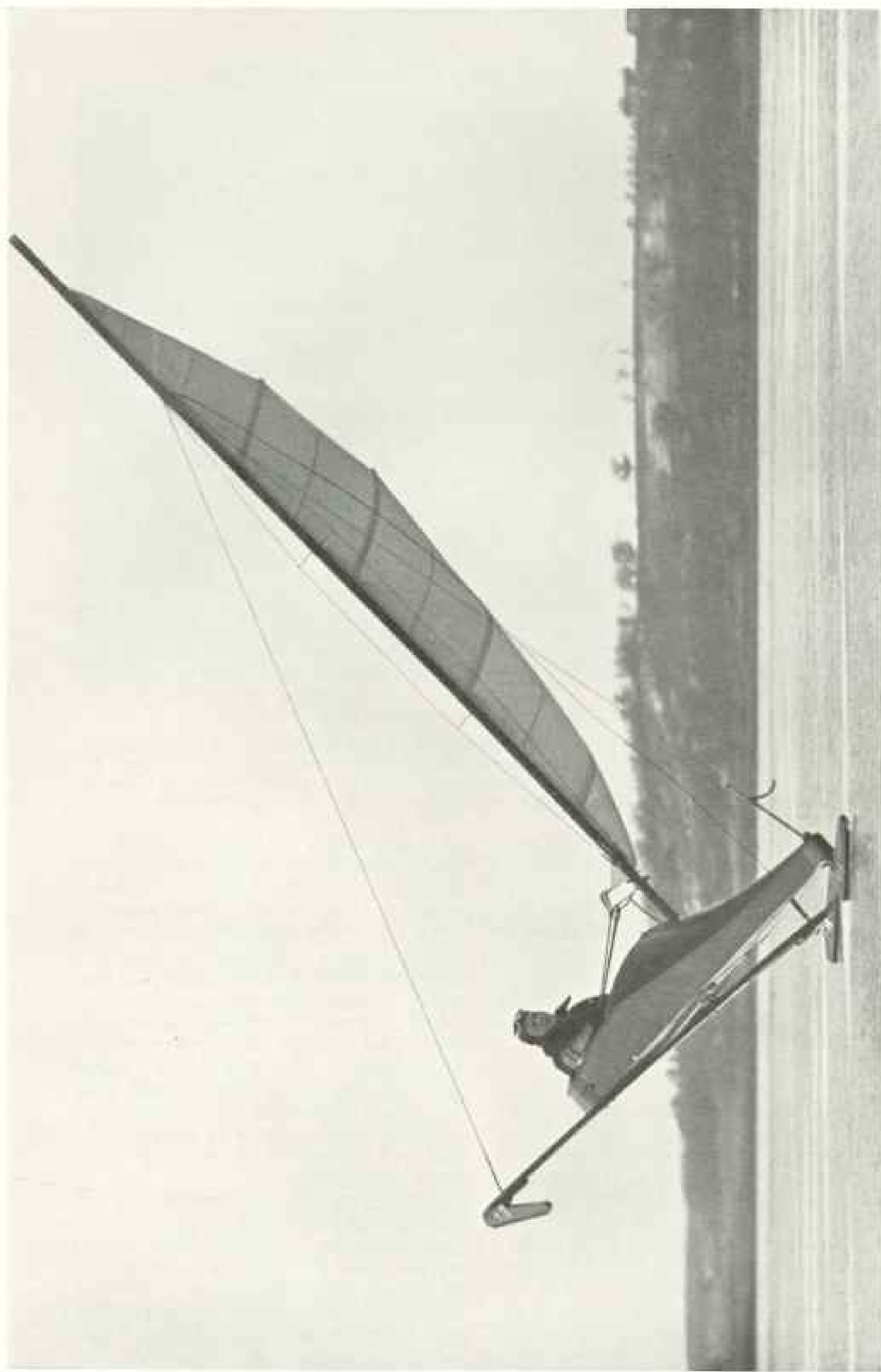
Here are baby coons hanging upside

down and looking very solemn. Here are fishers, magnificent tree animals, a species native to the State but too near extinction at present to provide even a movie star with a wrap; the hope is that the fisher can be "brought back." Here are nutria from South America and karakul from Asia, trying the Wisconsin climate.

Paul Bunyan's rip-roaring era has long since closed in another of the State's leading industries—lumbering. The yellow birch and maple, the hemlock and white pine—these provide the chief timber crops. And logs, far from jamming the rivers for miles at a stretch, ride in on trucks to the few remaining mills.

Eau Claire, Hayward, Fond du Lac, Black River Falls, and the many other towns where the saws once screamed have had to adjust themselves to new roles as distributing or tourist centers.

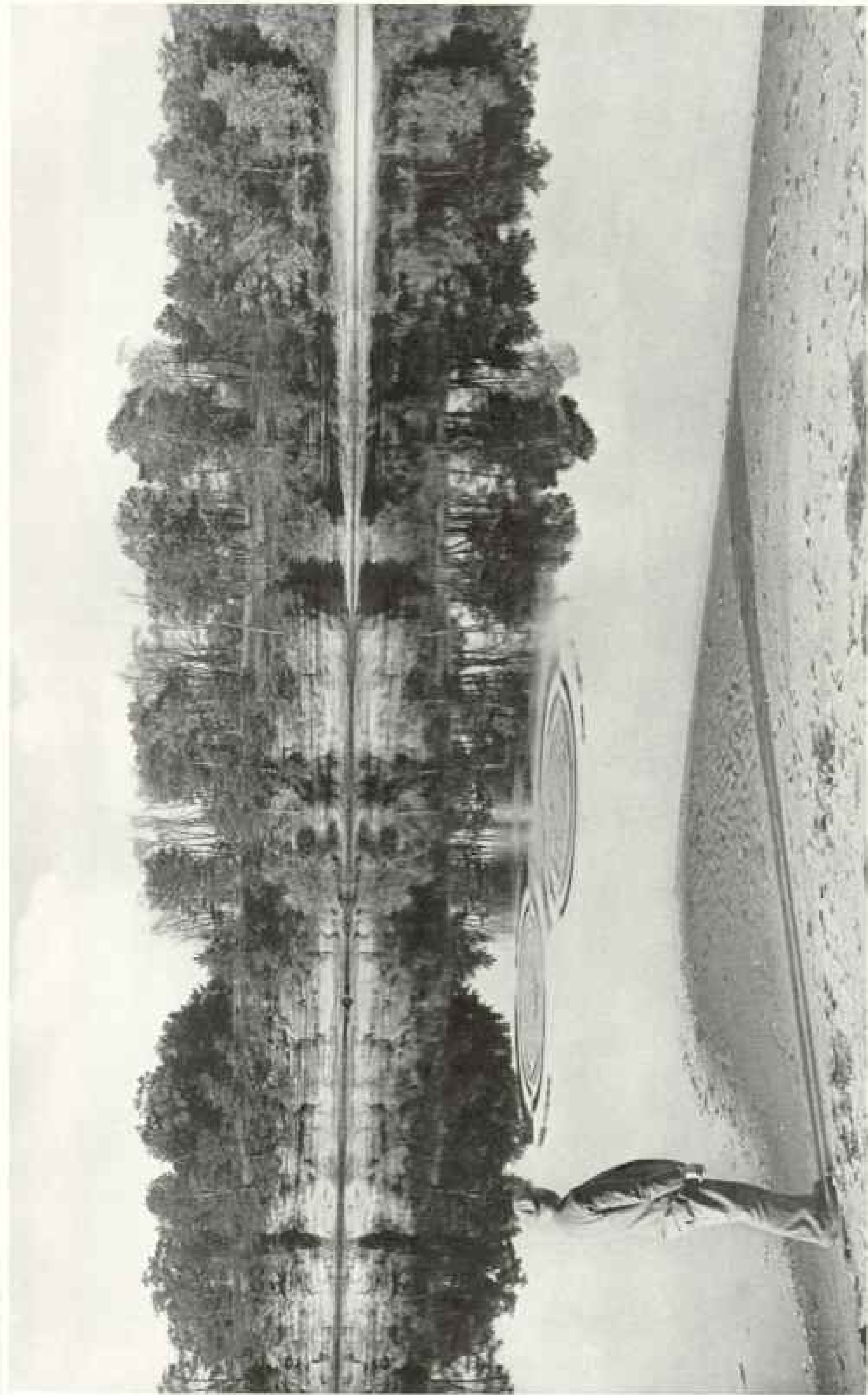
Only one grand tract of virgin timber now remains in the State: the Menominees,



Photograph courtesy Milwaukee Journal

THERE'S MANY A THRILL—AND SOMETIMES A SPILL—“HUKING” AN ICEBOAT ON PEWAUKEE LAKE.

With windward runner bucking high, the light craft whizzes along with the speed of the wind. When it hits rough ice or a coating of snow, the skipper has to “slide ‘im” like a cowboy. Goggles, leather helmet, and fur-lined coat are often needed to shed the stinging breeze.



Photograph by B. Anthony Stewart

FISH MAKE HINGED RIPPLES ON THE MIRROR THAT REFLECTS THE BEAUTY OF THE FAMED WISCONSIN BELLS

In early days, this reach of the river was full of treacherous rapids, making it something of a feat for Jefferson Davis, just out of West Point, to raft logs through for the construction of Fort Winnebago at Portage, a few miles downstream (page 10). But now the stream has been dammed for electric power and a canoeist has plenty of time to enjoy the drooping lacework of fern and hemlock or admire the fragile rock formations.



Photograph by R. Anthony Stewart.

RIPON COLLEGE STUDENTS TALK POLITICS AT THE BIRTHPLACE OF THE ELEPHANT.

The plaque on the little old school building at Ripon reads: "In this School House March 20th 1854 was held the first Mass Meeting in this country that definitely and positively cut loose from old parties and advanced a new party under the name Republican." Michigan, too, claims the elephant as a native son (page 26).



© Chicago Aerial Survey Co.

FROM A WISCONSIN HILLTOP YERKES OBSERVATORY STUDIES THE STARS

Founded in 1892 by Charles Tyson Yerkes, the institution at Williams Bay belongs to the University of Chicago. The big dome at the left houses a 40-inch refracting telescope, the largest of its type. In the smaller domes are a 24-inch reflecting instrument and a 12-inch refractor.



Photograph by B. Anthony Stewart

A CROSSROADS CHEESE FACTORY NEAR BEETOWN SERVES OUTLYING DAIRY FARMS

Here the farmer unloads his gleaming cans of milk and cream, then, drawing up to the wooden tank, reloads with whey to be fed to his hogs. Early miners, overturning a bee tree near here for honey, found lead under the roots and dug a mine on the spot; hence Beetown's name. But lead mining is now largely a thing of the past, and neatly painted cheese factories are typical.



© F. W. Lavinetti

SNOW GARLANDS—RARE SPECIMENS OF A RARE PHENOMENON

As a gentle breeze shifted the semi-wet snow off the arm of the clothes reel and onto the cross ropes, the temperature evidently dropped just enough to hold it together and form this ropelike mass. The unusual formation was photographed at Ripon, Wisconsin, in January, 1936.

by some miracle of stubborn good judgment, have preserved theirs. These lucky Indians, in fact, are supported by their forest, which, logged in a steady but ungreedy way, supplies their mill at Neopit with logs of old-time girth (page 12).

At the same time the wood products industries are among Wisconsin's most characteristic. The Federal Government's Forest Products Laboratory at Madison, housed in a huge modernistic structure, explores just that field (page 13); and the cities of the upper Wisconsin and the lower Fox thrive on its many lines: baskets, furniture, paper towels, cartons, luggage, implement handles, boxes, toys, excelsior, and so on.

TREASURE-TROVE IN OVERALLS

Here is an Appleton paper mill where rags and wood pulp are combined to make a high-grade bond. Or is this a steam laundry? No, it is a paper mill, all right; but these greasy old overalls that the women are sorting require strenuous laundering—and get it—before they will make white paper.

Sorting overalls, made, very likely, in the nationally famous factory at near-by Oshkosh, b'Gosh (Plate XIV), looks like a dull task. But overall pockets yield surprising finds. One of these sorters once pulled twenty \$20 bills from one pocket—and did it make her head grow swimmy!

But if her head swam, what were the sensations of the overalls' late owner? And what did he do to the wife who had handed them to the junk man? Perhaps a broom handle (another Wisconsin wood product) played a part in that domestic picture.

The rags are chewed up, steamed, bleached, pulverized, brushed—not a speck of dirt nor an overall button is to be seen when the creamy mixture at last is blended with the wood pulp. This final mixture is floated thinly on a traveling screen, looking like very superior (and very watery) horse-radish. It disappears between two rollers. On the other side—paper!

Flour used to be the staple product of the Fox River mills. But when Wisconsin's farmers learned that milk, not wheat, was their best bet, the mills migrated to points nearer the sources of wheat supply.

Will the depletion of the State's forests force a like migration of its great wood products industry? Probably not. The northern counties are a natural timber country, in which the growing of forest crops is actively encouraged.

Fire fighting and tree planting have been expedited by the current C. C. C. The State maintains two extensive nurseries at Trout Lake and Wisconsin Rapids, and the Federal nurseries at Rhinelander provide 30 million young evergreens annually for planting in the vast Nicolet and Chequamegon National Forests. Reforestation is a Wisconsin enthusiasm.

The dams that make the lower Fox navigable have proved chiefly valuable for their water power. The country's first hydroelectric power was developed at Appleton on the Fox. In fact, probably the first house to be wired for electricity stands on the river bank there, a mansion in the fanciful style of the eighties, in which a visitor can eat an excellent supper by the light of those historic chandeliers.

BUSY CITIES SERVE THE MACHINE AGE

Headquarters for Wisconsin's very important metal industries are in Milwaukee, but many other cities share in that work.

Racine, for one, is nationally famous for farm implements, made by the J. I. Case Company. And in this city, where are built the reapers that cut the grains of the Great Plains, also are built, on the same principle, the clippers that the barber runs up the back of your neck.

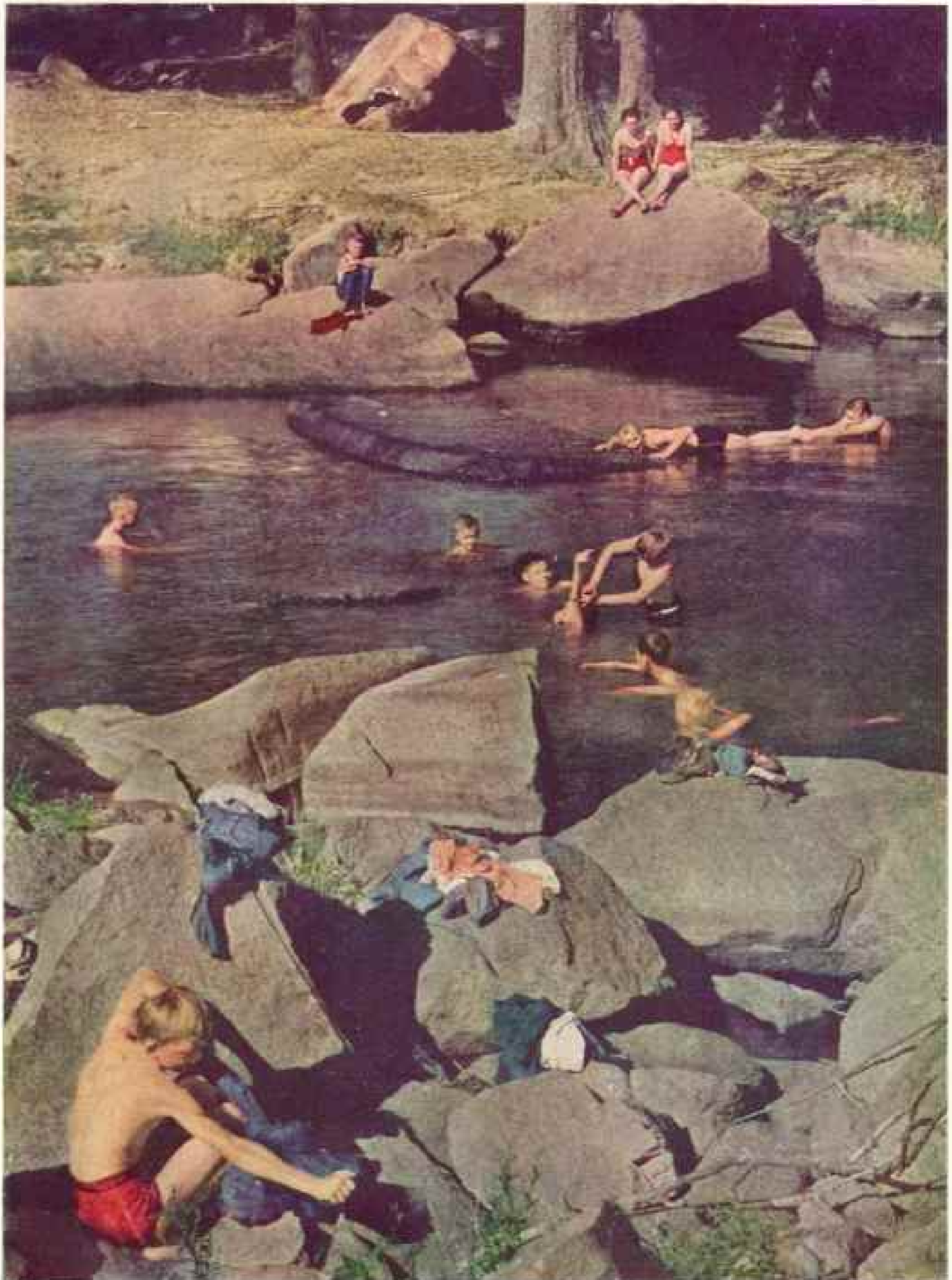
Sheboygan, for another, is noteworthy for teakettles, pots, and pans. The Vollraths who make them, and the Kohlers of Kohler, who make bathtubs and sanitary ware, brought the secrets of the enamel processes with them to America (Color Plates IV and XV).

It is awe-inspiring in the great Kohler plant to see a tub or sink riding in and out of its fiery furnace, first dusted with enamel powders from an implement that looks like an elongated banjo, then baked, then re-dusted, and baked again, until its gloss is perfect.

Sheboygan people say that a man from Kohler can always be recognized by the hedge clipper in his hand. It is a model village, neat and flowery; rivalry is keen among the householders. Each house is owned by its occupant, his children go to the best of schools, there are musical and athletic doings for everybody—Kohler is a model village in more than merely looks.

The Girl Scouts' clubhouse there, hidden away in its own woodsy park, is patterned after the country houses of the Kohlers' native Tyrol—a picture straight out of *Grimms' Fairy Tales*.

LIFE'S COLOR IN WISCONSIN



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Dufaycolor Photograph from Milwaukee Journal

"SKIN-NAY" GETS A DUCKING IN THE OLD SWIMMING HOLE

A sunburned chum meanwhile sneaks out of the water behind the bowlders, and puts plenty of knots in the pants of his friends. If he is caught, into the stream he'll go—with his clothes thrown in for good measure. Clare Briggs, creator of "Skin-nay," "The Days of Real Sport," and "When a Feller Needs a Friend," gained a deep knowledge of boy life in his native Wisconsin. This present-day scene, on the North Fork of the Eau Claire River, near Owen, is typical except for one thing—the unwonted feminine touch!



YOUNG HUSKERS WORK IN A GREEN-GOLD SEA OF CORNSTALKS AND EARS

Nearly swamped in fodder, the men often turn this farm drudgery into thrilling competition. Beef cattle and hogs consume much of southern Wisconsin's ripened corn. Farther north, early frosts prevent the crop's maturity, and green fodder is siloed for dairy cows.

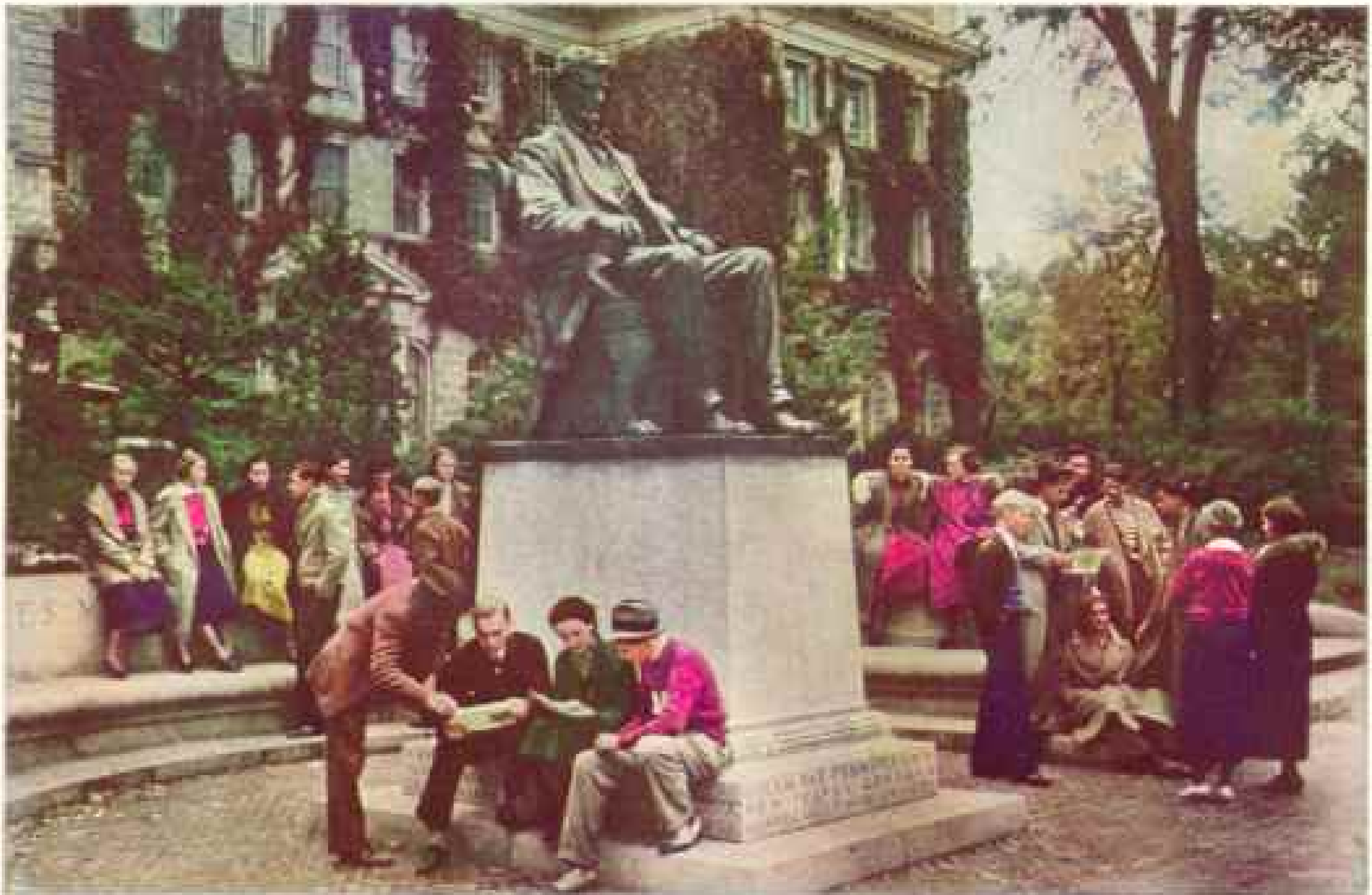


© National Geographic Society

Fishery Photographs by B. Anthony Stewart

PLUM LAKE IN NORTHERN WISCONSIN WAS THE SCENE OF THIS TRIUMPH

To land a 30-pound "muskie" and follow it with one of 19 pounds would set any sportsman's pulse racing. These joyful fishermen marched into camp singing "Hail, Hail, the Gang's All Here," with the catch dangling from an oar. Gamy muskellunge sometimes grow six feet long and weigh 80 pounds.



A BENIGN AND BELOVED PRESIDENT LOOKS DOWN ON CAREFREE STUDENTS

As a young militiaman, Lincoln took part in Wisconsin's Black Hawk War (Plate I), and afterwards boasted humorously of his bloody battles with the mosquitoes, and his daring raids on wild onions. The statue stands in front of Bascom Hall, University of Wisconsin, at Madison.



© National Geographic Society

Finlay Photographs by B. Anthony Stewart

EACH GRADUATING CLASS HANDS DOWN THE RIBBON-DECKED "PIPE OF PEACE"

With this calumet as a symbol, the custody of traditions at the University of Wisconsin passes from old hands into new. During an elaborate Indian ceremony, the colors of the departing class are knotted around the stem. The oldest ribbon was tied there by a representative of the class of '94.



© National Geographic Society Dufaycolor Photograph from Milwaukee Journal
HARVEST BRINGS THE EXCITEMENT OF THRESHING TIME

While father, boys, and hired men haul sheaves from field to machine, mother and girls have their hands full cooking for the crew. Oats and barley are increasing in Wisconsin; wheat and rye are losing ground.



Friday Photograph by B. Anthony Stewart
AN OLD-WORLD ATMOSPHERE SURROUNDS THE BREWING INDUSTRY

Dressed in peasant smock and cavalier finery, these La Crosse folk add a touch of pageantry to an old-country inn. Beer made in Wisconsin carries German names and emblems from one end of the Nation to the other.



© National Geographic Society

Behind her grows another variety of apple, the Wealthy, which ripens later in the season. Fruit is so abundant that it actually bends the lower branches to the ground.

Finlay Photograph by B. Anthony Stewart
A STRAW-CROWNED QUEEN PRESENTS A "DUCHESS"



Dufaycolor Photograph from Milwaukee Journal

ON A SPECIAL RACK FARMERS HAUL THEIR BINDER LEAF

Hung upside down, the tobacco leaves handle more easily and are less likely to be broken. In domestic cigar making, Wisconsin's binder leaf is used to make the rolls hold their shape.



© National Geographic Society

Finlay Photograph by B. Anthony Stewart

ONCE THE NAME OF AN INDIAN CHIEF, OSHKOSH HERE MEANS OVERALLS

Expert stitchers sew on roomy pockets. Machines slap buttons into place—and fasten them to stay—with a speed that makes visitors' eyes bulge. The city of Oshkosh is also an important wood-working center, owing to the proximity of northern forests.



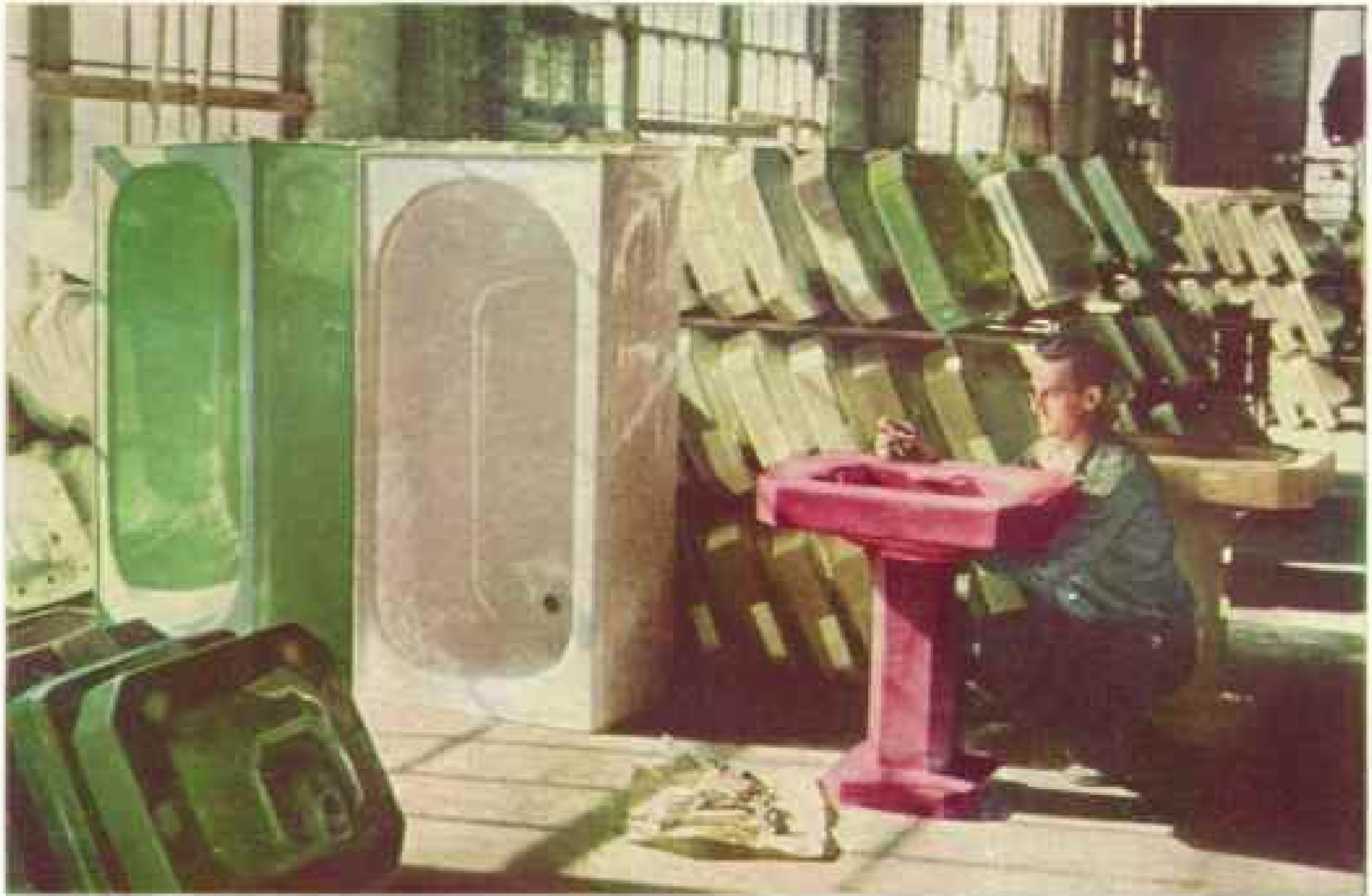
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Dufaycolor Photograph from Milwaukee Journal

AGNES TIES A BASS FLY, HIDING A HOOK UNDER BRILLIANT FEATHER "WINGS"

Fishing means profits as well as sport at Stevens Point, in central Wisconsin. The Weber Life-like Fly Company specializes in paraphernalia to capture trout, bass, and pike, planted by the million in Wisconsin lakes and streams.

LIFE'S COLOR IN WISCONSIN



BATHTUBS AND SINKS MATCH ANY MOOD OR MODE

Immense Kohler workshops mold, glaze, and fire the sanitary plumbing ware. Other departments supply brass fittings. The model town of Kohler, incorporated in 1913 as a home for employees, has grown exactly as planned, with wide streets, shady parks, and vine-clad homes.

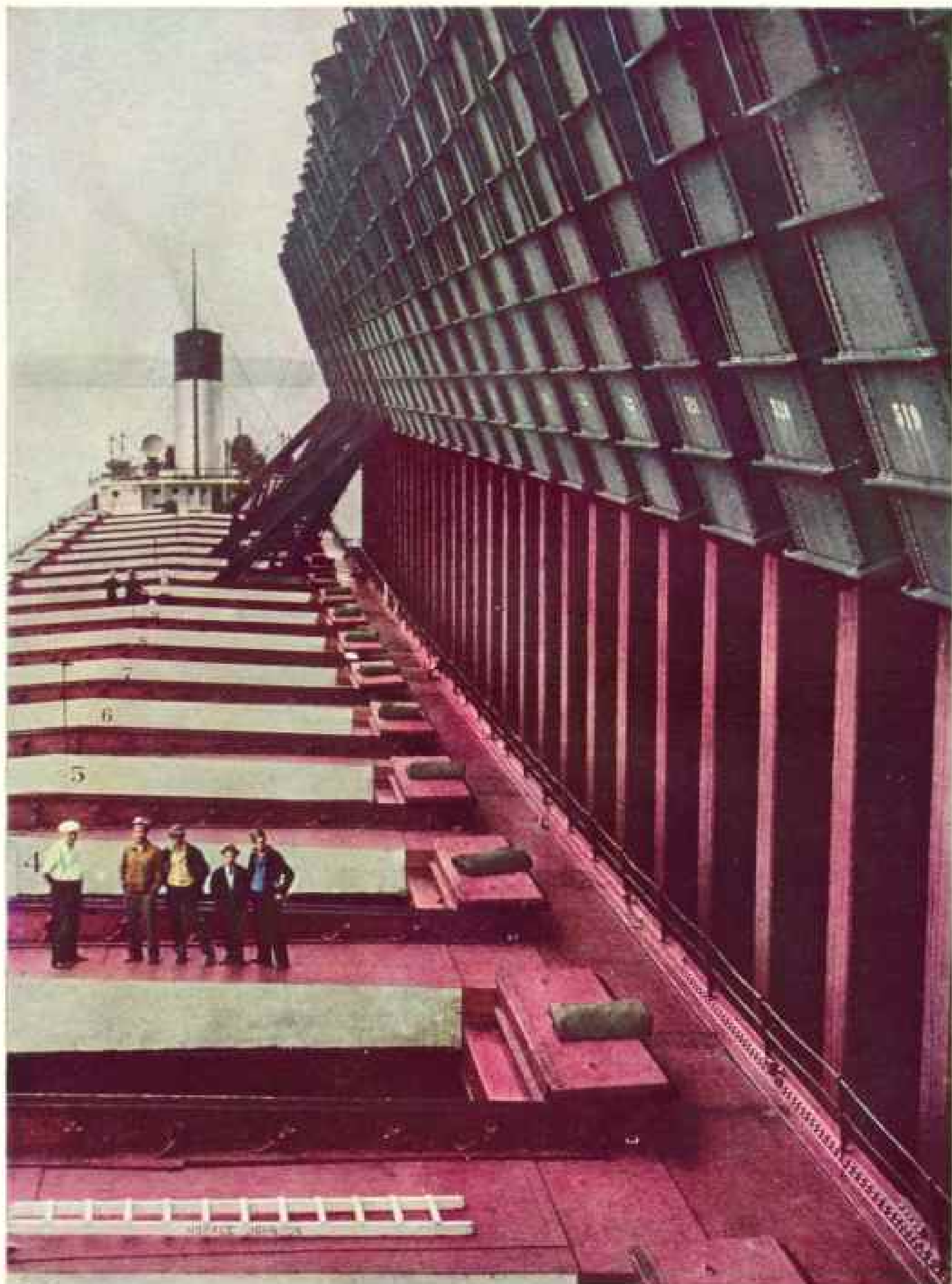


© National Geographic Society

Fairley Photographs by R. Anthony Stewart

YOUNGSTERS SOON WILL TEASE, "PLEASE, SIS, ANOTHER PIECE OF PUMPKIN PIE!"

Autumn's first heavy frost has shriveled the broad leaves that conceal the fruit in summer. This crop is sometimes fed to cattle and hogs. Wisconsin soil that is unadapted to intensive farming is being retired from cultivation and returned to its natural state.



© National Geographic Society

Finlay Photograph by B. Anthony Stewart

TEN THOUSAND TONS OF IRON ORE THUNDER DOWN THE CHUTES INTO THE
"HORACE JOHNSON" AT ASHLAND

Railroad cars, each carrying 50 to 90 tons of ore from Gogebic iron mines, move along overhead tracks across the top of the high dock (right) and dump their loads into storage pockets. Later, boats pull alongside the dock, anchor, and open their hatches. Chutes are lowered from the great bins, and ore pours out. Water ballast in a special compartment keeps the empty boat at the proper level and is pumped out as ore supplies the necessary weight. The *Horace Johnson*, which can be loaded in about two hours, carries its cargo to such lower lake ports as Detroit, Cleveland, and Buffalo.

In Milwaukee one of the most noteworthy metal-working establishments is that of the A. O. Smith Corporation.

This firm has attained such proficiency in the science of welding that oil-cracking vessels of a size formerly thought impossible are being made in Milwaukee and installed in lands as distant as steamy Java. Pipe-line pipe, coated with flexible, corrosion-resisting glass, can be turned out at the rate of ten miles a day.

Automobile frames, too, are produced, on an "automatic" which is one of the marvels of the mechanical world. Every eight seconds, out rolls the completed article.

The riveting of these frames is a sight fit to raise the hair on any scalp. Into the assembled frame the hundred-odd various rivets are fed with one blast of compressed air; it then runs the gantlet of a series of crablike robots that advance upon it with smooth suddenness, bend over, grip it, and head the rivets with one fiendish pinch of their steel jaws.

A famous Milwaukee industry is brewing; the city boasts four breweries of national importance. Pabst's, to mention but one, favors a thirsty public with 1,300 bottles (or cans) a minute, not counting the more abundant barreled beer.

The beers of La Crosse and Manitowoc also command national markets (Plate XII). And as the frequenters of the Rhine fairs compare the wines of various vineyards, so do hoar-headed Wisconsin connoisseurs compare the brews of Two Rivers, Fort Atkinson, and other local favorites.

Mineral waters come principally from the springs of Waukesha. White Rock, bottled there in an up-to-the-minute plant amid lawns and gardens wantonly sprinkled with White Rock water, is shipped to all quarters of the globe.

CHEESE PURVEYOR TO THE NATION

This one State provides the Nation with three-fifths of its cheese. The New Glarus region (whose present-day center is Monroe) produces 70 per cent of our Swiss cheese (Color Plate V). National cheese prices are largely set in little Plymouth.

To see a Switzerland-trained technician washing 250-pound Swiss cheeses in some Monroe "warming room" and rubbing them with salt—the process is repeated every 36 hours for several weeks—reminds a visitor of the care given champagne in the caves of Reims.

One Wisconsin specialty, Colby cheese, bears the name of the town where it was first produced. Mild but not sissy, it provides the ideal third in the trio of cheese, rye bread, and Milwaukee beer. To be at its best, it must be fresh.

Quite another matter are the Italian-type grating cheeses of Campbellsport. These, to be at their best, must have been aged at least two years.

As decentralized as this dairy industry is the canning of vegetables and fruits. Sturgeon Bay is famous for its cherries, for example. And since Wisconsin grows and packs about half of the United States pea crop, pea canneries are almost as common as filling stations.

LAKES AND WOODS LURE VACATIONISTS

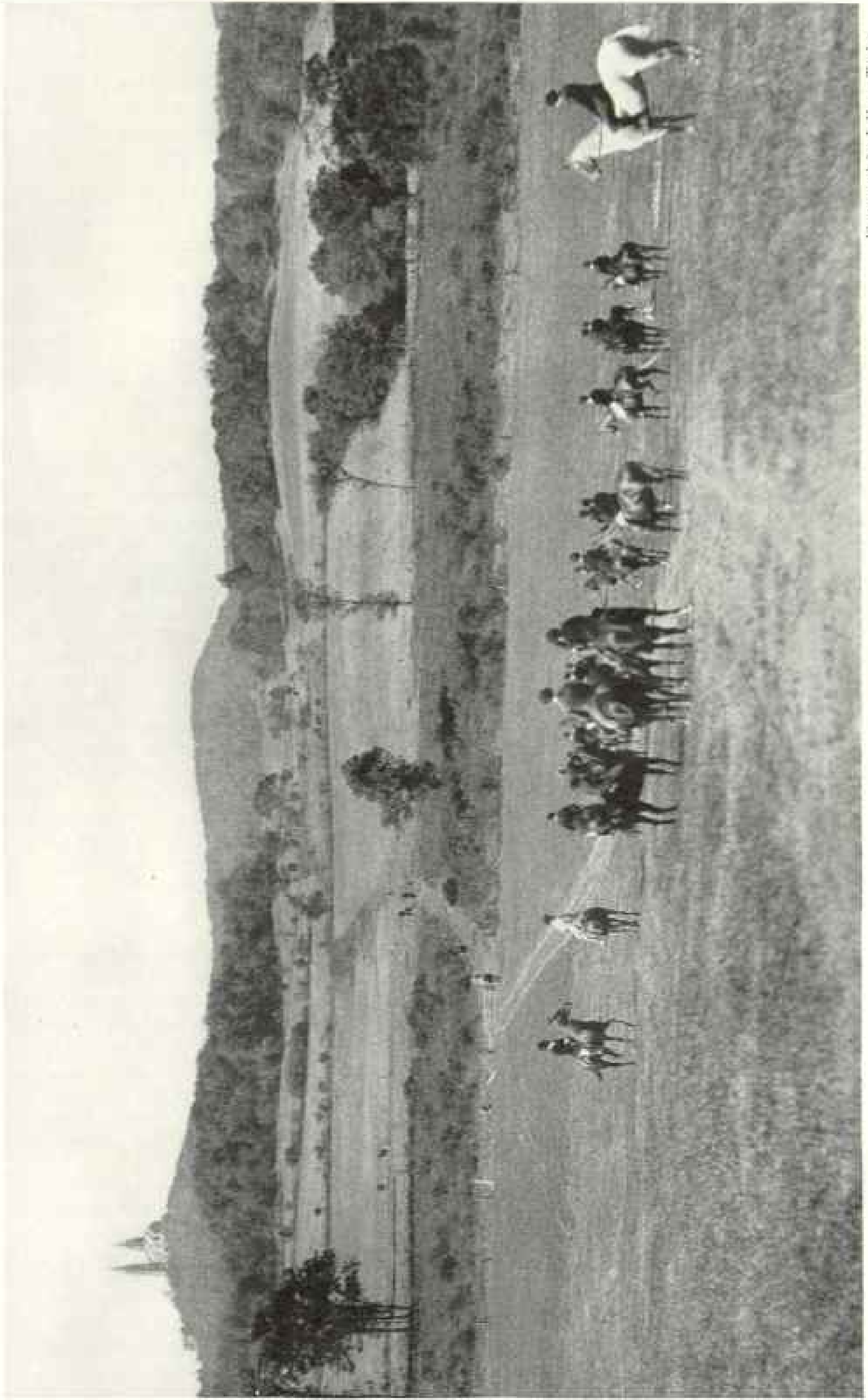
The annals of Wisconsin's pioneer times are full of picnics and outdoor fun; and the duck hunter of modern Wisconsin, while the first snowflakes of fall drift into his blind in the reeds, is the inheritor of that old delight. But his outdoor world he is glad to share: it is quite roomy enough to hold him, and others, too—Chicagoans tired of hot brick walls, dwellers of the lakeless prairies, fishermen anxious to feel the rod twitch in their hands.

Fine landscapes characteristic of various parts of the State are preserved in 18 State parks and five State forests.

There is the simple charm of New Glarus Woods, and the believe-it-or-not wonder of Copper Falls State Park near Mellen, where a red, rocky canyon has a waterfall pouring in at each end, as if it were a Paul Bunyan bathtub that never filled up.

Trempealeau—"the Mountain-soaked-in-the-Water"—preserves a generous slice of Mississippi River scenery in Perrot State Park. On Lake Michigan are the sand dunes, pines, and twinflower banks of Terry Andrae State Park. Devil's Lake, most visited park of all, was given its name in prehistoric times by Indians who grew goose-pimples at the voice of its echoing precipices.

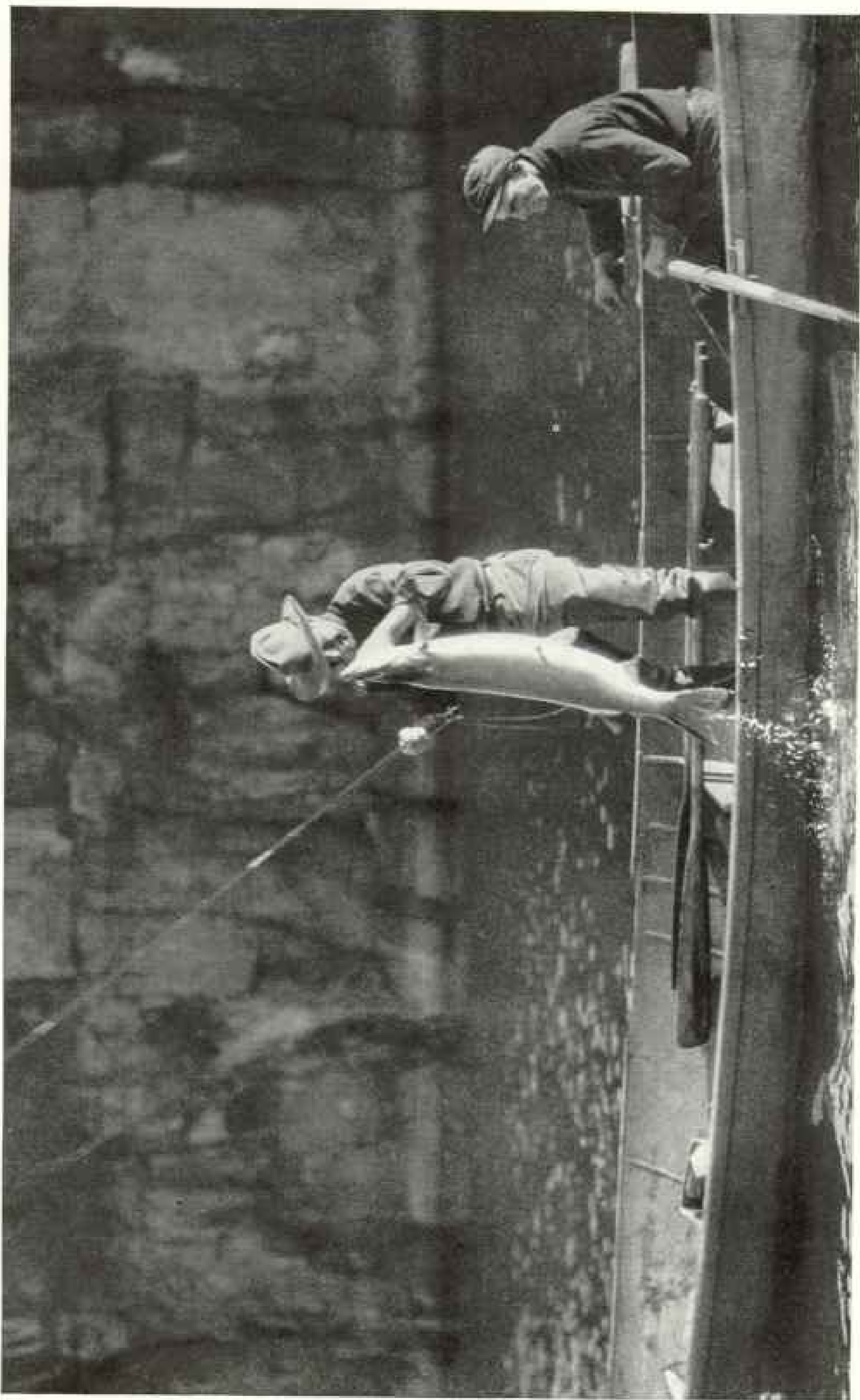
Wisconsin has lakes of all kinds. There are the field-girt sunny ones of the St. Croix tier of counties, and the pine-girt ones of the North Woods. There is Lake Geneva, with its palaces and its religious conferences, and Lake Winnebago, where the young bloods of Oshkosh tear down the wind in that reckless sport, iceboating (page 28).



Photograph by J. Harry Taylor

MEMBERS OF THE MILWAUKEE HUNT CLUB PAUSE IN THE CHASE NEAR HOLY HILL.

Over these broad acres northwest of the city elite residents of Washington County ride to hounds. Grassy meadows of the course suggest a British countryside. In the left background rises Holy Hill, a Roman Catholic shrine maintained by the Order of Carmelite Friars, who are now constructing a seminary near by.



Photograph by Mills and Bell

WITH THE CONFIDENT SMILE OF AN EXPERT, W. C. VOGT LANDS A 12-POUND "MUSKIE" AFTER A 12-MINUTE FIGHT

Its fins erect, and its mouth snapped shut, the gamy fighter hasn't yet given up the struggle. No ordinary angler would be as sure of himself as this sportsman, who lifts the prize with his left hand. A bass fly, single hook, and spinner were used to make the catch. The scene: a rocky gorge in the St. Croix River.



Photograph courtesy Milwaukee Journal

SAMPLE OF WISCONSIN WINTER: A SNOWPLOW RESCUING A TRAIN

Stalled near Jackson during a blizzard, the locomotive was nearly buried when the big snow fighter arrived to dig it out. Often, on the windward side of the track, high wooden fences are erected to break the path of drifting banks.

The State's nine most populous communities, in fact, are all on lakes of real size except La Crosse, which has to worry along with just the Mississippi River. Water and beach sports are everybody's heritage.

In maintaining Wisconsin as an angler's Mecca, nature is generously helped by the numerous State fish hatcheries. For one item, more than 470,000,000 wall-eyed pike were planted in 1955.

Even Lake Superior is mothered along by the Bayfield hatchery, which puts millions of lake-trout fry into it every year. In the same way the amber waters of the Chippewa-Black-Wisconsin River systems are kept stocked with their most famous game fish, the muskellunge (Plate X and p. 45).

Eagle River is noted for some of the finest fishing and hunting in the land, and the Bois Brule is a trout stream *par excellence*, perfect in cleanliness and regularity of flow, water grasses, and shore beauty. Indian guides pole the canoes upstream, or deftly run the rapids that link pool to pool, while

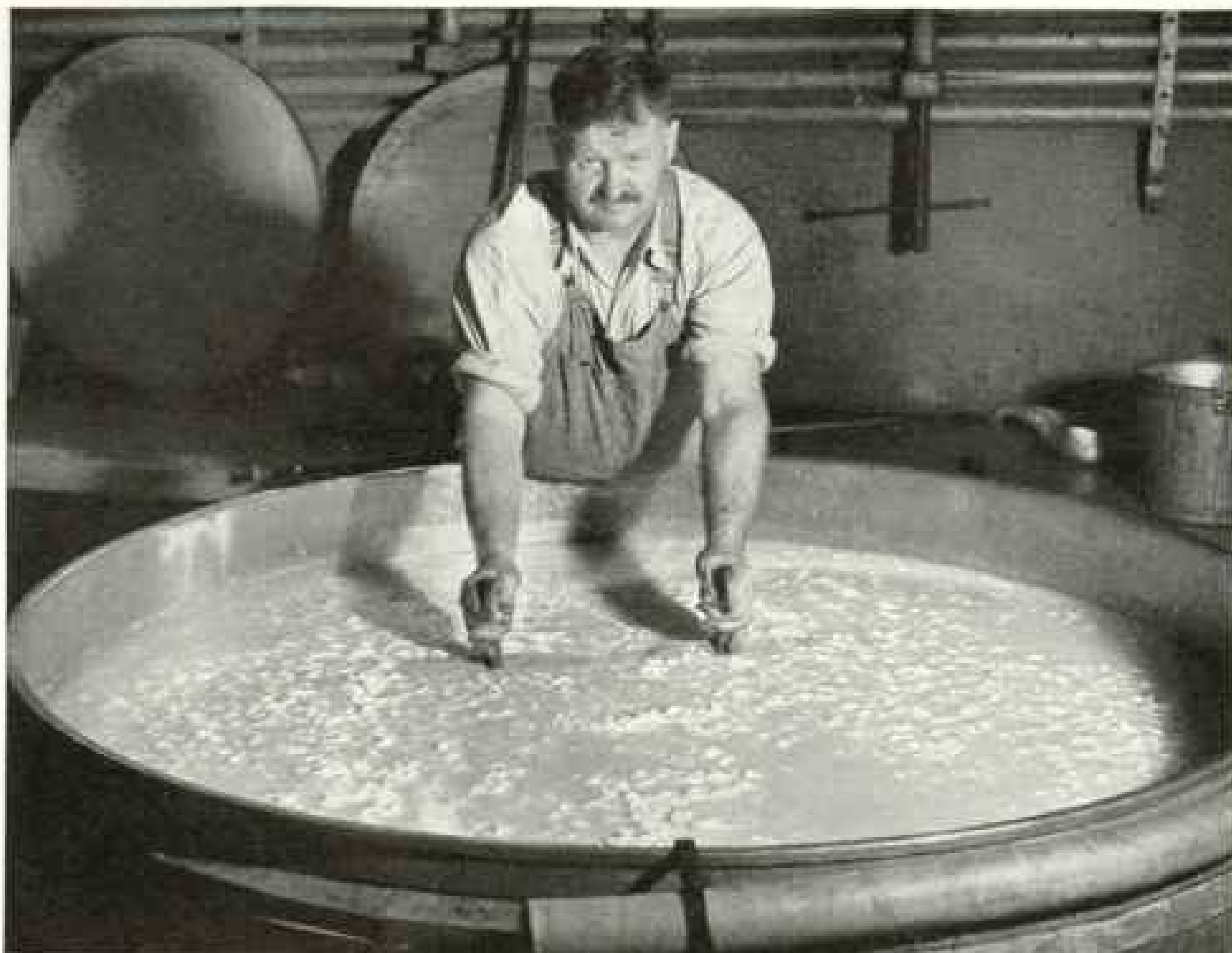
crusty old anglers from Dallas or Philadelphia happily ply their favorite waters.

To more low-brow fishermen, shamelessly contented with a reed pole and a can of worms, let me commend the Fox River at Montello. At the foot of the weir there, the white water boils black again with schools of blue-gills.

In the effort to bring back plentiful waterfowl to the State, the stocking of Horicon Marsh with great flocks of banded ducks promises to be a successful experiment. Of upland game birds the hardy Mongolian pheasant is being extensively propagated. In the north the native grouse, in the south the native quail, already are abundant. Deer, too, are plentiful.

THE STATE'S PAGEANT OF PEOPLES

Fond as I am of woods where no ax rings, rivers that turn nobody's loud mill wheels, and animals that are no man's target, I must agree that people are the most interesting part of geography. Wisconsin



Photograph by Fred G. Korth

IN A BIG VAT CHEESE CURDS BEGIN TO SEPARATE FROM THE WHEY

Young immigrants from Glarus, Switzerland, to New Glarus, Wisconsin, in 1845, did not begin cheese making at once, as they disliked the constant drudgery. But when chinch bugs ruined their crops, they turned with high success to the arts of their fathers (Plate V).

has a wonderful pageant of people to show against its green and friendly landscapes. And what these people have left behind, or build and do in our own time, is full of meaning.

What of the Indians? Of all the Wisconsin tribes about 12,900 individuals remain. At Baraboo we can pace off one of their ancient, mysterious, ceremonial earthworks, the famed Man Mound, 150 feet long and nearly 50 feet broad at the shoulders. In Milwaukee's museum we can examine specimens of delicate, graceful, and incised pottery from the earthwork of Aztalan, near Watertown.

Many of the various names the Indians left behind are full of mystery. Nobody is sure what "Wisconsin" means, for example, because the word has been corrupted from the very beginning.

What of the French? Wisconsin's history has been called "the Americanization of a French settlement." Never really numerous in any established, rooted group,

the French blended with, and vanished into, the Wisconsin we know. Poetic place names keep their memory fresh, however, and romantic stories, touched with the light of other days.

PIONEER INFLUENCE STRONG

Then, the Old Americans! The State is crammed with reminders of those energetic pioneers. Hartford, West Salem, Lancaster; Brown Deer, Spring Green, Beaver Dam—such were the familiar or plain-chosen names they added to the map.

It was New Yorkers, whose ancestors had brought the art of cheese making from England's Cheddar Gorge, who established that most characteristic of Wisconsin industries.

And oh, the rich stories, of pioneer, lumberjack, stagecoach, and river boat! The descendants of those vigorous people have brought balance and a backbone of American humor and ways of thought to the Wisconsin we know.



Photograph by B. Anthony Stewart

HIS SAILING DAYS ARE OVER, BUT HE CAN'T FORGET THE SEA

Even the sails of this model windjammer are made of wood, carved and plied into place with infinite care. On the deck are tiny figures of men, painstakingly whittled. The maker of the model lives at Sturgeon Bay, a yachting center, whence a canal cuts across Door Peninsula to Lake Michigan.

The architecture of the period, fortunately not yet trampled down in some of the quieter towns, yet charms the visitor. I think of Hudson on its hillside, with its white-painted columns and "American Gothic" windows facing the river. *Silver Threads Among the Gold* was a favorite new song then—its verses written by a Shiocton man.

For a last glimpse of the Germans, here they are in Mader's Restaurant in Milwaukee. The helpings of *Kalbshaxen* (calves feet), pickled string beans, and *Apfelkuchen* are enormous. Beer is plentiful—or perhaps it will be a choice bottle of wine from the Fatherland that is ordered, "the Fatherland" in most cases being the pre-Bismarck Germany of long, long ago.

For a last look at the Scandinavians, here is one of their Apostle Islands fishing villages. Shy yellow huskies that will drag the fishermen's sleds over the ice in winter peer out from under the reeled-up nets. This lore of boats, and sleds, and nets, and cedar-plumed pole buoys harks back to another country. Accomplished northern-

ers work here, who know how to live in a cold land.

And now what of the final mixture—of these, and the many lesser elements?

OUT OF THE MELTING POT

Our last stop is in a Milwaukee park on the Fourth of July. The band plays, and the school children of the neighborhood march in, wonderfully scrubbed and starched. All have their eyes pinned on the ice-cream booth, for on the Fourth of July ice cream is the portion of every Milwaukee boy and girl.

But now the band breaks into *America*. The parade stops and everybody waves his flag.

In a shady place, among the proud mothers and fathers, sits an old grandmother, watching and listening. Is her name Thompson, I wonder, or Wisniewski, or Lefevre, or O'Dowd, or Sundstrom, or Eschweiler?

Impossible to say. But behind the happy shine of her glasses is the shine of a tear, as the penny flags wave and the music rises.

POTENT PERSONALITIES—WASPS AND HORNETS

Though Often Painfully Stung, Mankind Profits Immeasurably from the Pest-killing Activities of These Fiery Little Flyers

BY AUSTIN H. CLARK

United States National Museum

STINGS have a high educational value. After one or two experiences with these concealed weapons, the personality of the little sting-wielders is firmly impressed upon you. Thereafter you instinctively avoid any creature that appears to be a wasp or hornet.

It is quite proper to regard the wasps and hornets with respect, as they insist you shall. But do not let their potent personalities prejudice you against them. For it is within this group, taken in the broadest sense, that we find the cleverest and most ingenious of all the insects, as well as the most efficient and destructive enemies of our insect pests.

The cleverness and ingenuity of wasps take numerous forms. Each of the many thousands of different kinds has its own little specialty which differs more or less from that of every other kind. Among these specialties few are more fascinating than those of the various digger wasps that burrow in the ground and lay up in little chambers food upon which their young subsist.

Let us look more closely into the habits of some of our common digger wasps and see what they are doing in that sultry season when we can think only of vacation, for it is then that they display the greatest energy.

THE CICADA-KILLER IN ACTION

Familiar to everyone in the hot, still, midsummer days is the monotonous shrill song of the cicada. Its aggravating quality seems to emphasize the heat and make it more depressing and debilitating.

Once in a while one of these monotonous trills stops suddenly. You hear a discordant shriek that startles you for a moment. Then all is the same again—the heat and the interminable trills of the cicadas.

What has happened? One of Nature's little tragedies. A cicada has been sur-

prised by a cicada-killer, has fled shrieking away, and in all probability has been caught and stung, not to death, but into a state of complete helplessness.

The cicada-killer is one of the largest and most conspicuous, as well as one of the commonest, of our burrowing wasps. To many people it is known as a hornet—in fact, *the* hornet—and is much feared (Color Plate III). But it is not at all aggressive. It resents undue familiarity, of course, but its nature is wholly peaceful—except when cicadas are concerned.

Cicadas are its only prey. Sometimes you see it flying about a tree, hunting for a victim up among the branches, or pursuing a cicada at high speed through the air. But it is usually noticed dragging a cicada, often much larger than itself, along the ground on the way to its burrow.

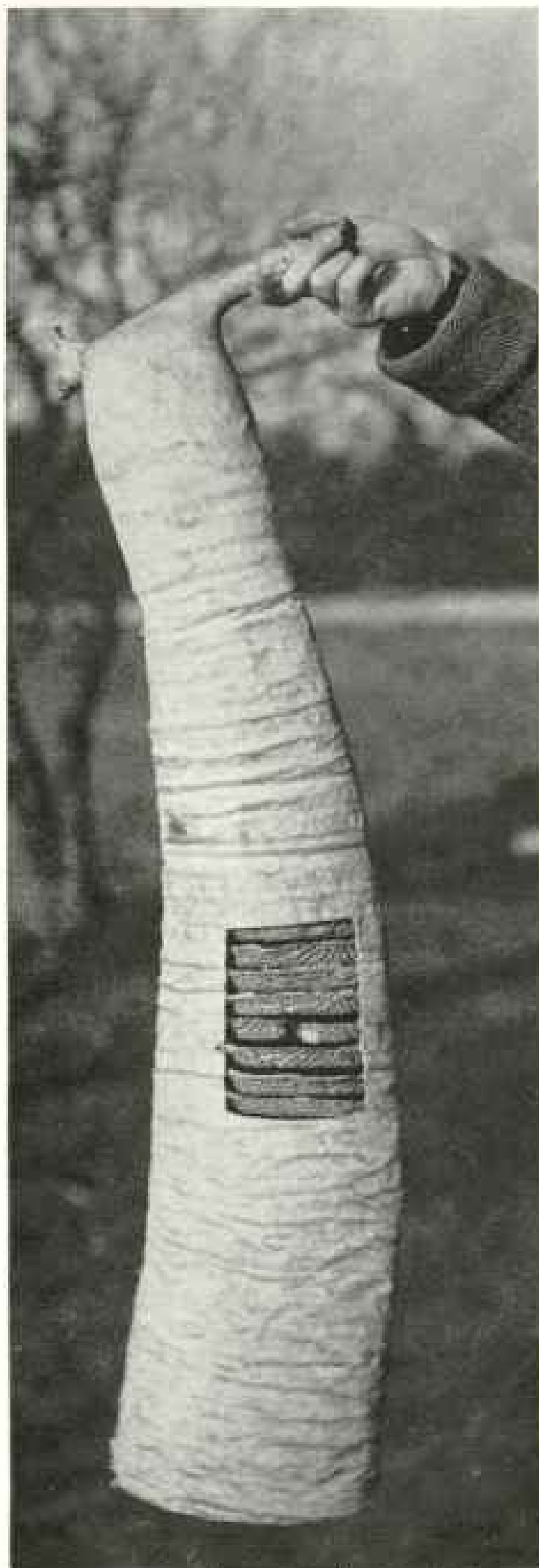
FOOD FOR A FUTURE GENERATION

This nursery is commonly made in the higher and drier portions of lawns or in sloping grassy banks, and runs to a more or less spherical cell about an inch and a half in diameter (Plate III, lower). The finished nursery usually includes four cells.

After each cell is completed the mother wasp goes on a hunting expedition. In bringing the cicada to the cell she frequently hoists her victim laboriously up a tree, from which she flies diagonally down toward her burrow. Thus she saves much time and energy, for dragging a creature as large as a cicada through the grass is a herculean task even for so powerful a wasp. Usually, though not invariably, a second cicada is added to the first.

After the cicadas—still alive but helpless—are stored safely in the underground cell, the wasp places an egg on the body of one of them just under one of the middle legs, then closes the cell with earth.

The egg hatches in three days, and the grub feeds on the cicadas for a little over



Photograph by Paul Griswold Howes

A SKYSCRAPER OF THE WASP WORLD

This huge Brazilian nest of 40-odd stories, found hanging from a branch, is the work of thousands of individuals. The cells are empty now and part of the tough, pasteboardlike wall has been stripped away to show the interior (opposite page).

a week. It then makes a cocoon of earth, mixed with enough silk to make it rather dense, and spends the winter inside. In the spring, after passing through the pupa stage, the wasp digs its way out of the ground.

The cicada-killers that you see walking or flying about a grassy slope are living evidence of the numerous tragedies that have taken place beneath the sod.

WASPS DRINK NECTAR AND BEER

Only the young of this wasp feed on cicadas. The adults, as is the case with nearly all the wasps, are vegetarians. For many days after emerging from the ground, the cicada-killers, indolent and peaceful, wander aimlessly about, lapping up nectar from the flowers. I have seen three of them on a single water hemlock.

They are especially fond of the sap of certain trees. If truth must be told, they much prefer this sap after fermentation has transformed it into more or less strong beer. Last summer on the border of the Dismal Swamp in Virginia I saw five of them drinking along an oozing cut in the trunk of a sycamore. They set up a horrid buzz when I approached too closely.

Idle ease, nectar, and beer satisfy these wasps for a few weeks. During this time they display not the slightest interest in cicadas. Then, with the attainment of full bodily development, the females somewhat suddenly become demons of dynamic energy murderously inclined toward all cicadas—full-fledged cicada-killers.

This ferocity, incidentally, is entirely lacking in the males and they do no hunting whatsoever.

The cicada-killers are interesting because of their great size, and the bulk and power of their victims. It is a thrilling sight to see one of them strike a cicada in full flight and, with its prey, go tumbling to the ground. But their technique is crude—effective, but lacking those finer touches that perfect the picture. So let us consider the most accomplished artists that are found among the digger wasps.

THE WAY OF A WASP WITH A CATERPILLAR

Rather large, very slender, and long-waisted wasps commonly are seen early in the summer on wild carrot and other flowers (Color Plate IV, figure 5), about decaying fruit, or drinking at the sides of puddles. Indolent and peaceful, they are

unsuspicious and slow to take offense. These are young caterpillar wasps, for which as yet life means little more than feeding on nectar in full enjoyment of the summer sunshine.

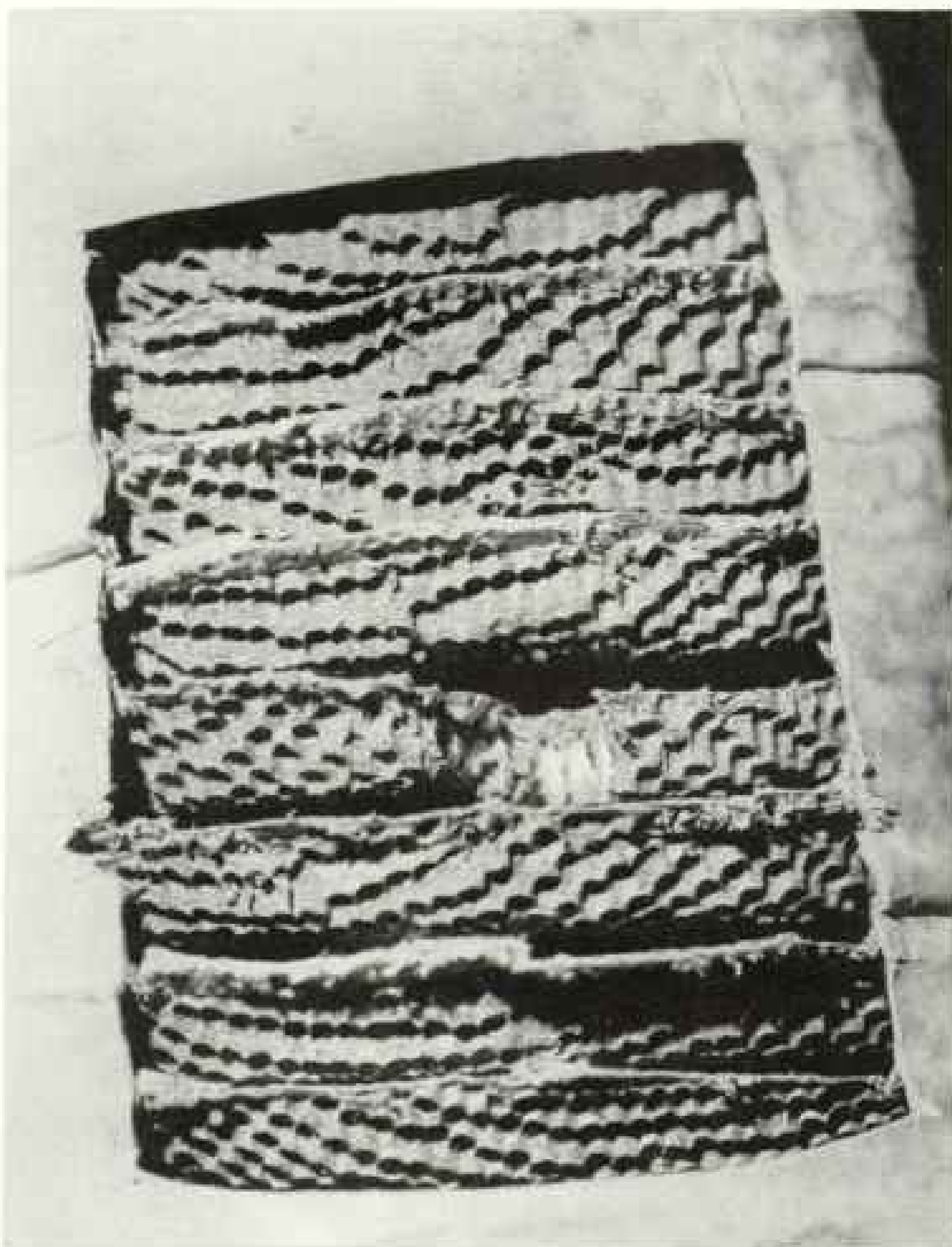
Lazy, slow-moving creatures, with an air of complete boredom, they could scarcely appear less interesting or more slothful. But while they are spending their time in frivolous enjoyment they are developing strength and energy and acquiring a knowledge of the world.

Energy finally gets the upper hand, and the female forsakes the flowers almost completely. The first thing she does on becoming energetic is to find a patch of bare, stiff soil, more or less protected, and there dig a burrow ending in an enlarged chamber, oval in shape and horizontal.

After the burrow is completed the wasp closes the opening with a little stone or a pellet of earth of just the right size, or sometimes with several pellets, filling the hole up level with the ground and often kicking some loose earth over it.

Her burrow completed, closed, and concealed from view, she now goes in search of prey—caterpillars found on or near the ground. Our commonest one prefers green caterpillars much larger than herself.

When a caterpillar is discovered the wasp knocks it off the leaf onto the ground.



Photograph by Paul Grissold Homes

EIGHT FLOORS IN A 40-STORY "WALK-UP" APARTMENT HOUSE

Each floor of the skyscraper (opposite page) is securely anchored to the strong outer wall, and all are connected by passageways in lieu of stairs and elevators. In these crowded tiers young wasps are reared.

Then, watching her chance, she seizes it with her mandibles near its head and gives it a prolonged sting between two of the earlier segments. This ends the struggles of the caterpillar.

The wasp then stings its victim between the other earlier segments and between most or all of the hinder segments. The stinging is followed by a thorough squeezing of the neck between the mandibles all around, this squeezing process lasting for some time.

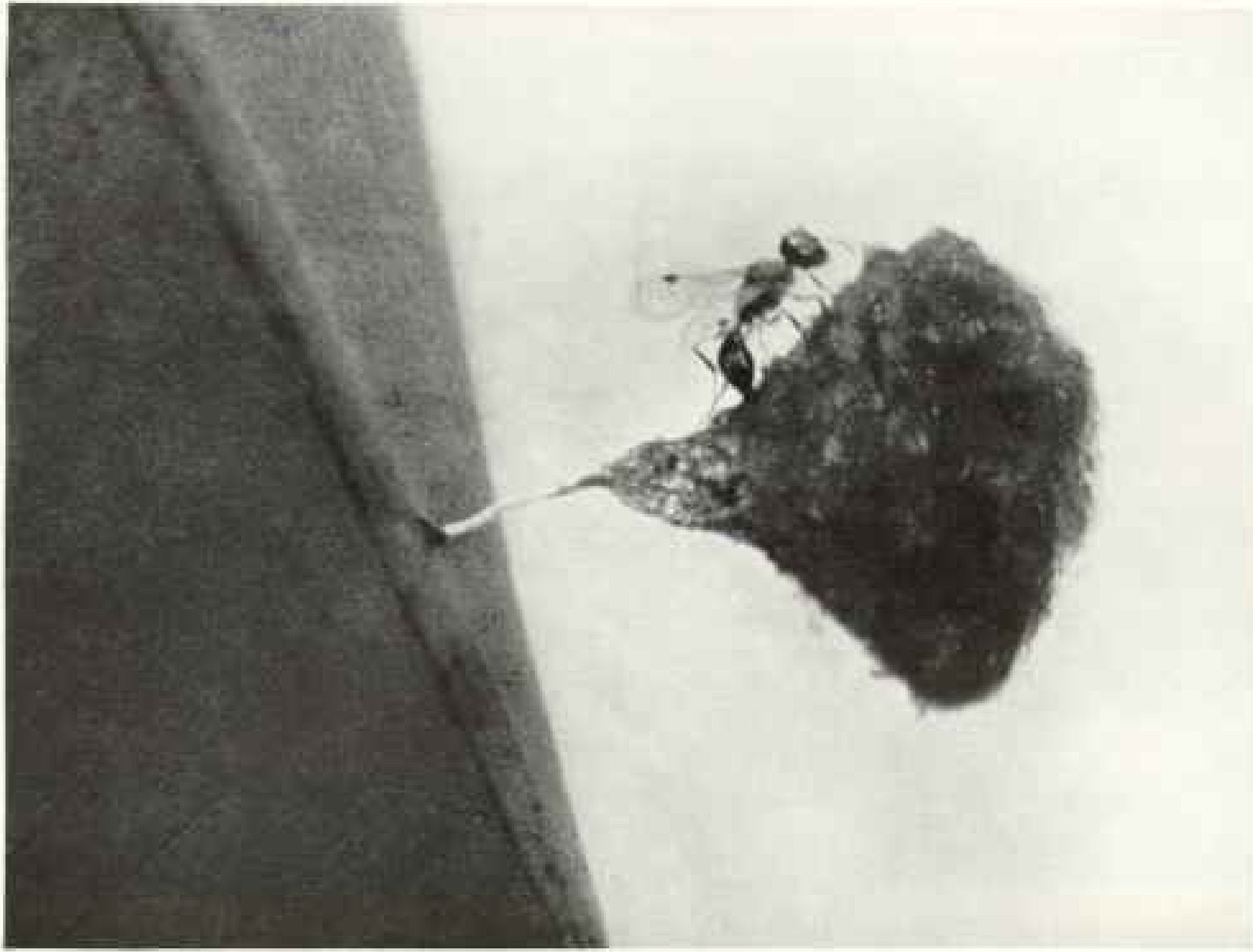
The caterpillar, reduced to complete inertness and lying extended at full length, is now ready to be transported to the burrow. The wasp turns it on its back; then,



Photograph by Lee Pomeroy

SIPPING NECTAR FROM A PEPPER BOUGH, THIS YOUNG TARANTULA HAWK IS AT PEACE WITH THE WORLD—BUT HER DISPOSITION WILL CHANGE!

Today she basks in the sunshine, flits about aimlessly, and seems to take little interest in the life around her. Soon, however, her entire nature will alter. A steely-blue killer driven by the mother instinct, she will hunt out and attack her natural prey—the large and formidable tarantula. Conquering the giant spider in fair fight, she will seal its paralyzed body in a dungeon to serve as food for her young (pages 52, 53, and 55). The antennae of this wasp (*Pepis middei*) suggest spectacles.



Photographs by Paul Grisonald Howps

ONE OF THE SMALLEST NEST-BUILDING WASPS KNOWN (SIX TIMES ENLARGED)

The mother perches on her neat little nest, suspended by a filament from the under side of a leaf in the jungle of British Guiana. Much larger than the insect itself is its name—*Microstigma guianensis*.



TINY WASPS OF ARTISTIC TEMPERAMENT DECORATE THEIR "CUP CAKE" HOME IN COLOR

Winged artists of British Guiana (*Nectarina ustulata*) build a nest of reddish-brown paper, then ornament it with curious stripes, figures, and masses of pure white, pink, and green. Many wasps display similar esthetic traits (page 54).



WASP FACES TARANTULA FOR A DUEL TO THE DEATH

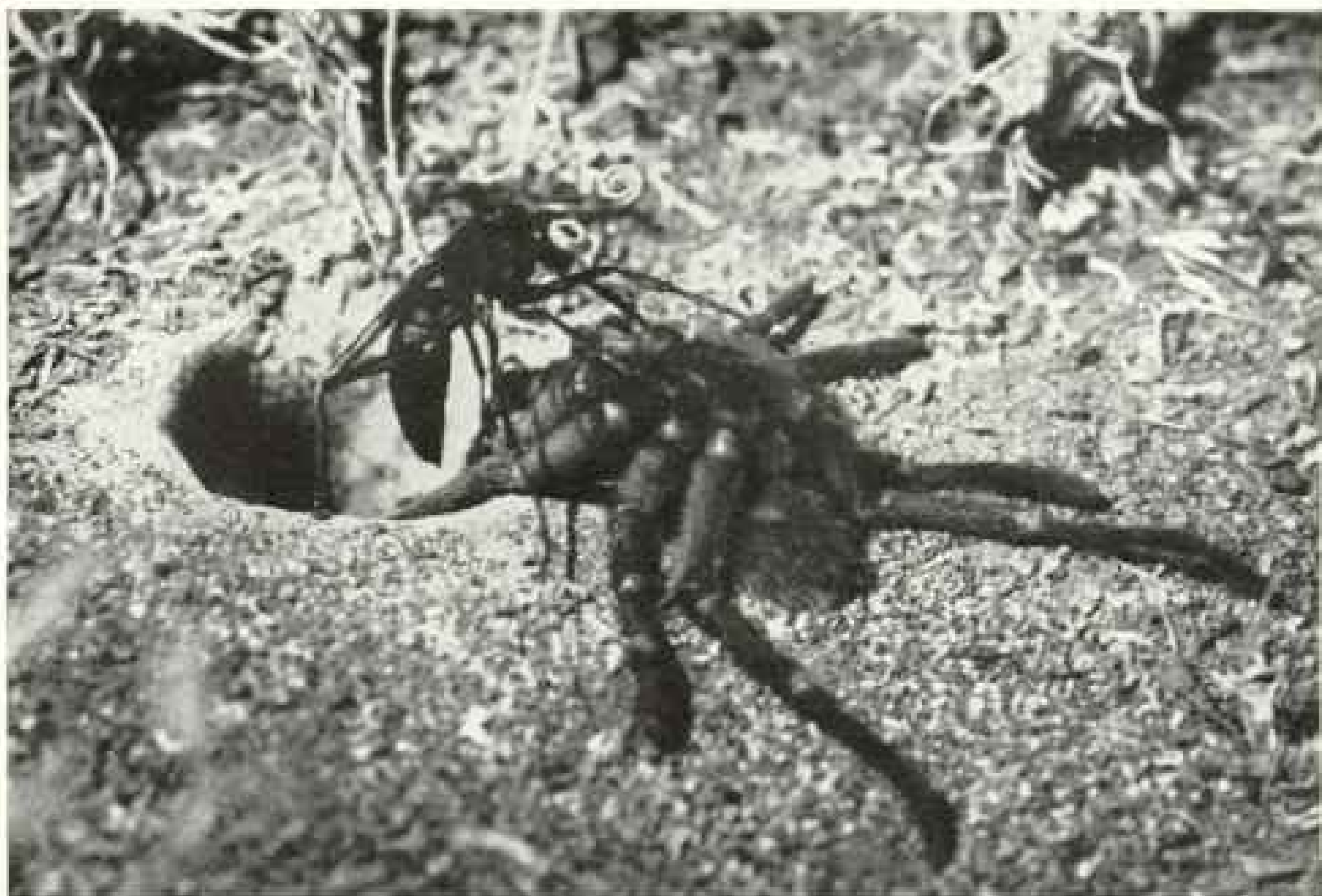
Alighting between the frightened spider and its burrow, the tarantula hawk (page 50) holds her victim at bay. Each is able to kill the other, for one carries a high-voltage sting and the other has powerful jaws. But the odds are heavily in favor of the eager, confident wasp.



Photographs by Lee Passmore

ONE THRUST OF THE HIGH-POWERED STING AND THE FIGHT IS OVER

By a quick strike—the speed of which has been likened to the snap of an electric spark—the tarantula hawk has paralyzed its adversary. The big spider now lies inert and entirely helpless.



THE TARANTULA'S HOME BECOMES ITS TOMB

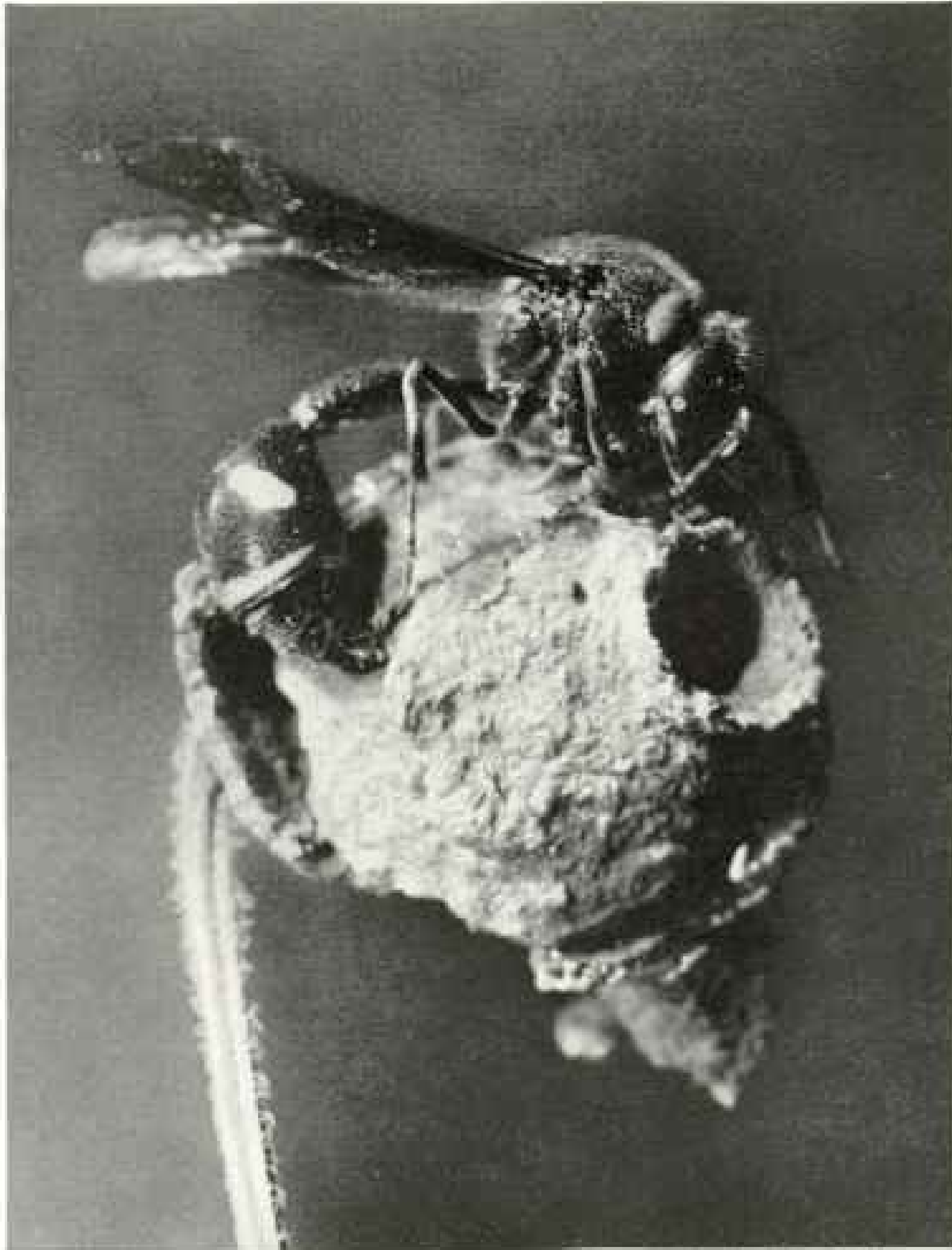
After examining the victim with extreme care, the wasp—always walking backward—drags the paralyzed spider to its own hole. When she gets it to the bottom of the burrow she will calmly lay an egg on the captive, close the hole, and go away.



Photographs by Lee Passmore

THE END OF A TARANTULA, THE BEGINNING OF ANOTHER WASP

From the egg laid on the living spider's body will emerge a grub that will feed upon the victim and ultimately become a tarantula hawk, perhaps a fighting female like its warrior mother (p. 25).



Photograph by Paul Griswold Howes

A YOUNG JUG-MAKER WASP GETS OUT OF THE "JUG"

Weak and clumsy, it prows itself after crawling out of the urn-shaped earthen cell through the large hole at the left (Plate II and page 65). The opening in front is still sealed, just as the mother left it after she provisioned the nursery with caterpillars and laid an egg. (Photograph greatly enlarged.)

seizing it by the throat, lifts its head off the ground and drags it along at a very creditable pace—at least when the ground is smooth and the way is unobstructed.

From time to time the wasp carefully parks the caterpillar and flies away, soon coming back and taking up the load again. These excursions are probably back to the burrow to see that nothing is amiss and to get her bearings.

If all goes well, the caterpillar is finally brought to the burrow, which is opened and the victim placed inside. Sometimes a single caterpillar is sufficient, but usually

two or even more are needed. If more than one is stored, the burrow is always closed after each is placed within it. When the store of caterpillars is complete and the egg is laid, the burrow is permanently closed with the greatest care.

SOME WASPS USE TOOLS

Now comes the most interesting part of the whole proceeding. The wasp searches for a little stone of just the right size and shape, and with this held firmly in her jaws she pats the earth down very carefully to obliterate all traces of her work.

Some kinds of digger wasps, instead of using a stone, sweep the ground smooth with a little stick used as a broom.

Frequently a dried leaf or a pebble is placed over the top of

the closed burrow, as if in memory of the poor caterpillars interred below. Similar artistic temperament is seen in many other kinds of wasps (p. 51). It is noted also in various birds which ornament their nests, sometimes in bizarre fashion.

The use of tools, however, is a different matter. Except for certain members of the wasp tribe, and the spinning ants,* which are related to the wasps, no other living things, unless taught, use tools but man.

* See "Stalking Ants, Savage and Civilized," by W. M. Mann, in *THE NATIONAL GEOGRAPHIC MAGAZINE*, August, 1934.

Loving and indulgent mothers are by no means rare among these canny insects. Although most of them, after provisioning their cells, seal them up and show no further interest in them, some tend their young bringing them food from time to time as do the birds.

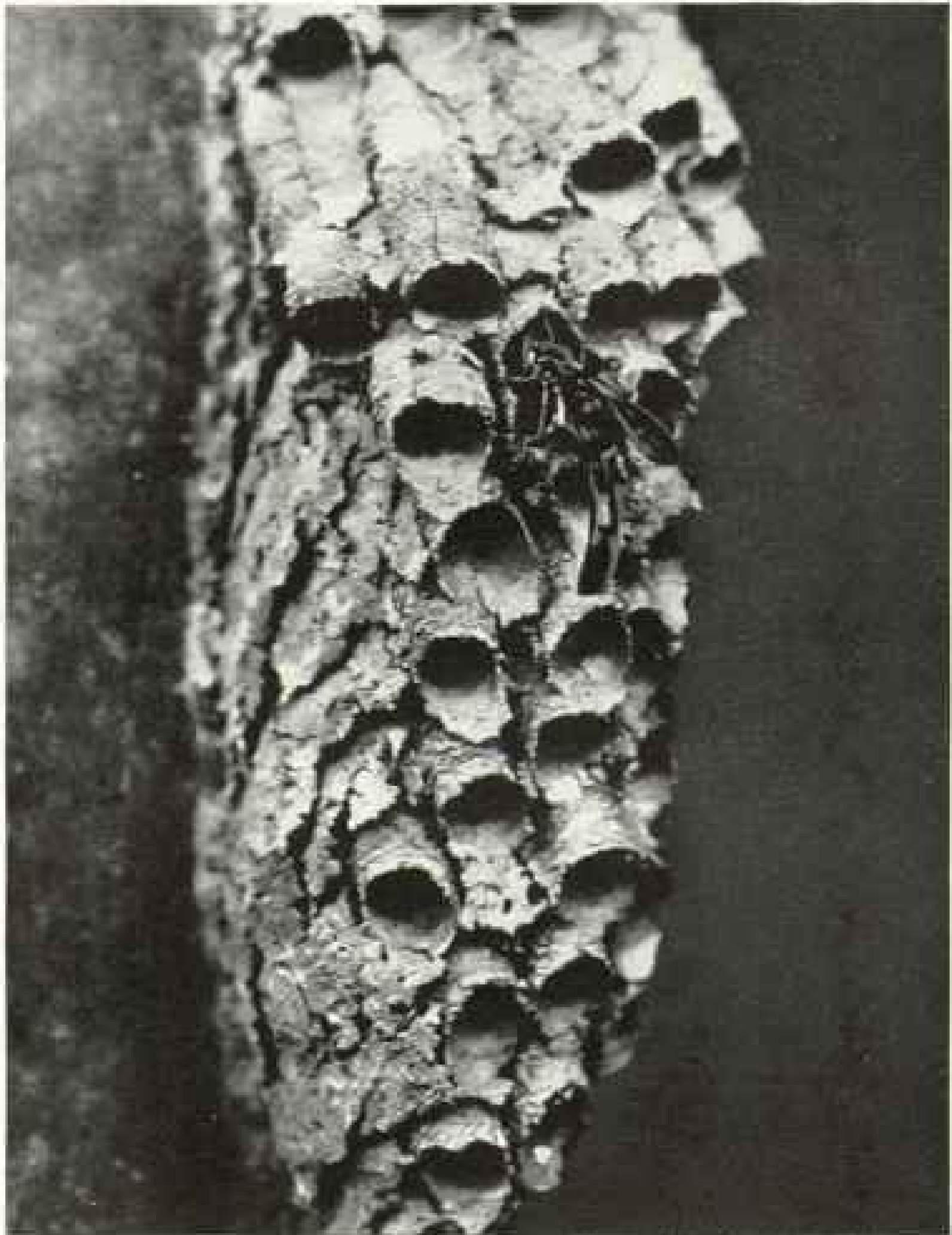
Thus the wasp called *Bembix*—the sand wasp—makes a burrow in the ground, stores a fly in it, and lays an egg upon the fly. The little grub is fed first with small flies and then with larger ones, until it is fully grown and ready to transform to the pupal stage.

These *Bembix*, which usually live in large communities, are quite unethical, much given to stealing each other's flies at every opportunity.

Though as neighbors they leave much to be desired, as successful mothers the *Bembix* have few, if any, equals in the animal world. During her ten to twelve weeks' activity as a full-fledged wasp, a mother *Bembix* can raise at most only five or six young. And yet these wasps are common.

It is about the same with the other digger wasps. The number of young produced is very small. They are so well taken care of, however, that relatively few are lost, and the race prospers.

In providing for the welfare of their



Photograph by Paul Griswold Howes

A BUSY LITTLE MASON PATCHES HER HOME OF CLAY

In the world of wasps, masonry is an ancient art. This pipe-organ wasp (*Trypoxylon fabricator*) uses clay so expertly that the cells of the nest, though as thin as paper, are tough enough to shed rain and hold together in the extreme weather of the Tropics. (Greatly enlarged.)

young, some mother wasps seem to show almost reckless bravery. This is true, for instance, of the tarantula hawks of the Southwest—fearsome-looking steel-blue wasps, some of which equal in size, and all of them in ferocity, the cicada-killer.

TARANTULA HAWKS ON THE HUNT

But tarantula hawks are far more alert and canny. They have to be, because the huge spiders with which they must deal are powerful, resourceful, and armed with formidable fangs—very different from the clumsy and defenseless cicadas.

Some of these big wasps hawk about searching for their prey, much like a sharp-shinned hawk hunting for small birds. Having discovered a tarantula, they hover over it awaiting an opportunity to strike.

STING LIKE A HIGH-VOLTAGE SPARK

In South America I once saw a tarantula running rapidly along a path. Well above it and a little behind flew a tarantula hawk. The spider stopped, exhausted. The wasp hovered above it.

Suddenly it descended. The instant it struck, the great spider was completely paralyzed. The sudden action of the sting of these tarantula hawks has been compared to the snap of an electric spark.

Sometimes there is a slip, and then a furious fight takes place. If this occurs, bet on the wasp and you probably won't lose.

After the battle the paralyzed spider is hauled to a suitable place, a hole is dug, and the victim is dragged into it. An egg is laid upon its body and the hole is closed. Then the wasp starts off on a hunt for another spider.

One kind of these giant wasps, having found a tarantula that has strayed some distance from its burrow, alights between the spider and its home, facing the poor frightened creature. If it is possible for you to entertain feelings of sympathy for a huge and ugly spider, now is the time to do it (pages 52 and 53).

They watch each other closely, the spider and the wasp. Each is capable of killing the other. But the spider is frightened—it is facing a serious crisis and knows it. The wasp, by nature cannier and quicker, is quite composed. It is simply about to undertake a routine performance. Suddenly it strikes, and all is over; or there may be a short tussle, with the wasp the victor.

The now paralyzed spider, after deliberate examination, is dragged by the wasp, always walking backwards, into the victim's own home, now become its tomb. An egg is laid upon the helpless though still living body, and the hole is closed.

Another tarantula hawk is a serious enemy of the trapdoor spiders in the West.*

Spiders are very much in demand as food for baby wasps, and many different kinds

of wasps stock their nurseries with them. Among these are the common mud daubers, the cells of which are often seen in barns, about verandas, in attics—indeed, in protected situations generally (Plate VIII).

What is the story of these unsightly and unwelcome lumps of mud? A story of tireless industry and maternal solicitude, with a sad background of villainy and tragedy, for the careful little mothers that construct these cells have their share of troubles.

Trim and slender wasps with yellow-banded legs, they are seen in numbers on muddy spots in summer. Each one is standing on her head, digging out a ball of mud. When she has gathered a sufficient load she flies away to the scene of her architectural operations.

Each load of mud is flattened out into a thin band that reaches halfway around the cell (Plate VIII, middle left). These bands are added first on one side and then on the other, so that the cell when finished has a sort of herringbone pattern.

Usually several or many cells are constructed, parallel to each other, side by side, or in a mass. Then the mother wasp brings more mud and plasters the whole structure smoothly over, sometimes studding the surface with numerous little pills of mud by way of ornament.

After each cell is finished there is a pause in building operations. Mother goes spider hunting. She catches and stings a spider and packs it in the cell. She lays an egg upon it. Then she catches more spiders and fills the cell with them. When the prospective baby's larder is complete, mother seals the cell with mud and begins another.

The group of cells shown in the upper left-hand corner of Color Plate VIII was found by Mr. Murayama and me in the Astrophysical Observatory of the Smithsonian Institution at Washington, D. C. It was made up of two lots of cells. The first group, attached to the board, was small. From these cells the wasps had all emerged some time before. About them was a larger group of cells, all of which were closed.

As Mr. Murayama worked, the wasps one by one bit their way out of the cells, just in time to have their portraits painted.

ENTER THE VILLAIN

When we were looking for the mud-daubers' nests, I noticed an active, nervous little wasp, vivid metallic green in color, taking an interest in the cells. This is the

* See "California Trapdoor Spider Performs Engineering Marvels," by Lee Pasmore, in THE NATIONAL GEOGRAPHIC MAGAZINE, August, 1933.

FARMERS' FRIENDS AMONG THE WASPS AND HORNETS



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Painting by Hashime Murayama

HONEST BEES AND THIEVES PASTURE TOGETHER ON NEW JERSEY TEA

All are native to North America. The Bumblebee, *Bombus vagans* (10), is a common garden visitor. (1) *Anthidiellum notatum*; (2) a robber who steals the stores of other bees, *Sphexodes ruficornis*, female; (3) *Halictus fuscipennis*; (4) *H. stultus*, called a "Sweat-bee" because it often flies about perspiring humans (Plate VI, fig. 7 and 10); (5) *Agapostemon splendens*, male; (6) same, female; (7) and (8) *Augochlora pura*, females; (9) *Augochloropsis coccinea*; (11) *Anthophora abrupta*, male; (12) same, female; (13) *Amblyopoda vestita*. Twice life size.



SUCH ADOBE BUNGALOWS AND APARTMENTS HOUSE YOUNGSTERS ONLY

As a mother Bushnell's wasp (*Odynerus tempiferus* var. *macis*) constructs each cell of her home (right), she provisions it with paralyzed caterpillars and lays an egg inside. Larvae hatch, gorge themselves, then sleep through the winter. Jug-maker wasps build small flanged urns (left). Life size.



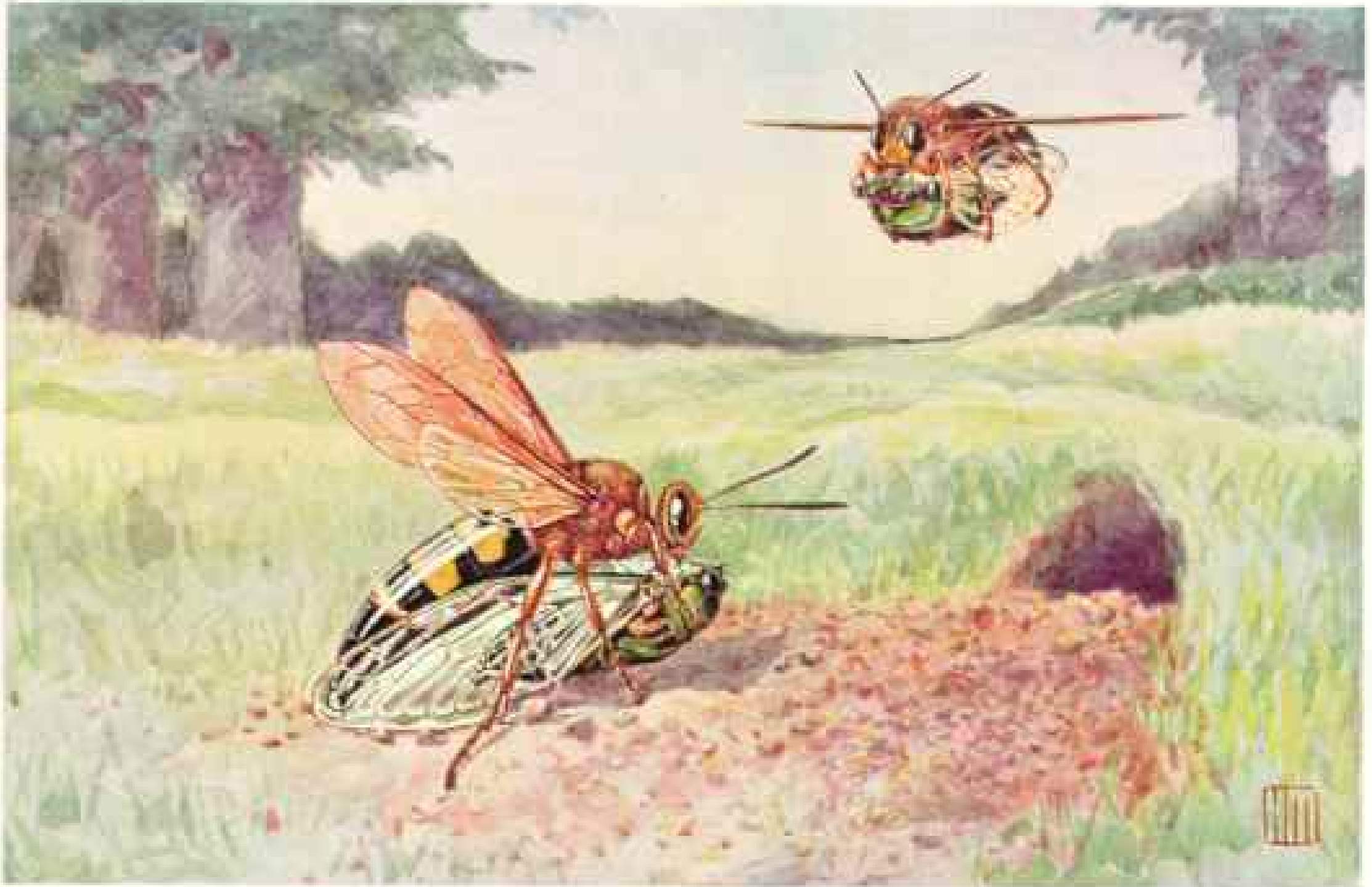
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Paintings by Hashime Murayama

RECENTLY DISCOVERED, BUSHNELL'S WASP POSES FOR ITS FIRST PORTRAIT

David I. Bushnell, Jr., found this nest of wasps, previously unknown, near Fredericksburg, Virginia, in October, 1935. On nest are males (above) and a female. On the alder leaves are Jug-makers (*Eumenes fraternus*), female left, male lower center, and parasites of Bushnell's wasp (right).

FARMERS' FRIENDS AMONG THE WASPS AND HORNETS



CICADA-KILLERS BRING HOME PARALYZED PREY CLASPED IN THEIR ARMS—

On sultry summer days, sharp discordant shrieks often pierce the ringing chorus of male Cicadas. The outcries come from victims surprised, stung helpless, and carried off by Cicada-killers (*Sphexius speciosus*). The Cicada-killer is a large and common burrowing wasp. Life size.



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Paintings by Hasbime Murayama.

—AND THEN DRAG THEIR VICTIMS DOWN INTO NURSERY DENS

After storing paralyzed Cicadas (upper), the wasp lays an egg on a captive. A grub hatches, eats until it grows fat (left), then spins a cocoon of earth and silk (right). In the spring a full-grown wasp emerges. The Cicada shown is *Tibicen linnæi*. Life size.



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Painting by Hashime Murayama

WASPS, SIPPING WILD CARROT NECTAR, ARE GOOD-NATURED—IF LEFT ALONE!

(1) *Psammochares fabricii*, female, known as a Spider-wasp because it stores spiders for its young; (2) same, male; (3) *Cerceris aliope*, male; (4) *Sphaerophthalma pennsylvanica* race *scabra*, male; (5) a Caterpillar-wasp (*Sphex urnarius*); (6) a Hornet (*Vespa squamosa*); (7) a Grasshopper-wasp (*Anomalia ichneumonina*); (8) and (9) *Ceropales bipunctata*; (10) a Cuckoo-wasp, *Chrysis laminifera*, which deposits its eggs in the nests of other wasps; (11) *Sphex nigricans*; (12) and (14) *Psammochares philadelphicus*; (13) *Holopyga verticalis*; (15) Blue Burglar (*Chalybion cyaneum*), and (16) *Cerceris chrysipe*. Late size.

FARMERS' FRIENDS AMONG THE WASPS AND HORNETS



AS A HORNET MURDERS A BUTTERFLY, ITS OWN ENEMIES LURK NEAR BY

Yellow Jackets, *Vespula arenaria* (1), (2), (3), (4), are victimized by another hornet, *V. arctica* (5). A gray nest of the White-faced hornets, *V. maculata* (6), (7), hangs in a tree. These relish house-flies (9). *Sphécophaga burra* (8) enters hornets' nests and lays its eggs in their young. Life size.



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Paintings by Hashime Murayama

PAPER WASPS BUILD THEIR NEST WITH NO OUTER ENVELOPE

The queen constructs the first cells and rears a few workers. Later, these add new cells. A female (*Polistes fuscatus* var. *pollipes*), right, has made a pellet of paper pulp for the home by masticating weathered timber. A male clings to a leaf (upper left). The nest hangs in a privet hedge. Life size.



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Painting by Hashime Murayama

WASPS, BEES, AND NEAR RELATIONS BUZZ ABOUT CHOKECHERRY BLOSSOMS

There are thousands of kinds of small parasitic wasplike insects. Because they prey upon crop-destroying insects, they are valuable farmers' allies. Those under the glass are enlarged five times, others are life size. (1) and (12) Leaf-cutter bees (*Megachile latimanus*); (2) a parasitic Chalcid-fly (*Spilochalcis flavopicta*); (3) a small Leaf-cutter (*Megachile brevis*); (4) a Braconid (*Bracon haematodes*); (5) *Cardiochiles tibialis*; (6) a parasite of other parasites, *Perilampus hyalinus*; (7) and (10) a "Sweat-bee" (*Halictus stultus*), Plate I, fig. 4; (8) *Bracon montrealensis*; (9) *Euphorus pallipes*, and (11) a Honeybee, *Apis mellifera*. Opposite plate, upper, enlarged five times; lower, two and a half.

FARMERS' FRIENDS AMONG THE WASPS AND HORNETS



LOOK FOR BURROWING BEES ON DRY SLOPES IN YOUR LAWN

Faces of *Halictus pruinosus* stop entrances (left), and a female dashes home (center). Enemies include a wingless wasp (*Pseudomethoca frigida*, right), *Melospia leucocephala* (left), *Leptotropa* sp., below, and *Megaselia divergens* (right center). A Bee-catching wasp crawls down its hole.



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TWO PARASITES, ONE INSIDE THE OTHER, LIVE WITHIN THE CABBAGE CATERPILAR!

Tiny wasps (*Apanteles glomeratus*, on yellow cocoons) lay eggs inside the host. Smaller ones (*Aspilota nana*, extreme upper right, and *Tetrastichus rapa*, lower) prey upon the first. *Hoplectus conquistator* (lower, male, left; female, right) and *Pteromalus puparum* (left center) destroy the chrysalis.



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"SQUATTERS" OFTEN CLAIM ABANDONED HOMES OF MUD DAUBER WASPS.

Under stones and in attics you will find these nests of the yellow-legged Mud Daubers (*Sceliphron caementarium*), upper and center left. On the bottom of one nest is a Blue Burglar (*Chalybion cyanicum*), Plate IV, fig. 13. Green Cuckoo Wasps (*Trichrysis parvula*) lay eggs in the Daubers' cells. Small tenant wasps (*Trypoxylon clavatum*), lower left, and *Aucistrocerus uncinatus*, right center, partition original Dauber cases, while *Pseudogenia adjuncta* (upper right) build new cells inside the old. Other squatters like the little *Osmia cordata* (lower right) also convert Daubers' cells into apartment houses.

villain in the story, the cause of many tragedies. It was a cuckoo wasp (Plate VIII, upper left and top), looking for a chance to place an egg in one of the cells.

The grub, emerging from its egg, would have fed upon the baby mud dauber, finally killing it. Many young mud daubers every year are victims of these cuckoo wasps.

HOW THE BLUE BURGLAR ROBS A HOUSE

Quite as callous as this jewel-like villain is another wasp, much like the yellow-legged mud dauber, but dark steel-blue in color—the blue burglar (Plate IV, figure 15; Plate VIII, on bottom of cell mass at upper left).

These steely-blue wasps are habitual housebreakers. After a yellow-legged mud-dauber has built a cell, stocked it with food, and sealed it, one of these burglars comes along, breaks open the cell, throws out the spiders, and proceeds to make itself at home. It cleans out the cell, then stocks it with a new supply of spiders, laying an egg on the last one. Then it seals up the cell in a clumsy and amateurish manner.

These wasps are common about puddles. But you never see them standing on their heads and digging up the mud. Instead, they fill themselves with water. This they use to moisten the mud of the cell so that they may break it open, and also to soften mud for use in sealing. Sometimes, instead of breaking into fresh cells, they use old ones from which the mud daubers have emerged.

THE MUD DAUBERS' TENANTS

Old mud-wasp cells are much in demand, being used by a number of other wasps, some bees, and different kinds of insects. One of the wasps (*Trypoxylon clavatum*, Plate VIII, lower left), being much smaller than the mud dauber, makes two cells out of a single mud-wasp cell by means of a mud partition.

Both sexes of this little wasp cooperate in home building. But the lady does all the heavy work. Her husband remains almost entirely within the cell. His duties, as he interprets them, are almost wholly supervisory.

Another little wasp (*Ancistrocerus uncinatus*, Plate VIII, right center) also uses as nurseries the abandoned cells of mud daubers, dividing each into three by mud partitions. In contrast to the others, this wasp stores the cells with caterpillars.

A third wasp (*Pseudagenia adjuncta*,

Plate VIII, upper right) finds these abandoned cells useful as hiding places for its own mud cells which it constructs within them, storing them with spiders. A few other kinds of wasps also use these cells.

In addition, some of the mason bees (as *Osmia cordata*, Plate VIII, lower right) find these cells useful. They divide them into compartments, sometimes as many as five, by partitions of a waxy substance. They then plug the opening with wax.

Besides the mud dauber many other wasps make cells of mud. One, the common pipe-organ wasp, constructs a number of parallel mud tubes, usually opening downward. After a tube is finished the inner end is packed with food, provided with an egg, and closed with a wall of mud. Then another section is provisioned and closed off in the same way, and the process is repeated until the tube is full, when another tube is built beside the first (page 55).

The most accomplished masons are certain small tropical social wasps (as *Polybia fasciata*) that build large and very hard mud nests in which even the delicate combs are made of earthenware.

JUG-MAKERS FASHION GRACEFUL URNS

The most artistically inclined of our common mason wasps are the potter wasps, or jug-makers. On slender twigs or grass stems they construct symmetrical little urns with a narrow neck expanding into a broad, thin, flangelike lip (Plate II, upper).

After the jug is made, the mother wasp stores it with paralyzed caterpillars, then lays an egg, which is suspended from the top by a slender thread, like a pendulum, and seals it. The young one, after emerging from the egg, consumes the caterpillars.

In winter you often see these little urns on the bare twigs, usually singly, sometimes two or even three together. Inside each urn is a plump grub, chilled and motionless—dead, apparently. But with the warmth of spring it revives and changes to a pupa. Later the pupa changes to a wasp that bites a hole in the side of its mud prison and comes forth (page 54 and Plate II, lower, female left, male lower center).

Other wasps related to these jug-makers construct more or less elaborate apartment houses—for children only. These, too, are often seen in winter, when they seem to be nothing but irregular lumps of mud wrapped around a twig (Plate II, upper, right).



Photograph by Paul Griswold Howes

RARELY DOES THE CAMERA CATCH A PAPER WASP QUEEN IN THE ACT OF LAYING AN EGG

Light has been reflected deep into the cell, making visible the oval egg, which is cemented into place in the unfinished paper cell. (Photograph greatly enlarged.) Later a grub will hatch and grow (opposite page and p. 69).

There are many different kinds and styles of these. The one shown in Plate II was found by Mr. David I. Bushnell, Jr., in 1935, near Fredericksburg, Virginia. It is larger than those usually seen.

In order to find out the kind of wasp that made it, I kept it through the winter in my house. In March the wasps emerged, digging their way out through the mud walls. First came four males, and about ten days later appeared the first females, larger than their brothers.

What were they? I showed them to Miss Grace Sandhouse, one of the leading au-

thorities on bees and wasps. She was puzzled. They were not like any she had ever seen, and no published descriptions fitted them. They proved to be a previously unknown kind. Dr. Joseph Bequaert of Harvard has recently named them *Odynerus tempiferus* var. *macio*. They are here figured for the first time (Color Plate II, lower).

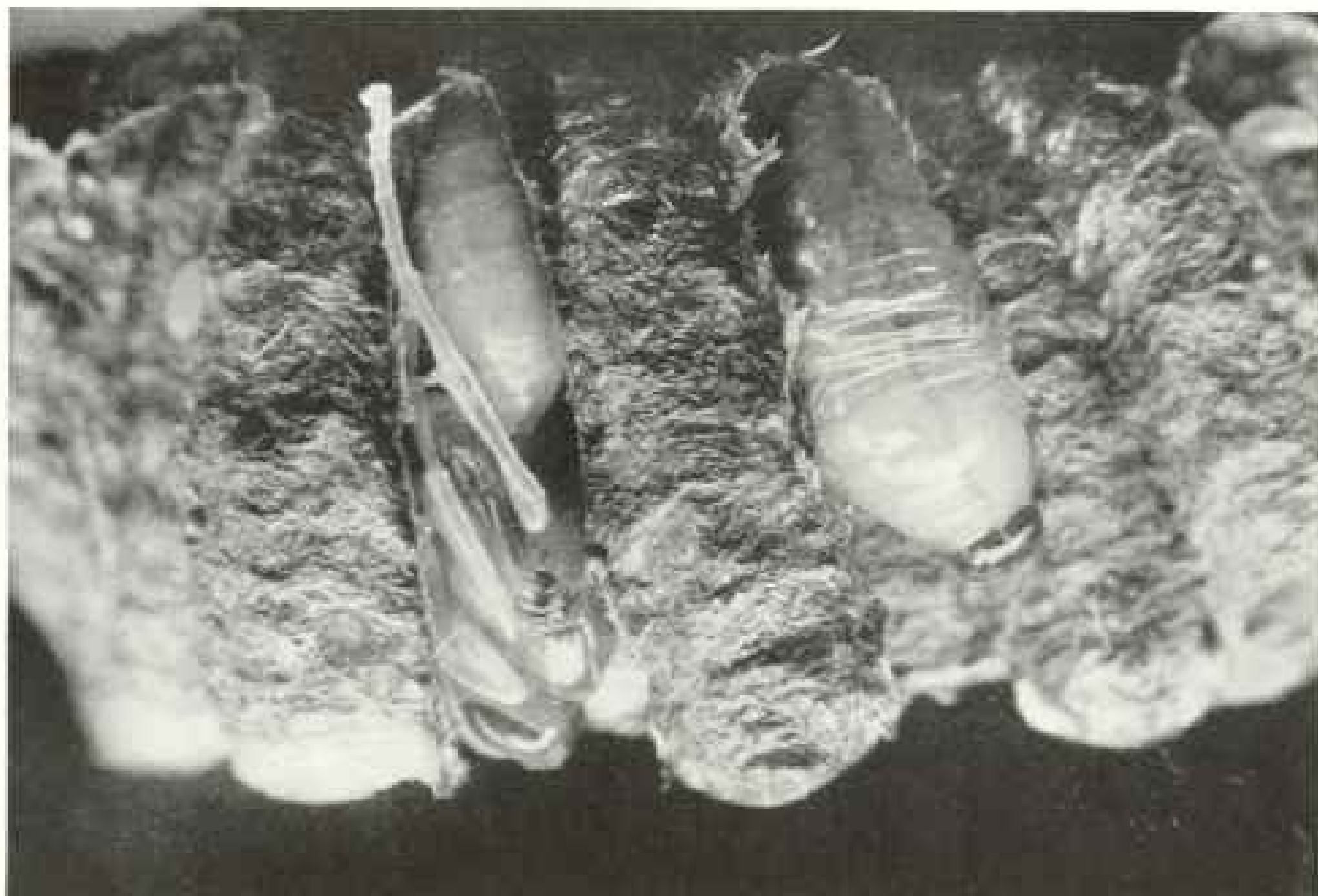
After all the wasps had dug their way out, the nest was cut in two across the middle. It was made up of 21 cells, each of which had been carefully formed by the mother wasp, provisioned with paralyzed caterpillars, furnished with an egg and sealed. After the twenty-one were completed the mass had been carefully smoothed over with additional

mud and a few large, shining quartz grains had been cemented to it, apparently by way of ornament.

HORNETS LIVE ON INSECT STEAKS

Bushnell's wasp, the jug-makers, the mud daubers, and the digger wasps are representatives of what are known as solitary wasps; each female, alone and unassisted, provides for her young.

But many wasps are social, living in communities of various sizes, usually with a single egg-producing female and several or many "workers," or undeveloped females.



Photograph by Paul Griswold Howes

TRANSFIGURATION: SOON A SLIM, WINGED BEAUTY WILL APPEAR

If the page is turned so the left side is at the bottom, the delicate pupa of a paper wasp may be seen more readily. Plainly visible are the huge eye, the two front legs, and the tiny transparent wing in front of the long rear leg. In a few days the larva (right), already grown fat on insects, will likewise pass through the pupa stage and emerge a sleek and slender wasp. (Greatly enlarged.)

Most obnoxiously familiar of our social wasps are the various hornets, of which ten different sorts live in the northeastern United States. Two of these are shiftless racketeers, living at the expense of hard-working relatives.

If curiosity should induce you to observe the activities of hornets, you would soon discover that all of them are insect feeders. They catch insects of very many different kinds, carve them up into steaks and chops of the proper size or chew them up into a sort of pudding, and feed them to their young ones. It is surprising to find how many noxious insects every day disappear into a hornets' nest.

Commonest of our native hornets is the little yellow jacket (Color Plate V, upper) that builds its nest usually in the ground, just where you are likely to step on it. Sometimes it builds in an old tree stump, and occasionally under the eaves of buildings. We have another kind much like it and equally common, and farther south a third, *Vespula squamosa* (Plate IV, fig. 6).

The yellow jackets feed their young on

insects of various kinds, including sometimes butterflies, which they dismember with skill and chew into a pulp. A yellow jacket catching a cabbage white butterfly is shown in Plate V, upper.

A larger hornet, *Vespa crabro*, introduced from Europe and now widespread in the eastern United States, has the reprehensible habit of gnawing twigs of trees, especially the birch, and is sometimes injurious to the lllac.

Larger than the native yellow jackets and black and white is the white-faced hornet that builds its paper nest in trees or bushes, or about houses. The nest is often very large, as much as two feet in length, and may contain several hundred individuals (pages 68, 70, 71 and Plate V, upper).

INTRUDERS IN A HORNETS' NEST

This hornet feeds its young chiefly on flies, especially on houseflies, *Musca domestica*; that is why you so often see it about stables, and about the kitchen door. After catching a fly it chews it into a pulp, commonly suspending itself by one hind leg while doing so (Plate V, upper, right).



Photograph by Lynwood M. Chase

SYNONYM FOR TROUBLE—A HORNETS' NEST!

Filmy and fragile may seem the paper home of the white-faced hornets (Color Plate V, upper), yet summer wind and rain do it little damage. The nest is used only a single season (pages 70 and 71). Like masonry, the art of papermaking was practiced among the wasps and hornets long before it was known to man. The insects manufacture their own pulp by chewing tiny bits of weathered wood. One nest exhibited at the National Museum in Washington, D. C., bears vivid reddish streaks throughout, for some of the workers obtained their pulp from painted wood.

One would think that a hornets' nest would be free from intruders. But this is not the case. The existence of a worker caste which feeds the queen provides a new temptation for lazy and unscrupulous relatives. Slavery appears.

Perhaps slavery is too harsh a term. Let us say that certain unethical young ladies succeed in adopting for their own benefit the swarms of worker nursemaids attendant upon a matron more advanced in age.

As an example of such conduct, take a small hornet that lives wholly at the expense—and to the detriment—of the little yellow jackets, whose nests are all too common in our fields in summer.

This lazy, sponging relative, *Vespula arctica* (Plate V, figure 5) has no worker caste—only males and fertile females. The overwintering females probably appear later in the spring than the female yellow jackets, emerging from hibernation after the latter's nests have been established.

Entering the yellow jackets' nests, they induce, or force, the yellow-jacket workers to raise their progeny instead of the young of the rightful queen, their mother. Both the intruder and the true queen may live in the nest together, or the intruder may be found alone.

I do not like to appear unsympathetic, but it is difficult to suppress a feeling of admiration for an insect so very clever and persuasive as to be able to make nursemaids for its babies out of a nestful of yellow jackets!

Besides their lazy relatives, hornets have other sorts of enemies. Among these is a puny little ichneumon fly, *Sphécophaga burra* (Plate V, upper, extreme right), the young of which live within the bodies of their grubs, including those of the formidable white-faced hornet.

PAPER WASPS CHIRP AS THEY WORK

As familiar as the hornets are the common paper wasps, of several different kinds, that build their combs exposed, without any protecting envelope, usually in sheltered situations and commonly about houses (Plate V, lower, and page 66).

In contrast to the hornets, the workers of these paper wasps scarcely differ from the queens. If you observe them carefully you will notice that they have a way of chirping cheerfully while at work. This is also true of many, if not most, other wasps.

The plate shows a portion of the privet

hedge outside my office window. Mr. Murayama and I spent some time watching the wasps hawking back and forth along the hedge and in and out among the branches, searching for insects.

Our native paper wasps are unaggressive, and their nests are usually placed where there is no danger of hitting them. So they are not likely to sting you. Hence they are much less unpopular than hornets.

FLOOD CONTROL AND AIR CONDITIONING

Interesting creatures are these paper wasps. For instance, flood control is one of their specialties. When a nest is built so that it is exposed to the weather it is naturally likely to get wet. Undaunted, the wasps lap up the water and then regurgitate it away from the nest.

Mr. Phil Rau has discovered a still more remarkable fact. In times of drought the workers bring water and drench the nest, in this way cooling it and providing needed moisture for the young. Air-conditioned nurseries, therefore, are no new invention.

Paper wasps used windows untold centuries before man ever thought of them. Some tropical kinds under certain conditions insert in the outer covering of the nest small transparent specks, apparently of mica, up to an eighth of an inch across. These are evenly distributed over the paper sheet, each one being framed in a mouthful of pulp.

Mr. Rau found one nest with approximately one-third of the surface translucent, and another with about half the surface made up of these particles.

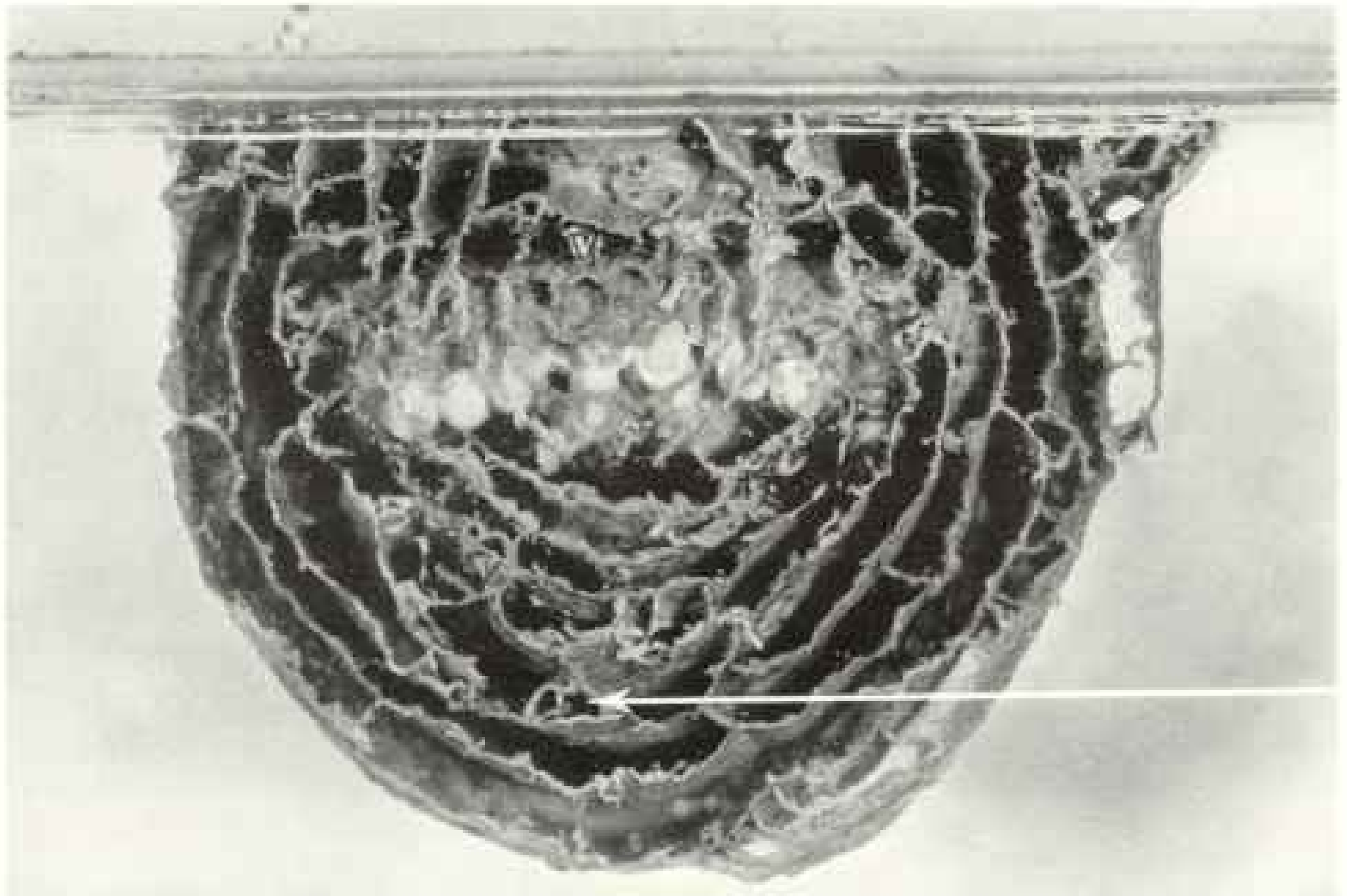
MY FRIENDS THE HALICTUS

Like the burrowing wasps, many of the daintiest and prettiest of our smaller bees are true children of the soil. One of these, *Halictus pruinosus*, is a special friend of mine, for I have a little village of them right in my front yard.

Here in bare spots in the grass conical little faces peer at you. Each face serves as a stopper for a burrow in which resides a growing family of bees (Plate VII, upper).

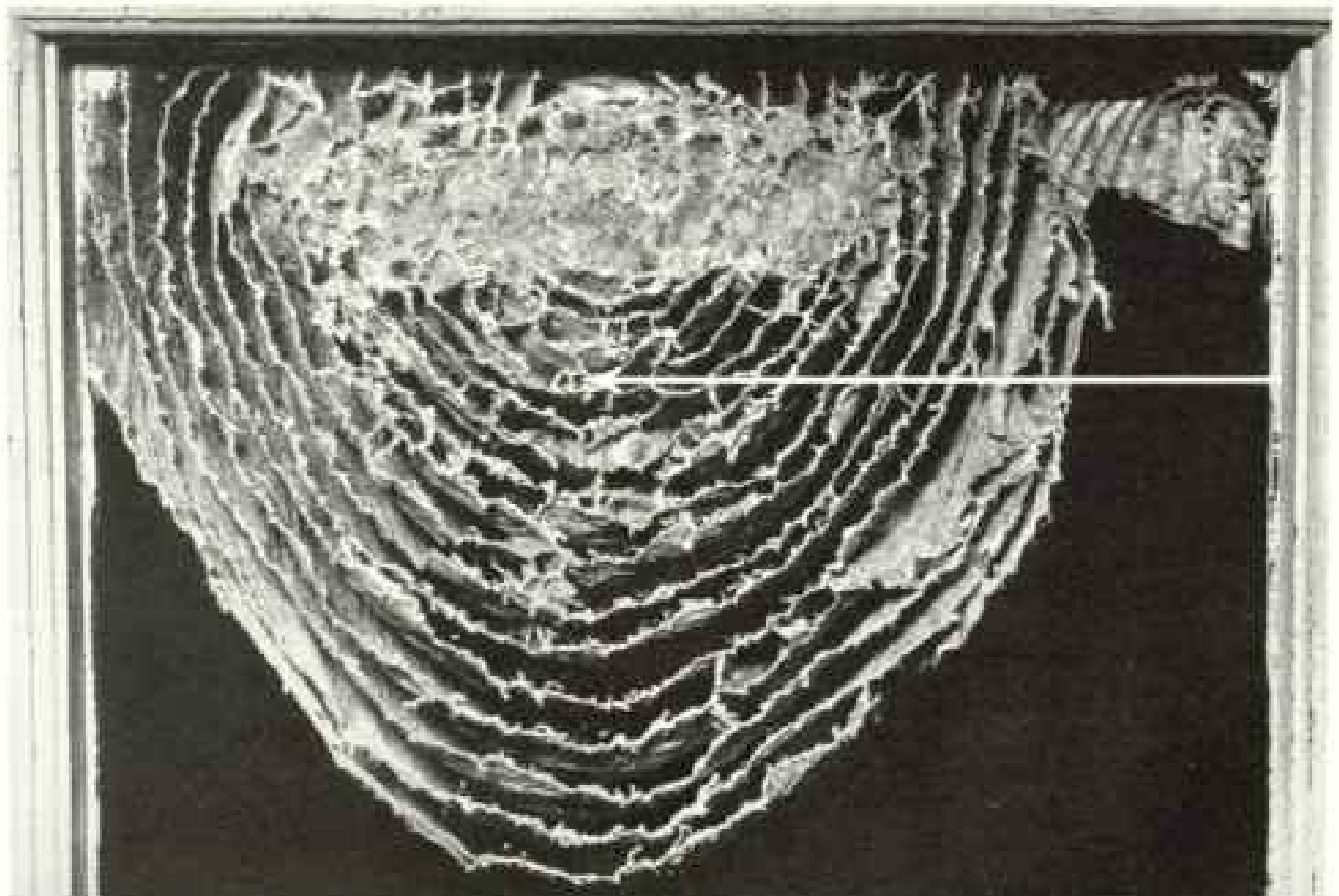
These pretty bees are very satisfactory neighbors. Though many times, in weeding and other operations, I fear I have treated them most thoughtlessly, they have never stung me.

They are suspicious little creatures and always keep a guard, usually a male, whose face almost completely fills the doorway.



IN JUNE—THE INSIDE OF A HORNETS' NEST, SEEN THROUGH A WINDOWPANE

Each tiny white sac holds a pupa that will soon emerge as a full-grown white-faced hornet (Plate V, upper). The striped face of the queen peers out above the brood. The arrows in the two pictures indicate the same point to show the growth of the nest.



Photographs by Edwin L. Wisner

IN AUGUST—THE SAME NEST, GREATLY EXPANDED BUT DESERTED

Now the cells are dry and empty, for, as autumn approaches, the mother ceases egg-laying and all of the hornets abandon the nest. The workers and males die during the winter, but the females survive by hiding under stones or thick tree bark. Each founds a new colony in the spring. This hornet community flourished on the window of a Maryland house (opposite page).

When a female returns with a load of pollen the face disappears at once. The little guard has slipped into an anteroom just inside to let her pass. When she has entered, up pops the face again.

The females, with unremitting toil, fill several cells with pollen and honey and lay an egg in each. These little cells are often raided by various kinds of robbers, most brazen of which are close relatives of *Halictus*, as for instance *Sphecodes* (Plate I, figure 2.)

The *Sphecodes* are incapable of honest labor. They cannot carry pollen because they have no pollen baskets. And they do not need to, because they have learned to appropriate for their own young the little stores laid up by the industrious *Halictus* mothers. This they do in the most ruthless fashion.

If a *Sphecodes* finds its entry into a *Halictus* burrow blocked by a guard and is unable to seize it by the head, it retreats a little distance, tunnels into the burrow, comes up behind the guard, and kills it. Then, one by one as they appear, the other tenants of the burrow are murdered and thrown out. After this wholesale assassination the thug proceeds to lay its eggs in the fully furnished but unprotected cells.



Photograph by Edwin L. Winbert

A YOUTHFUL READER OF THE NATIONAL GEOGRAPHIC BROUGHT THIS UNUSUAL HORNETS' NEST TO THE EDITOR'S ATTENTION

His interest fired by nature articles in *The Magazine*, Thomas S. Murray wrote, from the home of his uncle, John T. Magness, Jr., near Fallston, Maryland: "I have read your books quite a lot. . . . We have, on a window, a hornets' nest—one could say a perfect cross section of a hornets' nest. . . . You can easily see the little hornets being fed; in fact, every move that is made by old hornets and their young. If you are interested in this, you may come and take pictures, as you will find it is just about perfect." This photograph and the two on the opposite page resulted. Tom's sister Betty is watching the nest.

Not only the pollen and honey, but the plump little baby bees themselves are much sought after. The chief baby killer is a handsome velvet ant, really a wingless wasp with a very long and exceptionally potent sting—*Pseudomethoca frigida* (Plate VII, upper, right, facing burrow).

If a velvet ant approaches a burrow guarded by a female, and there are other females within, the guard rushes out and grapples with it. The velvet ant is too heavily armored to be injured, so either the bee is killed or the velvet ant escapes. If the



Photograph by Paul Henri Fabry

USING ITS STING AS A HYPODERMIC NEEDLE, A WASP PARALYZES ITS PREY

The May beetle larva, too large to be carried away, is scientifically immobilized and left in its tracks with an egg of the wasp (*Scolia*) attached to its body. Upon hatching, the grub will find itself in the midst of an ample food supply. Thousands of wasps have been imported recently from Chosen (Korea) to combat the Japanese beetle by laying their eggs in its larvae.

guard is a male, or a lone female, it immediately turns around and effectively blocks the entrance with its abdomen (Plate VII, upper right).

When a velvet ant gains entrance to a burrow it lays its eggs in the cells and its offspring feed on the young bees.

Various kinds of digger wasps catch and kill the mother bees themselves and store them away beneath the ground to serve as food for their young. In my little colony there are two burrows of one kind of these bee-catching wasps (*Philanthus gibbosus*, Color Plate VII, top, lower right).

KILLERS SHOW A CERTAIN DELICACY

Although these wasps are storing their cells with the dead bodies of my little friends right in their own village, they show a certain amount of delicacy in their murderous work. For they never trouble the bees on their nesting ground, but fly some distance away and catch them on my neighbors' flowers.

About these bee colonies you will notice tachinid flies (*Metopia leucocephala*, Plate VII, top, upper left) watching for an opportunity to lay their eggs in the bees' burrows. Their young live within the bodies of the baby bees.

Dancing about the bees as they return

laden with pollen you see much smaller phorid flies (*Megaxelia divergens*, Color Plate VII, upper, right center). They also live at the bees' expense, as do others, including minute slender wasps (*Loxotropa*, sp., Plate VII, top, lower left), canny, crafty things that sneak past the guard.

The burrowing bees are not the only ones victimized by other bees that have learned the art of living at someone else's expense. Among the commonest of these robbers are the usurper bees, which prey upon their closest relative, the bumblebee.

A female usurper bee makes her way into a colony of bumblebees, cows the queen into submission or kills her, and then coaxes, or forces, the workers to raise her young. The young are all males or fertile females, as usurper bees have no workers.

The low ethical standards of the usurper bees are not infrequently approached by certain young queen bumblebees that appear late in the season and forcibly adopt an elderly queen's household.

The scandalous conduct of these racketeer bees and of the few corresponding gangster wasps is not a pretty thing to contemplate. But they form an important part of the picture of bee and wasp life as a whole. Besides, if it were not for them there might be too many wasps and bees.

FROM NOTCH TO NOTCH IN THE WHITE MOUNTAINS

Soaring Heights of New Hampshire Attract Multitudes to America's Oldest Mountain Recreation Area

BY LEONARD CORNELL ROY

"THIS is the second greatest show on earth."

Thus spoke P. T. Barnum when he stood on the summit of Mount Washington and scanned the jumble of peaks and ridges of the White Mountains, spreading from the waistline of New Hampshire to Canada and from its Maine border to the Connecticut Valley, which separates this Granite State from Vermont.

Many New Englanders, dyed-in-the-wool White Mountain fans who insist that nowhere has Nature endowed a region with such fascinating heights, on first thought questioned Barnum's judgment. To them, the White Mountains show is second to none.

However, when they recalled the showman's love for his trained animals, gaudy trappings, and strange creations of Nature that drew millions into his acres of canvas, they felt that his exclamation was the highest praise.

WHY THE "WHITE" MOUNTAINS?

How and when the White Mountains got their name is as mysterious as many of their often-told legends. "White Mountains" appeared in a manuscript as early as 1672; and even before that time they were called the "White Hills" by mariners on the Atlantic, sixty miles away, for whom they formed an important landmark.

To modern eyes, too, the name seems apt, whether it be derived from the white mist that often hangs over the higher peaks, from the whitish-gray effect of the sun upon rocks of the mountaintops above timberline, or from the snow that normally covers the peaks of the Presidential Range for eight or nine months of the year (p. 82).

I found the White Mountains divided into two distinct areas (see map supplement).*

Between Plymouth on the south and the vicinity of Gorham on the north is the high mountain region where every year more than two million men and women enjoy testing their leg muscles among New

England's highest peaks, motoring on excellent highways, and utilizing the scores of recreational facilities, or just looking up from spacious hotel verandas toward the lofty eminences sweeping from quiet valleys.

Beyond Gorham is a challenging wilderness with Dixville Notch its crowning glory and Berlin its only large population center. Here is the paradise of the sportsman searching streams and lakes for trout, salmon, pickerel, horned pout, perch, and small-mouthed bass. The forests shelter bears, deer, and ruffed grouse.

It is the high mountain area that has been the White Mountains' chief lure to vacationists for more than a century.

"We know our mountains are not the highest in the East," a resident remarked. "Mount Mitchell in North Carolina and several peaks in the Great Smoky Mountains National Park slightly top Mount Washington. But the impressions of Hawthorne, Whittier, General Grant, Webster, Mark Twain, Winston Churchill, and scores of other men outstanding in politics, literature, and the arts of their day certainly warrant the enthusiasm of those of us who see the White Mountains in every mood."

"But Grant came to the mountains for relief from hay fever," I said.

"That is true, but he, like many others, then and now, came here without knowing the mountains, and left with an indelible impression of their lofty summits, their tree-clad slopes, their cascades, lakes, and scenic curiosities, and their legends that have inspired multitudes of artists, writers, and just plain people."

My genial acquaintance must have been an Irishman, for he spoke with pride when he told me the story of Darby Field, a son of Erin, who was the first man to con-

* Members wishing additional copies of the new Map of the White Mountains, distributed as a supplement to this issue, may obtain them at 50 cents each (on paper, unfolded) by writing the National Geographic Society's Washington, D. C., headquarters.



Photograph by B. P. Atkinson

ALL ABOARD FOR THE GRANDSTAND OF NEW ENGLAND

An easy but thrilling way to climb Mount Washington is to take the cog railway's sturdy little one-car train, here getting up steam at the Base Station. The boiler seems to be tipping forward, as if it has lost its supports in the front and is in no condition for one of the world's steepest climbs. But actually it was built that way to keep it more nearly level on the stiff ascent (pages 76 and 78). Seats for passengers are similarly tilted.

quer the heights of Mount Washington. Highest peak in the White Mountains, it thrusts its summit 6,288 feet above the sea and a mile above the valleys at its base.

It was just 22 years after the *Mayflower* had deposited its human cargo on the shores of Massachusetts when Field struck out from the coast on one of his many trips into the unknown wilderness that lay immediately behind colonial villages.

Some settlers feared to wander far from their settlements, but Darby Field was one of those bold adventurers for whom even the hard life of the colonist was too tame. He was accompanied by two Indian guides. On a June day in 1642, Field stood on the summit of Mount Washington.

"DIAMONDS" PROVE WORTHLESS

Chroniclers of events in the White Mountains, while praising the spirit of Field, refer to him as a master spinner of yarns. He returned to Portsmouth with his pockets bulging with "diamonds"—but the diamonds turned out to be worthless crystals.

Undaunted, Field insisted that the White

Mountains were a treasure house of precious stones. Although men braved the wilderness to seek the gems and returned empty-handed, his stories persisted. To his dying day Field was unwilling to admit his tales were untrue.

Could Field return to the White Mountains today to see what his adventure started, no doubt he would be overcome, for he would find his name inscribed among those intrepid men and women whose spirit pushed back the boundaries of colonial America and opened up new regions to American life.

As the Colonies grew and demanded wood for building, for paper, and for other manufactures, lumbermen carelessly swung their axes over the White Mountain slopes and stripped them of their trees. All but a few thousand acres of primeval forest were cut over.

The forests one sees today are largely second growth, but no longer are they in jeopardy. The United States Forest Service began acquiring land in the White Mountains shortly after the turn of the



Photograph courtesy U. S. Forest Service

DOWNWARD BOUND AFTER CLIMBING MOUNT WASHINGTON

The hiker's line of least resistance is the "Carriage Road," which loops up the mountain in eighty-odd curves (page 99). This automobile route to the summit is about twice as long as the hiking trails on the eastern slopes, but many climbers prefer the road, as the grades are less precipitous and there is no danger of losing the way in case of a sudden storm. Mount Adams and Mount Madison lift their heads in the left background.

century and now about four-fifths of the high mountain area, or 1,100 square miles, is national forest—the White Mountain National Forest—while the remainder is carefully protected by the State of New Hampshire.

In some portions of the National Forest lumbering is permitted, under supervision of the United States Forest Service.

"We are taking about 20,000,000 board feet a year," the forest supervisor told me in his office at Laconia. Twenty million board feet! I was not familiar with measurements of lumber; the figure amazed me. I could see the White Mountains again nearly denuded in another decade and the trees bound for lumber yards and paper mills.

It was explained to me, however, that twenty million board feet is not nearly so much as it sounds, and that the cutting of this quantity in no way disturbs the beauty of the mountains; in fact it benefits the forests to thin them out scientifically.

As in the case of the "White Mountains," historians are still debating just when and

by whom Mount Washington was named in the early 1780's. It probably seemed only logical that New England's highest peak should honor the ranking hero of the Revolutionary era—General George Washington. The Reverend Manasseh Cutler called it "Mount Washington" in 1784 in his report on a scientific expedition of which he was a member.

PEAKS MEMORIALIZE PRESIDENTS

Five years later Washington was inaugurated, and the fact that one peak bore the name of a President perhaps influenced the naming, in 1820, of Mount Adams, Mount Jefferson, Mount Madison, and Mount Monroe, also in what was later designated the Presidential Range.

Barnum is only one of the hundreds of thousands who have stood on Mount Washington and looked north far into the wooded north country, east to the swells of the Atlantic Ocean, south into industrial New Hampshire with the lake country shimmering between, and west into the Green Mountains of Vermont.



Photograph by Harold Giese

UP, UP, AND UP, WITH A PLUME OF SMOKE, WHILE A SAFETY DEVICE RATTLES IN YOUR EARS

Passengers on the cog railway up Mount Washington find the sensation as thrilling as flying. The average grade is 25 per cent, but this trestle is a part of the steepest section (Jacob's Ladder) where it exceeds 36 per cent. It is only three miles from the Base Station to the summit (page 99), but the trip takes an hour and ten minutes. Twice the hard-working engine stops for water, and passengers, alighting, enjoy spectacular views of the jumble of White Mountain peaks and ridges and the quiet, hotel-flecked valleys.

Many have arrived on the summit when clouds filled the valleys and the mountain peaks formed islands in a billowy sea, the lower ones resembling mere islets in the fluffy mist, the higher crests boldly thrusting themselves into the observer's vision as if commanding attention.

Then there are times when you may arrive in clear weather and, while you are scanning the panorama, a sea of clouds rushes in from the northwest, swirling through the valleys and dashing against mountain slopes like giant waves against a sea wall. You are amazed when you are told that this grandstand of New England was only a part of a tract of land purchased in 1832 for \$300.

FICKLE MOUNT WASHINGTON

There are probably few mountains as fickle as Mount Washington. Some observers have said that the summit is in a weather zone strange to the region about it.

"It seems to permit a few people to reach its summit, and then, as if to choose its visitors, fights back others who would revel in its glorious views," a native of North Conway told me as he related one of his own experiences.

August 2, 1921, was a bright sunny day. From his front porch the summit of Mount Washington was as clear as he had ever seen it. With his wife and four children, he took a summit trail in Pinkham Notch.

He had often been on the mountain at sunset when the blues and purples of the distant forests vied with the reds and yellows of the sky; he had seen the moon shining brightly above the summit and clouds shimmering in the moonlight below, and he had seen the sun rise over the Atlantic beyond Portland, Maine, its radiance lighting the sea before it while the valleys below him were dim in the dawn. This was his opportunity to enjoy the summit panorama on a clear afternoon.

Halfway up the mountain the trail was flanked by thick forest walls. The weather remained favorable until just a short distance above timberline, when the wind began to blow. With it came a heavy mist which froze on the rocks. The going became more difficult.

A lone hiker hurried past the family. A short distance beyond they met him again. He was coming down the mountain, actually weeping in discouragement.

Finally they reached the summit, but

more than once in the last mile a frigid, gusty wind nearly blew them off their feet.

In Crawford Notch I met a hiker whose story was so similar that I concluded that perhaps Mount Washington more often frets than smiles at the multitudes who wish to share the secret of its popularity.

He also started for the summit on a clear afternoon late in June. He managed to reach a hut of the Appalachian Mountain Club at the Lakes of the Clouds when a blizzard broke and he was unable to continue his climb for two days.

These were recent experiences, on modern, well-marked trails. In earlier days the difficulties, of course, were even greater.

In the summer of 1821 three sisters, urged by a desire to be the first women to climb Mount Washington, set out for the summit. They were accompanied by two men. They reached a camp on the trail and spent the night.

Their plan was to continue their climb the following morning, but a storm compelled them to remain in camp until more favorable weather. Their food ran low and to add to their misery a frigid wind swept a dense mist across the slopes. They were five days on the trail and marooned in camp, but they were richly repaid for their discomforts by a clear view from the summit.

The sisters started a movement among women that has resulted in the "weaker sex" becoming just as enthusiastic about Mount Washington as men, and every year thousands of them join the hiking parade on the trails.

Even the feminine hiker who is overweight need not be awed by the steep slopes of the mountain, for more than eighty years ago, when the trail population of the White Mountains was not nearly so large as it is today, a woman weighing 230 pounds hiked to the summit of Mount Washington and returned in a single day to win a wager.

A WIND OF 200 MILES AN HOUR

The difference between the weather atop Mount Washington and that in the valleys a few thousand feet below has long been intriguing to weather men.

The echo of the War Between the States had hardly subsided when the first party of scientists spent the winter on the summit. They began their vigil in November, 1870, and from their station came thrill-



© Keystone

MORE SMOKE THAN SPEED ON THE COG RAILWAY

Old-fashioned though this engine may appear, it is present-day transportation to the top of Mount Washington. A dream come true, the railway was established 68 years ago by Sylvester ("Crazy") Marsh, who had been told he might as well try to build a railroad to the moon. (page 80).

ing stories of weather phenomena that stirred even the residents of the quiet snow-bound New Hampshire villages who thought they knew the habits of the mountain.

In the spring of 1871 the report of the observers so interested weather officials of the Government at Washington that they took over the station. The records from 1870 to 1887 were the first officially kept on any mountain top in America.

One winter, the scientists reported, the thermometer dipped to nearly sixty degrees below zero and the wind blew 140 miles per hour.

So cold were the small quarters of the observers that even with two fires burn-

ing, water in buckets only a few feet away was covered with a skim of ice, butter kept in the building was cut with a hammer and chisel, and salt pork was sawed as one would saw a wooden slab. In 1892 the Government's interest in the station waned and for 40 years no weather station was maintained.

The New Hampshire Academy of Sciences, the Blue Hill Observatory of Harvard University, and private contributors sponsored the re-establishment of the station in 1932. Now the United States Weather Bureau and the State of New Hampshire are cooperating and the scientific work on the mountain is expanding each year.

The old wind-velocity record of 140 miles per hour stood until April 12, 1934, when the anemometer registered about 200 miles per hour—one of the highest wind velocities ever recorded anywhere. The

instrument, especially designed for Mount Washington's particular brand of weather, was electrically heated to keep it free from ice.

Summer and winter, three observers are on duty at the station. Every six hours they make complete meteorological observations and report their findings to the Blue Hill Observatory at Milton, Massachusetts, by short wave radio. The Observatory relays the reports to the United States Weather Bureau station at Boston where they are immediately dispatched by the Bureau's teletype system to weather stations throughout the Northeast to aid in the preparation of upper air charts for aviation

and for general weather forecasting. The Blue Hill Observatory directs the activities of the station.

Life on the mountain in the winter has greatly changed since the days of the early weather station. The present one is equipped with an efficient heating system and electric lights, and has telephone facilities that link it with villages in the valleys. In recent years there have been many winter visitors to the summit. During the winter of 1936-7, more than 250 persons came.

A new building for the station is under construction. It will provide improved living quarters, work rooms, library, and an observation tower. Accommodations also will be provided for scientific parties.

There are three ways to reach the summit of Mount Washington: by highway, by cog railway, and by numerous well-marked trails. It is eight miles by road from the Glen House in Pinkham Notch and in that distance you climb more than 4,600 feet.

Not long after the mad rush of forty-niners to California for gold, the road was begun. The first organization that undertook its construction failed when the project was about half completed. A few years later another company was organized and pushed it to the top. August 8, 1861, it was opened for traffic.



Photograph by Trask's Studio

A WEATHER OBSERVER CUTS HIMSELF A DRINK OF WATER

On top of Mount Washington one winter it was so cold that water froze in a bucket only a few feet from a stove, and butter had to be cut with a hammer and chisel. The outside thermometer has registered nearly sixty degrees below zero and some of the swiftest winds that blow have been recorded here.

On that day the first passenger-carrying vehicle, a stagecoach drawn by eight horses, successfully made the trip to the summit. That was the only trip of a clumsy stage except in the nineties when one negotiated the road as a stunt.

RECORD IS NOW UNDER 14 MINUTES

Until the automobile came, lighter horse-drawn vehicles, carrying from nine to twelve passengers, were used, and every day, weather permitting, from fifty to one hundred people were transported up and down the mountainside.



Photograph by Trask's Studios

HE PLUNGES INTO A 90-MILE GALE LIKE A SWIMMER DEFYING A HUGE BREAKER

The anemometer on Mount Washington has registered a velocity of about 100 miles an hour (page 78). The ice formation consists of "frost feathers," or rime, built up in spikes toward the wind as it blew moisture against the pole at the end of the cog railway trestle. In a single storm these formations have been known to reach six feet in length.

It was in 1899 that the first automobile, a steam-driven vehicle, started from the Notch and in the "remarkable" time of 2 hours and 10 minutes reached the top. Five years later, in an automobile climbing contest, a driver rolled his car onto the summit in 25 minutes.

The next year the record was broken when a daring driver covered the route in about 21 minutes, but that record was shattered by four minutes in 1922. The record made in 1934 now stands at 13

minutes, 20 $\frac{1}{2}$ seconds—quite a record when one considers that the grade is from 12 to 26 per cent and there are more than eighty curves in the highway (p. 99).

The Carriage Road, as the highway is still called, was the most popular means of reaching the summit until the cog railway came into being, and it still is used by thousands of visitors annually.

"CRAZY MARSH" AND HIS BIG IDEA

The cog railway is as much a part of the story of Mount Washington as the White Mountains are a part of the story of New England.

In the early fifties, Sylvester Marsh, a native of New Hampshire who sought his fortune in business in Chicago, returned for a visit to his native State and set

out to climb Mount Washington. He lost his way and was forced to spend the night in the open. Despite his hardships, the White Mountain panorama so thrilled him that he visioned riding to the summit in a railway car.

Retiring from business in 1855, he worked out plans for a cog railway and built a model. With this he appeared before the New Hampshire Legislature to apply for a charter. He was greeted with guffaws.



Photograph by Harold Orne

HEAVY CHAINS KEEP THE WEATHER STATION FROM BLOWING AWAY

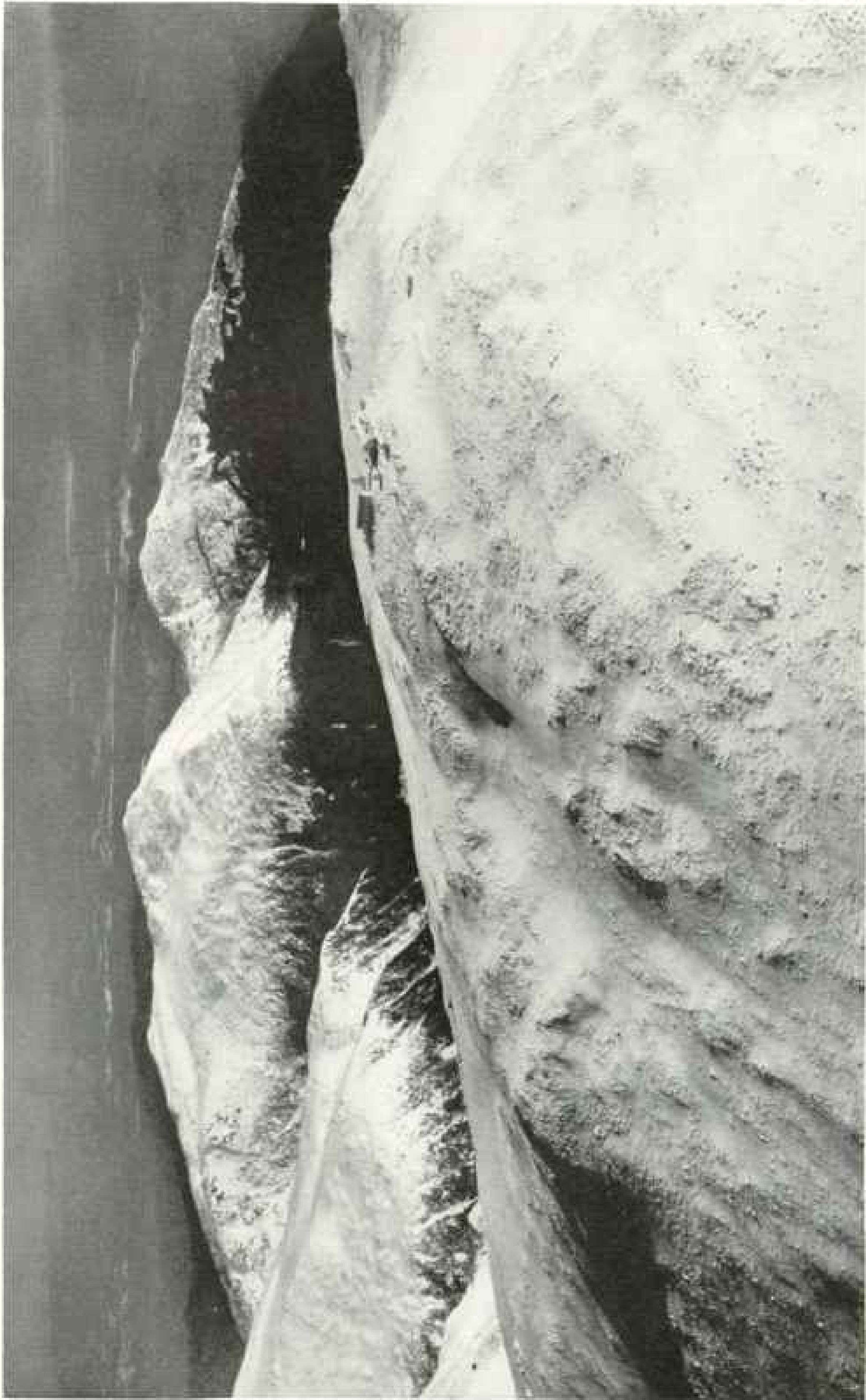
Reaching high into the air above New England, Mount Washington yields weather reports of considerable value to aviators and general forecasters. Observations are made every six hours (page 78). At the right is the terminus of the cog railway (page 76).



Photograph by Winston H. Pote

SAP'S A-RUNNIN' IN THE SUGAR BUSH

Spring has come to Black Mountain, near Jackson, New Hampshire, and the sweet life fluid in the maple trees is beginning to rise. So out come buckets of many shapes and sizes to catch the dripping juice that soon will become maple syrup and maple sugar. Since more than a barrel of sap must be boiled down to make a single gallon of syrup, the tall woodpile is none too high.



Photograph by Bradford Washburn

WHITE MOUNTAINS THEY ARE INDEED, LIFTING THEIR POWDERED WIGS A MILE INTO THE AIR

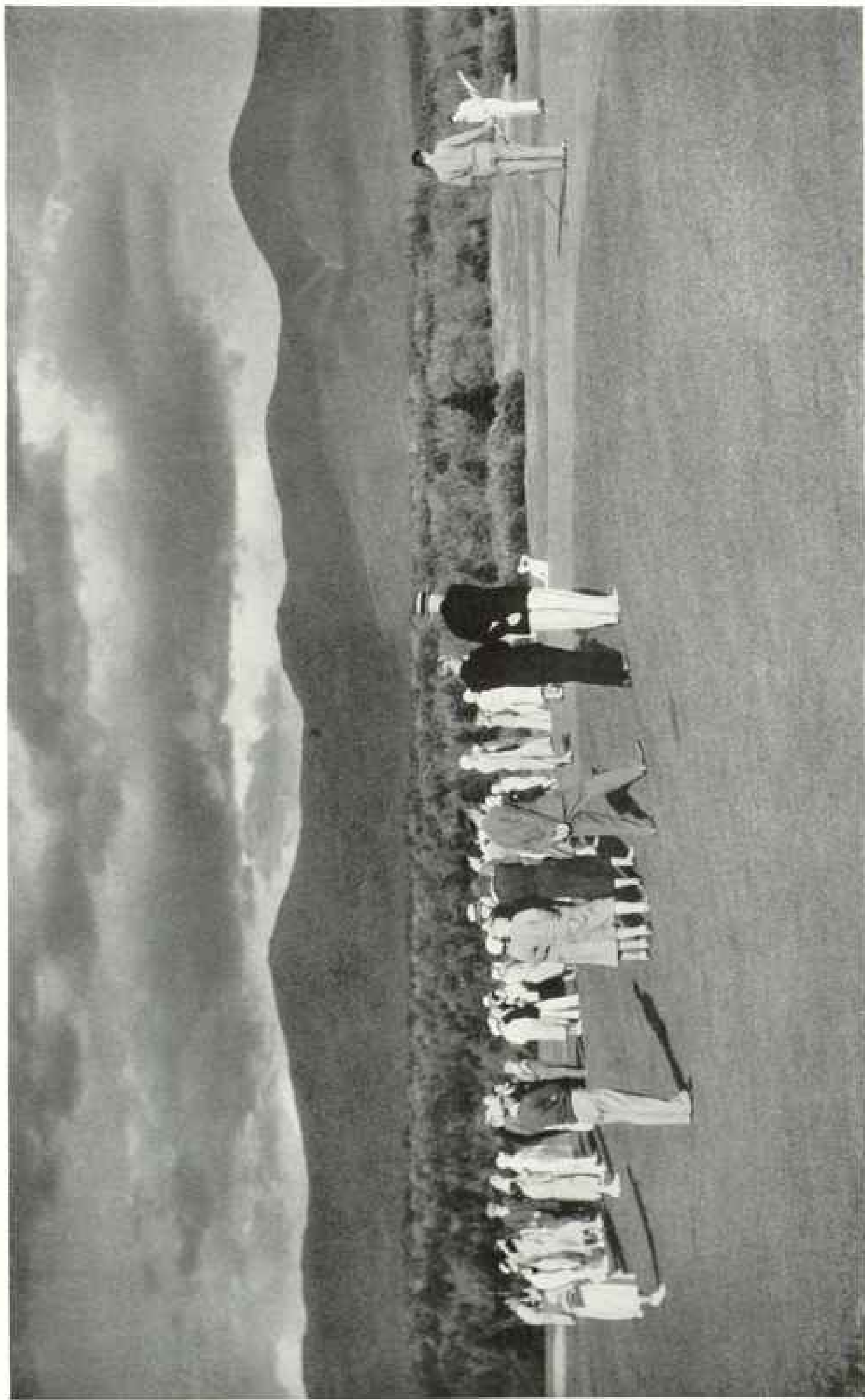
In all except the hottest months of summer the high peaks glisten white with snow, forming a landmark that was known of old to mariners on the Atlantic, sixty miles away, and today is familiar to aviators. In the foreground of this aerial view looms the loftiest of all—Mount Washington, 6,288 feet above the sea and a mile above the valleys at its foot. The cluster of buildings includes a weather station and two mountain-top hotels (page 101). Beyond appear other peaks of the Presidential Range: a shoulder of Mount Jefferson (5,715 feet) at the left; then Mount Adams (5,798 feet); and Mount Madison (5,363 feet).



Photograph by Winston H. Note

LAKE CHOCORUA, NAMED FOR AN ILL-FATED INDIAN CHIEF, MIRRORS PEAKS OF THE SANDWICH RANGE

Chief Chocorua, according to legend, left his son with the family of a white friend while he visited Canada. The son accidentally poisoned himself. Chocorua, on his return, took vengeance by killing the wife and children of his friend. He was tracked to the summit of a near-by mountain, which also bears his name, and died invoking curses upon all white men.



Photograph by Walter K. Merryman.

LIKE A GIANT BUNKER IN THE DISTANCE LOOMS THE PRESIDENTIAL RANGE

Golf flourishes on the verdant mountain-framed plain at the north end of scenic Crawford Notch (opposite page). The region is dotted with huge frame hotels, here called "houses," and offers views that would compensate even a duffer for his score. The first high peak from left to right is Mount Washington; then follow Mount Monroe, Mount Franklin, and Mount Pleasant. The cog railway climbs this side of Mount Washington; a side road from the main Crawford Notch highway leads to the Base Station (page 74).



Photograph from Sawyer Fictional

CRAWFORD NOTCH FORMS A SCENIC SHORT CUT ACROSS THE WAISTLINE OF THE MOUNTAINS

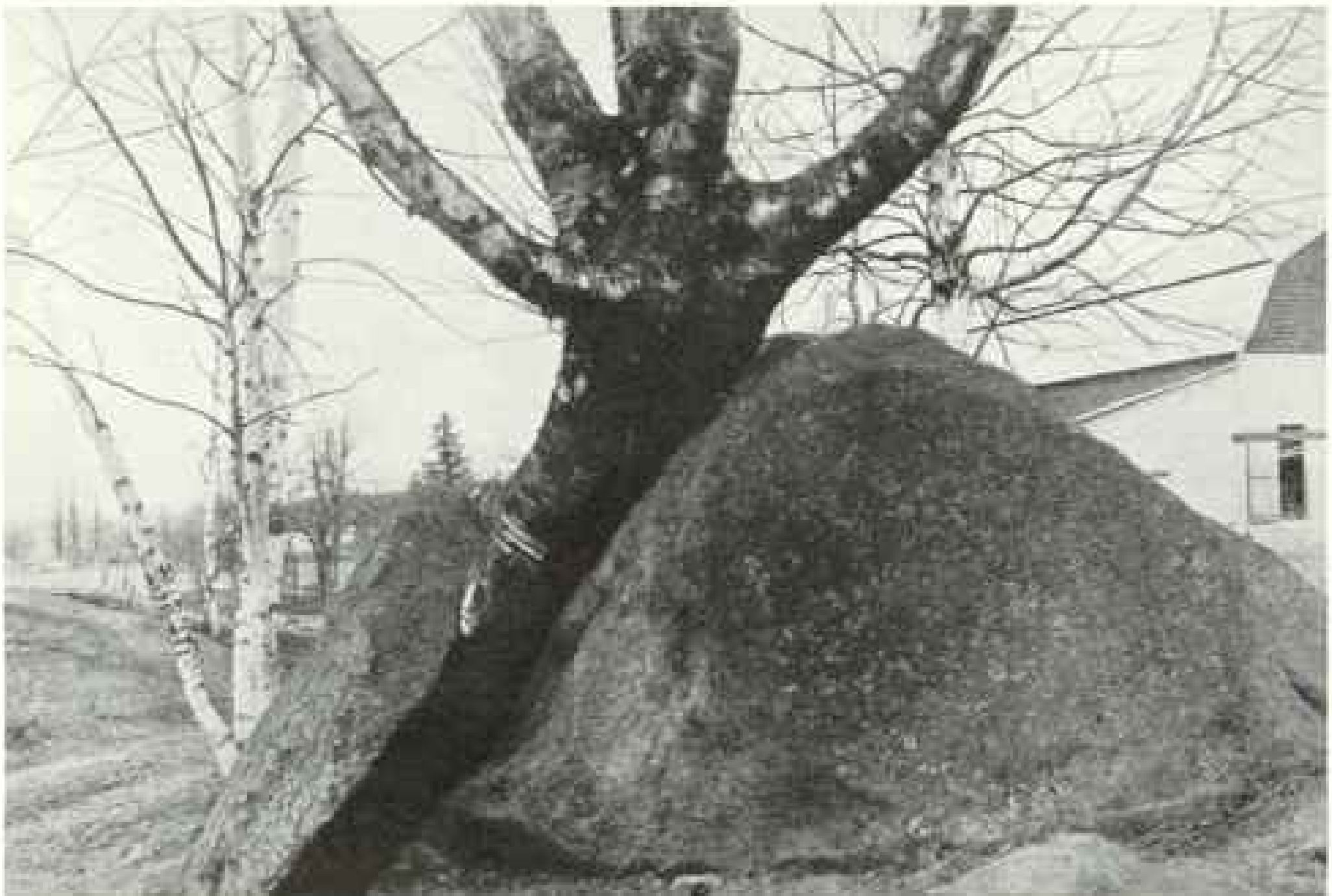
A frightened moose which eluded a hunter in 1771 caused its discovery (page 94). Today motorists revel in the arboreal beauty of the Notch, as seen from a winding road (the white streak in the center) that follows the cascading Saco River. At the right runs the railroad; at the left rises glacier-scarred Mount Webster.



Photograph courtesy U. S. Forest Service

A C. C. C. PICK-AND-SHOVEL SQUAD RIDES BACK TO CAMP.

Boys of the Civilian Conservation Corps take a last glance at the results of the day's work before heading for a hot dinner and a comfortable bunk. Throughout the mountains the Corps has improved highways, cleared debris from the roadsides, rid trees of branches that might injure motorists during storms, and cut vistas in the forests to reveal spectacular views (page 89).



Photograph from International News

TREE CONQUERS ROCK IN NATURE'S NEVER-ENDING STRUGGLE FOR EXISTENCE

Tenacious of life, this white birch at Bethlehem, New Hampshire, overcame the seemingly insuperable handicap of having a big boulder on its head. It found a fissure and grew and grew, at last splitting open the heavy burden to win its place in the sun.

Some legislators called him "Crazy Marsh." Another suggested an amendment to the charter so that Marsh could continue his railroad to the moon. But in the end the charter was granted.

The War Between the States slowed Marsh's progress, but immediately after hostilities ceased he began pushing his dream to a successful conclusion. He set up an operating model of his railroad in a Boston office. The engine weighed 17 pounds and the inclined track was 20 feet long.

Capitalists refused to become interested in the strange creation, so the inventor dug into his own pocket and built a short experimental section of track on a shoulder of Mount Washington, August 26, 1866. Marsh demonstrated his

"folly." It was a success. Even men who had jeered him were amazed and became interested. The first train chugged to the summit without mishap in 1869.

The engine resembled a modern hoisting engine. It was named *Hero*, but someone remarked that it looked like a peppersauce bottle, commonly used in New England homes in the sixties. "Old Peppersass" it was dubbed.

The railroad has carried more than a half million passengers to the summit of Mount Washington without a casualty on



Photograph by Clifton Adams

"THAT'S A LOAD OFF MY SHOULDERS"

At one of the cabins of the Appalachian Mountain Club below Mount Washington, two hikers wearily take off knapsacks which somehow have come to weigh a ton. Little wonder, for the two have just descended the big mountain by way of Boott Spur and Montalban Ridge. Such comfortable shelters as this add greatly to the enjoyment of hiking in the White Mountains (pages 102-3).

a regular run. The average grade of the track is about 25 per cent and on one stretch, Jacob's Ladder, it is more than 36 per cent (page 76).

As you observe the queer little engine pushing the passenger car up the mountainside, you agree that "Crazy" Marsh was no more unbalanced than Seward when he proposed the purchase of the Alaskan "folly."

The three-mile trip on the railroad takes 70 minutes. For the comfort of passengers, the seats are so constructed that they are nearly level on the steepest grades.



© C. T. Bodwell

TAPESTRIED WALLS OF FLUME GORGE ECHO THE SYMPHONY OF A STREAM

To walk through the gorge, with its gurgling water, and to see the colorful patterns that Nature, with mosses and shrubs, has woven upon the precipitous, rocky sides, visitors flock to this beauty spot by the thousands (page 93). Vapor, constantly rising from the cascading stream, and pencils of sunlight that penetrate the trees above the gorge, promote lush vegetation wherever the tiniest bit of earth may find a hold.

The early part of the trip is through a broad swath in the wooded lower slopes of Mount Washington. Frequently vistas, recently opened by Civilian Conservation Corps boys, offer splendid views of the sea of peaks about you.

At the water stops passengers alight and view the surrounding mountains. Southern peaks of the Presidential Range—including Mount Monroe and Mount Franklin—are clearly visible, as well as the peaks in the Franconia region where Mount Lafayette thrusts its ravine-scarred bulk above its lofty neighbors. Below are the large hotels at Bretton Woods.

With a safety device rattling in your ears, you continue the journey upward, entering virgin forests of conifers, and then pass above timber line where the mountain is strewn with rocks and dwarfed, twisted trees that have defied high winds for more than half a century.

HOW THE "GREAT STONE FACE" WAS FOUND

Mount Washington is admittedly the dominating feature of the White Mountains and nearly every visitor to northern New Hampshire hopes to stand on its summit. But if your time is short and storm clouds thwart that hope, there are scores of other features that are well worth a ramble among the heights.

Chief among these is the Profile, popularly known as the "Old Man of the Mountain," or as Hawthorne's "Great Stone Face," peering from the rugged granite ledges of Profile Mountain above the highway through Franconia Notch (page 92).

It was a man's appetite for partridge for breakfast that led to the discovery of the Profile in 1805. Nathaniel Hall was a member of a road-building crew. Early in the morning he shouldered his gun and left camp.

With only a well-browned partridge on his mind, he silently crept along the shore of a small lake, his eyes penetrating the undergrowth. For some reason unknown to Hall he looked up—and for a moment was stunned by "the most wonderful face" he had ever seen.

News of the discovery spread rapidly over New England. The road Hall was working on was pushed through the Notch. Men and women came on horseback, by stage, carriage, and cart. The popularity of the Profile was one of the factors that

influenced the building of a railroad into the Franconia region and the erection of the famous Profile House, since destroyed by fire.

The rugged features of the Old Man, formed by five layers of granite ledge, measure 40 feet from the top of the forehead to the bottom of the chin. Two layers of granite make up the forehead, and one each the nose, upper lip, and chin.

"There's the Great Stone Face," my companion said as he pointed out to me the rocky side of Profile Mountain. I looked, but saw no face. I learned later that I was peering at the Old Man full face and his features were not discernible.

A short way up the road we stopped, placed our car in a large parking space provided for visitors, and against the southwestern sky I saw the face that startled Nathaniel Hall.

Observers differ about the Old Man's mood. Some have called him cold and stern; others, warm and kindly. As I saw him from one vantage point, he seemed to be frowning at the mad world he has known since the great glaciers that once covered the White Mountains left him gazing upon a desolate, ice-scored land; yet his determined chin indicated that he was confident he could handle any situation the world might present for his judgment.

As I made a step or two to one side, the Old Man became a sympathetic old gentleman, for the bold chin and the protruding forehead were not so accentuated.

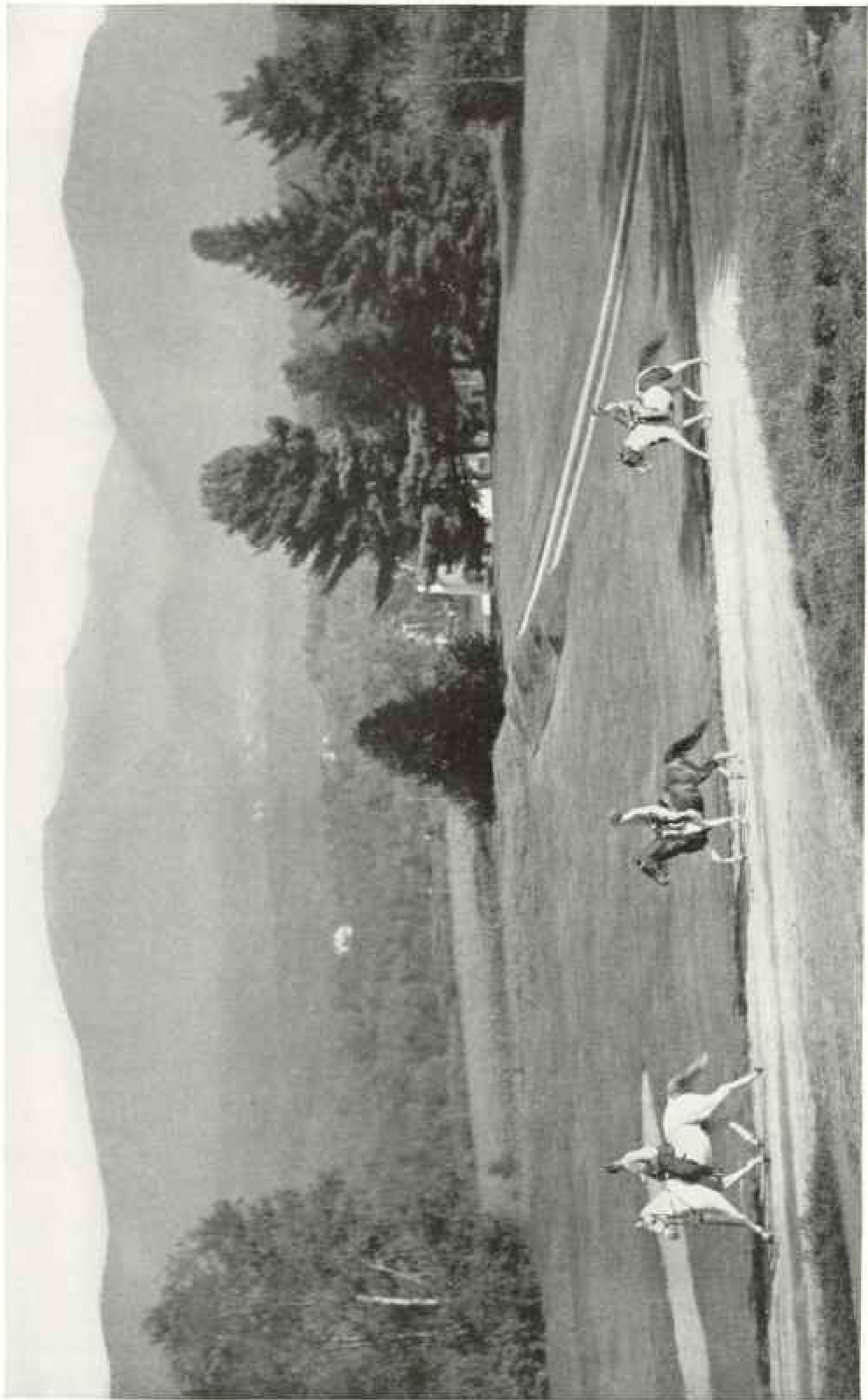
FACE LIFTING WITH SLEDGE HAMMERS

The rugged Old Man has had a major face-lifting operation. In 1852 a group of mountain climbers located the ledges forming the face and discovered that a 25-ton stone, a part of the forehead, was slipping out of place.

The discovery was widely publicized, but nothing was done to save the face until 1915 when the pleadings of a clergyman impressed proprietors of hotels in the vicinity with the immediate need of repairs if the Profile was not to be lost forever.

The next year a "surgeon" was employed. He was a stone quarry engineer and his "delicate" instruments were sledge hammers, steel pins, clevises, rods, turnbuckles, and chisels (page 94).

You cannot see the heavy steel "sutures" with which the surgeon knitted the Old Man's brow. Had the operation not taken



Photograph by Roger L. Moore

THEY ENJOY A CANTER IN SUMMERY SUNSHINE, WHILE HIGHER IN THE MOUNTAINS WINTER SPORTS STILL REIGN

Skating is still going on in Tuckerman Ravine, on the east slope of Mount Washington, in June, as summer visitors are rediscovering bridle paths on Sugar Hill in the Franconia region, where this photograph was taken. The ivy-scurred bulk of Mount Lafayette (5,249 feet) rises in the center background and Profile Mountain at the extreme right. Between them is Franconia Notch through which more than a million people pass annually to enjoy the summer and winter recreational facilities of northern New Hampshire.



© C. T. Boswell

A 34-YEAR-OLD MYSTERY IS THE "KIDNAPPING" OF THIS BOWLDER

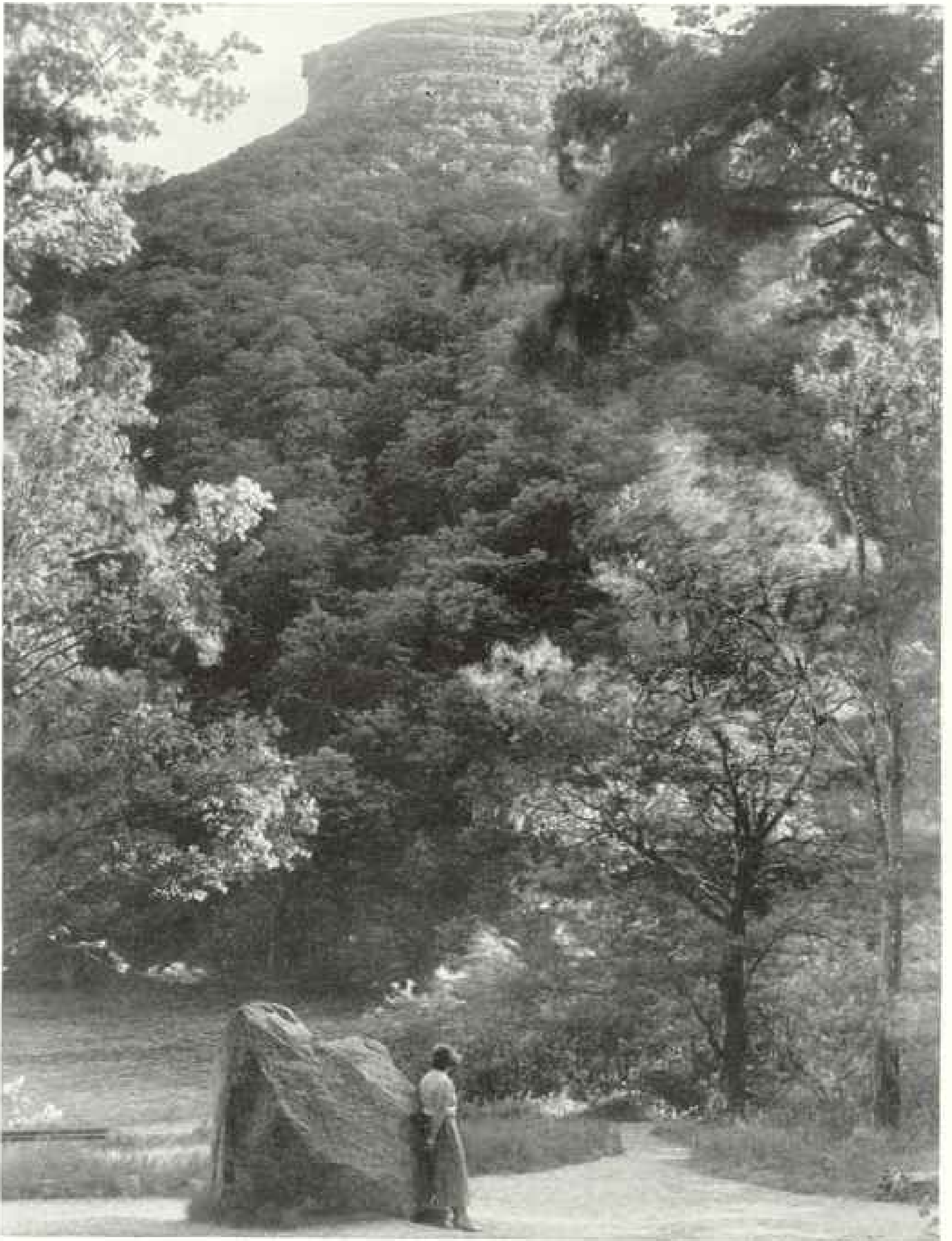
Until June 20, 1883, the huge egg-shaped rock, 10 feet wide and 17 feet long, was wedged between the walls of the Flume Gorge, as shown in this old picture. Then came a memorable flood which swept through the Flume with terrific force. From that day to this the boulder has never been found (page 9).



© C. T. Boswell

STRANGE ROCK FORMATIONS ARE LOST RIVER'S LURE

This hole was bored into the rock by a mighty torrent that plunked down the gorge in late-glacial times. Lost River, in Kinnaman Notch, was "lost" perhaps thousands of years ago when the receding ice sheet or a storm thrust bowlders into the gorge (page 93).



Photograph by Walter M. Edwards

AMERICA'S MOST FAMOUS PROFILE IN ROCK SCANS SOUTHERN NEW HAMPSHIRE FROM
ITS LOFTY PERCH

Does the Old Man of the Mountain, officially called the Profile, and widely publicized by Nathaniel Hawthorne as the Great Stone Face, smile or frown? The boulder in the foreground, the best vantage point, marks the debating ground for this subject (page 89). "It was a happy lot for children to grow up to manhood or womanhood with the Great Stone Face before their eyes," wrote Hawthorne, "for all the features were noble, and the expression was at once grand and sweet, as if it were the glow of a vast, warm heart, that embraced all mankind in its affections, and had room for more. It was an education only to look at it."

place, the Profile might have passed from the list of famous natural wonders of the world. The loss of the stone would have caused his forehead to recede, and in its dash to the valley below it might have disfigured his nose and scarred his chin.

If the Old Man had eyes, what could he see? In the summer he would look upon a never-ending caravan of automobiles pouring into the Franconia area, the White Mountains' region of natural curiosities.

At North Woodstock the Old Man would see part of the caravan turn westward toward the Lost River in Kinsman Notch, where the Society for the Protection of New Hampshire Forests presents one of Nature's strange creations.

In late-glacial times, when the Lost River was a mighty torrent plunging through a deep gorge in the Notch, the receding ice sheet or a violent storm thrust huge boulders into its bed in such a way that numerous caves were formed (page 91).

Don overalls, climb up and down ladders and ramps in that gorge, and you can imagine yourself passing under the sharp edge of a guillotine blade, visiting in a king's bedchamber, or imprisoned in a gloomy dungeon. If you must do a stunt, you might try to pass through the "lemon squeezer" or crawl through many other narrow apertures in the rocks that have no respect for the most securely sewed buttons.

A GIANT INDIAN HEAD LOOKS DOWN

The Old Man would see the caravan moving nearer. The Lost River visitors have again joined the column. Near Lincoln the caravan slows down. There is something of interest to the west; it is the Indian Head, a profile in an attitude of stoical repose peering down the Pemigewasset Valley.

The forests above the head suggest a war bonnet. It was because of the forests, however, that the Indian Head failed to draw the attention of travelers until early in the present century, for trees once covered the warrior's chin, and who would be interested in a face without a chin—except in a newspaper comic strip? A forest fire burned off the unbecoming chin whiskers in 1901.

From forehead to chin, Indian Head is nearly as tall as a 10-story building. Its nose is slightly longer than the whole face of the Old Man; its forehead is 17 feet high, the upper lip 23 feet wide, and the chin 16 feet long.

A short distance up the highway from the Indian Head vista, the Old Man would observe the caravan stopping at the Flume Reservation, a spot of such beauty that Emerson, after a visit, refused to attempt to describe it. Thousands of people see the Flume every summer, and the manager told me several hundred of them are repeaters (pages 88 and 95).

THE FLUME AROUSES AWE

It was not partridge but fish that led to the discovery of the Flume, a magnificent gorge 400 feet long with a cascading stream, and walls on which Nature, with mosses and flowering plants, has woven a natural tapestry. I think the comment of one writer expresses, as nearly as is possible, the visitor's deeper feelings after beholding the colorful grandeur of the Flume: "There is something ecclesiastical about this forest crypt—a sublimity and an awfulness."

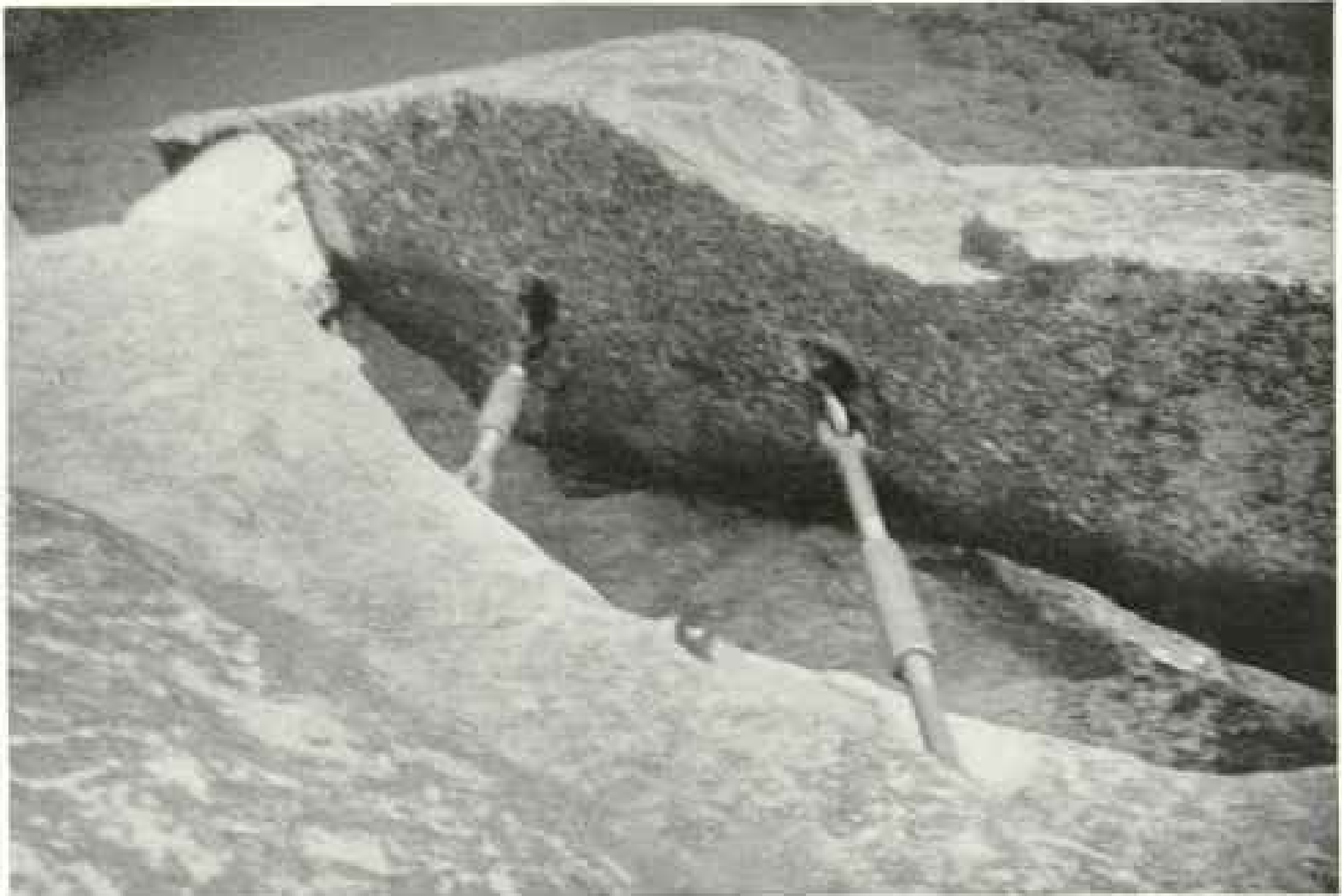
When 93-year-old "Aunt Jess" Guernsey discovered the Flume while seeking new fishing grounds, a huge boulder was wedged between the walls 20 feet above the stream. Some years ago a storm sent water and earth dashing through the gorge, dislodging the boulder, which was never found. Scars in the gorge walls show that the rock was reluctant to leave its perch, as if wishing to remain a part of one of the White Mountains' loveliest spots (page 91).

Under the Old Man's left ear, beside the Notch highway, is Profile Lake, probably the lake by which Nathaniel Hall was hunting partridge. Though small, it is one of the best-known lakes in the White Mountains, because a million and a half people look into it each year to see the reflection of the Profile.

And just back of that same ear is Echo Lake, its surface unruffled as it mirrors the lofty green mountains that frame it. Echo Lake has earned the right to its name for I am told that once nine echoes were heard from its shore.

The caravan moves on through Franconia Notch and beyond to Franconia, Littleton, Whitefield, Randolph, Gorham, and through Pinkham Notch to Jackson, Intervale, and the Conways, all typical New England towns of rambling homes and hotels that seem to have changed little in the last few decades, except, perhaps, by the addition of a gasoline station or two.

In those towns you meet with genuine hospitality. I was welcomed with friendly



Photograph by Trak's Studio

STEEL "SUTURES" HAVE SAVED THE FACE OF THE OLD MAN OF THE MOUNTAIN

Mountain climbers some years ago discovered that a 25-ton stone was slipping out of position in the forehead of the Great Stone Face (page 89). In 1915 hotel owners successfully employed a "surgeon," a quarry engineer. Had the stone actually fallen, it would have caused the Old Man's forehead to recede and might have damaged his nose and chin in its mad dash to the valley below.

handshakes at the annual town meeting in Franconia in March. Town finances were the chief subject for discussion and men talked of "hiring" money from the bank to meet the cost of town improvements.

The towns I have mentioned are so situated as to present grand panoramas of the mountains, and each insists that its view is the most fascinating. Mount Washington is nearly always in those panoramas, and Mount Adams, Mount Madison, and Mount Jefferson, of the Presidential Range, seem only now and then hidden behind a peak close in the foreground.

I have asked more than a dozen people what town or site along the numerous highways presents the most striking view of the mountains, and I have had nearly a dozen different answers. Sugar Hill, Whitefield, Bethlehem, Intervale, Conway, Gorham, Pinkham Notch, Jackson, Bretton Woods, Twin Mountain, and Waterville Valley were among the choice observation points.

As inspiring as panoramas from these points may be, if only one spot makes a lasting impression on the visitor it is Craw-

ford Notch. A pass on the highway across the waistline of the White Mountain heights, it bulges with history and legend and reeks with beauty (page 85).

WHAT A MOOSE HUNTER FOUND

Neither partridge nor fish, but a frightened moose was responsible for the discovery of Crawford Notch in 1771. Timothy Nash was pursuing the beast, lost sight of it, and climbed a tree on Cherry Mountain in the hope of again picking up the trail.

Like Hall who forgot his partridge, Nash forgot the moose when he saw the Notch which was to become one of the chief highways through the White Mountains. He set out for Portsmouth and reported his discovery to Governor Wentworth.

Travel from the coast to the upper Connecticut Valley had been roundabout and expensive. The Governor at once realized the value of such a pass and offered Nash a tract of land if he would prove his contention by bringing a horse through the Notch from Lancaster.

Nash, a companion, and the horse were



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THREE THOUSAND PEOPLE HAVE VISITED THE FLUME IN A SINGLE DAY

When 93-year-old "Aunt Jew" Guernsey discovered the Flume Gorge in 1808 while seeking a new fishing ground, she little suspected that the spot, with its gorgeous coloring, would become one of the most popular of the White Mountains' scenes (page 88). The Flume Reservation, beautifully landscaped, is maintained by the Society for the Protection of New Hampshire Forests.

weary and worn when they accomplished the feat, but the discoverer received the promised reward.

Funds from the sale of a seized Tory estate were appropriated to build a road through the Notch. Sections of it were so steep that ropes were often used to aid drivers on the inclines.

The first merchandise to pass through the Notch from Lancaster to Portsmouth was a barrel of tobacco; the first to pass in the opposite direction was a barrel of rum. The story is that by the time the barrels arrived at their destinations, little of their contents was left.

Crawford Notch, named for one of the White Mountains' most illustrious pioneering families, is about four miles long. The Maine Central Railroad, the Saco River, and the highway are all squeezed between its great walls. Some idea of the difficulties met by the builders of the highway may be understood when it is recorded that it required the construction of 32 bridges.

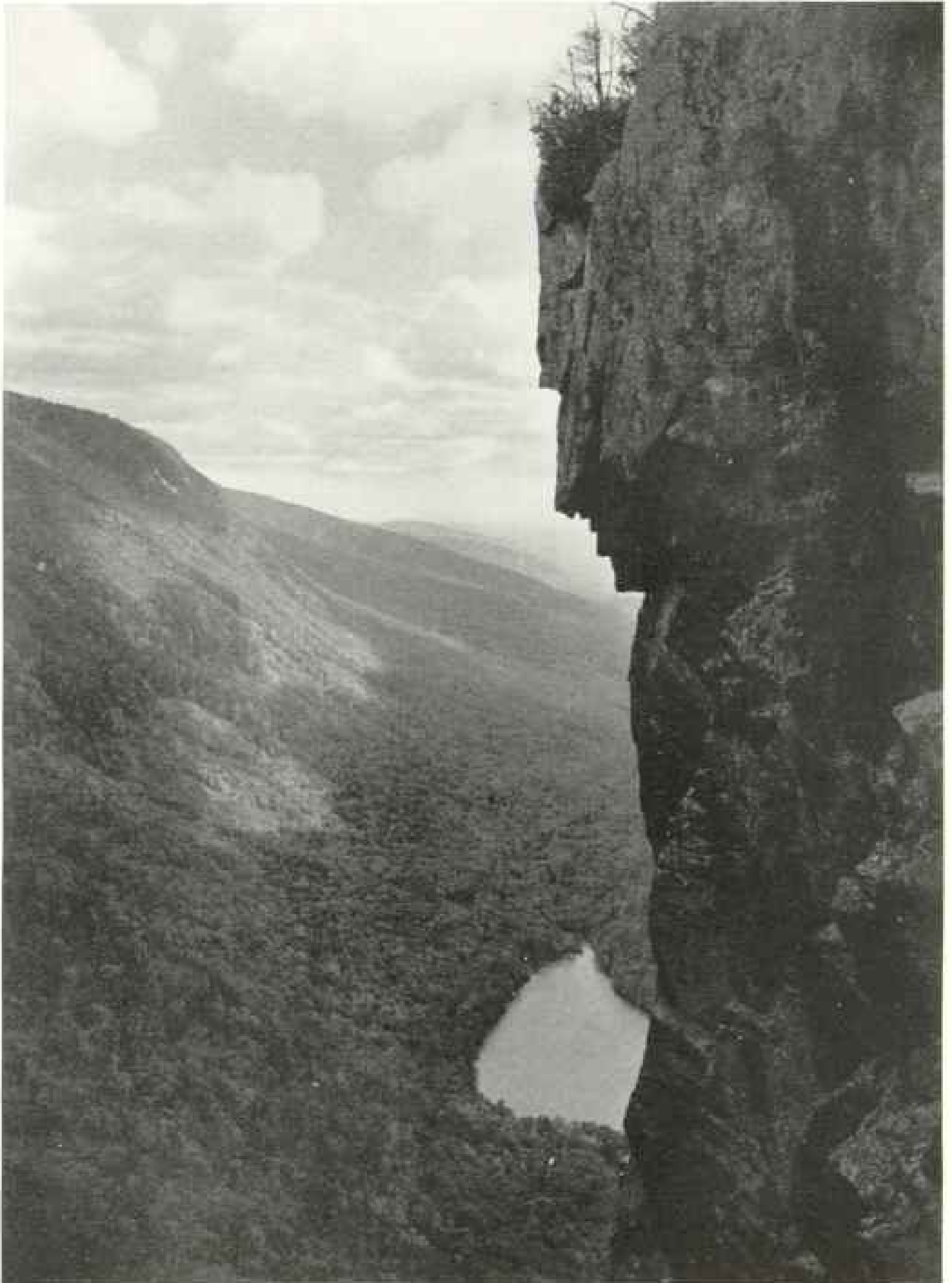
The highway today is amply wide for two-way traffic. As I drove through the

Notch I felt myself absorbing the same enthusiasm for the pass that had gripped others who had traveled this route. The scene is a quiet, winding road through a wooded glen, now squeezed in by precipitous, naked granite cliffs, now winding among gentler slopes clad in a dark-green robe of conifers.

At the northern gateway to the Notch a broad meadow framed in lofty peaks and ridges is flecked with huge hotels, here called "houses." In the spring the proprietors swing open their doors, the meadow suddenly comes to life, and for more than three months the mountains echo with the merriment of vacationing throngs, who may remain for a day, a week, or the entire summer.

A MOUNTAIN TRAGEDY

Perhaps few of those who are inspired by the verdant beauty and ruggedness of the Notch, where the infant Saco cascades toward the Atlantic and birds add their symphony to its serene atmosphere, or those who revel in the glorious panoramas from Bretton Woods, are aware that in this



© C. T. Botwell

THE "OLD WOMAN OF THE NOTCH" IS A NEIGHBOR OF THE "OLD MAN OF THE MOUNTAIN"

His stony face (page 97) is not seen in this picture, but hers looks down from Eagle Cliff as if a bit dejected. Profile Lake, under her chin, though small, is one of the best known of all White Mountain lakes, because annually more than a million and a half people look for the Old Man's reflection on its mirrorlike surface. The Old Woman is not so well known as the Old Man, because she is not so readily discernible from the highway through Franconia Notch and has not enjoyed the long publicity accorded her masculine rival.

region of spectacular beauty occurred the Willey disaster that stirred the emotions of the region in the summer of 1826.

A severe drought seared the White Mountains. Trees withered, and dust, in some places, was ankle deep. Small landslides occurred in June, frightening Samuel Willey and his family. He sought a safer home, but friends urged him to remain in his house at the foot of Mount Willey.

On August 28th the drought broke with a raging storm that continued all night. The Saco River, reduced to a mere trickle by the drought, rose 24 feet, flooding Crawford Notch, stripping houses from their foundations, uprooting trees, dislodging boulders, and sweeping livestock, fences, bridges, and even sawmills into its torrent.

The following day was cloudless. Men looking up the mountain slopes that two days earlier were clad with trees, saw them shorn to bare rocks. Twenty-one of the 32 bridges in the Notch went out with the flood and much of the road was destroyed.

Passing through the Notch, John Barker stopped at the Willey house, which was untouched by the storm, though a tangle of trees, rocks, and sand lay on both sides of it.

A landslide had swept down the mountain, and, encountering a ledge of rock not far from the back door, had split into two sections, flowing around the house and meeting on the other side.

The house was deserted except for a dog. An open Bible on the table, unmade beds, and clothes strewn about the rooms indicated that the occupants had hurriedly left.

In the near-by debris a searching party unearthed the crushed remains of Samuel Willey, his wife, two of the Willey children, and two farm hands, but the bodies of three of the children were never recovered. All apparently were engulfed as they fled from the house—which ironically was spared.

The site of the house is marked by a boulder with a tablet recalling the disaster.

FROM TINY INNS TO BIG BUSINESS

To the early innkeeper is due much credit for the development of the White Mountains as a recreation area. The first innkeepers were natives of the hills who now and then were called upon to "put up" for the night a commercial traveler or to accommodate for longer periods artists, writers, and tired New England business men who sought the inspiration as well as the complete relaxation the mountains afforded.

The calls upon the natives became so frequent that some of them neglected their usual pursuits and were literally forced into the hotel business early in the last century, but their love for the mountains was not overcome by the figures on their ledgers. They sought to tell the world not of the luxury of their establishments, for luxuries then were few, but of the wonders at their thresholds.

That was the spirit of Eleazer Rosebrook who threw open the doors of one of the first inns in the White Mountains in Crawford Notch in 1803, and that same spirit prevails today among many of the hotel proprietors. Perhaps it is because some of the hotels are operated by descendants of the old innkeepers, who manage the houses in the same hospitable manner as their forbears, with the necessary modern facilities.

HOTELS IMPORT SKIING INSTRUCTORS

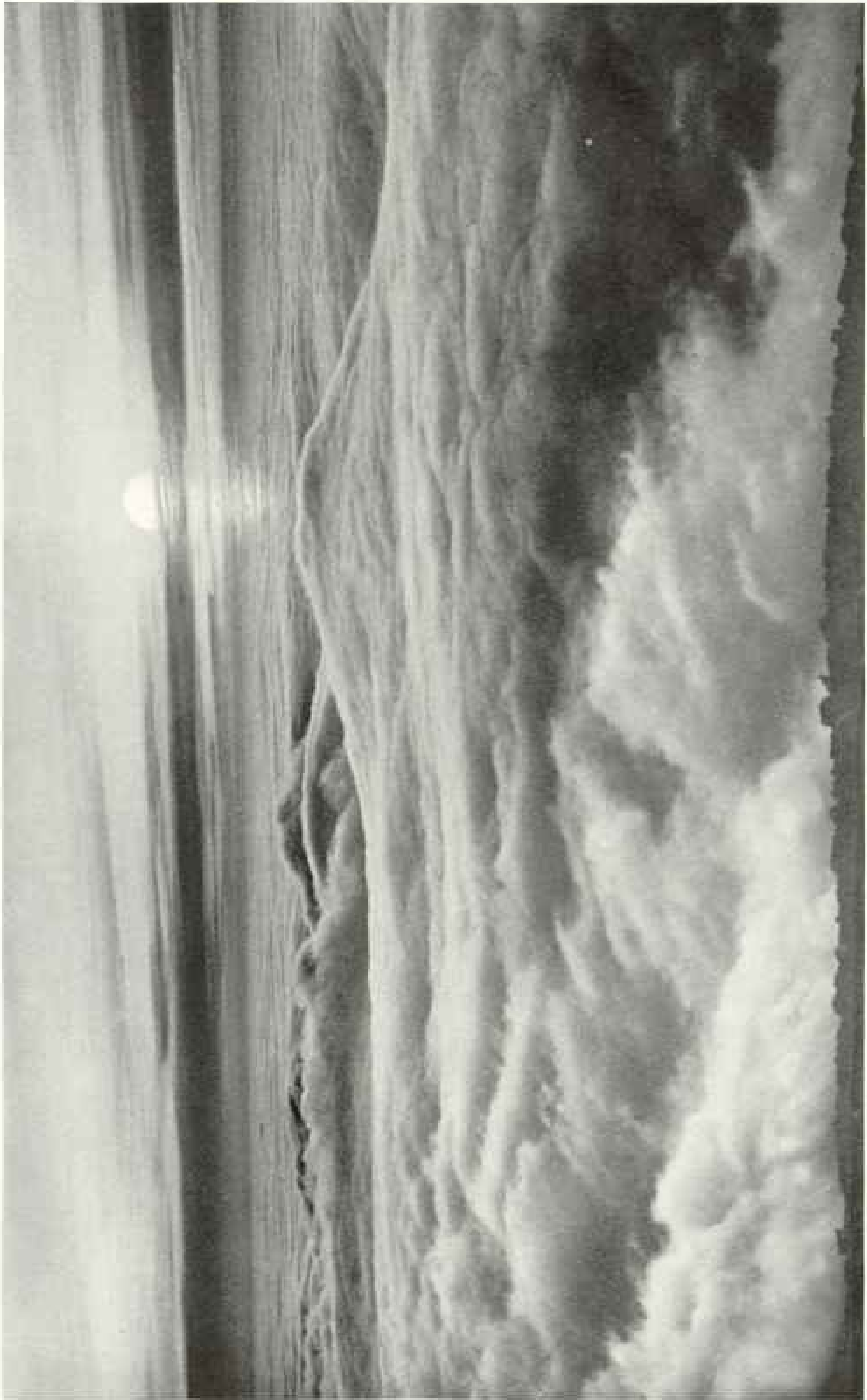
The hotels provide road and trail maps. There are guides for the timid souls, horses for the horseback riders, automobiles for those who choose the highways, swimming pools for the amphibians, courts for the tennis players, and 18 holes in inspiring settings for golfers.

One hotel that I visited imports three expert skiers from Austria to show guests how to bend their knees in approved fashion and to slide down snow-covered hills on polished, lightning-fast skis and still remain perpendicular.

It also has a trail-marking system that a ten-year-old can follow. If a guest expresses a desire to hike three miles from the hotel and return, he is shown a trail with trees plainly marked with red disks. If he desires a five-mile hike and return, the trail marked with blue disks is suggested. If a six-mile walk is desired, the yellow-marked trail is pointed out.

The United States Forest Service, the State of New Hampshire, through its Planning and Development Commission and Forestry and Recreation Department, and the Appalachian Mountain Club are constantly improving the recreational features of the mountains.

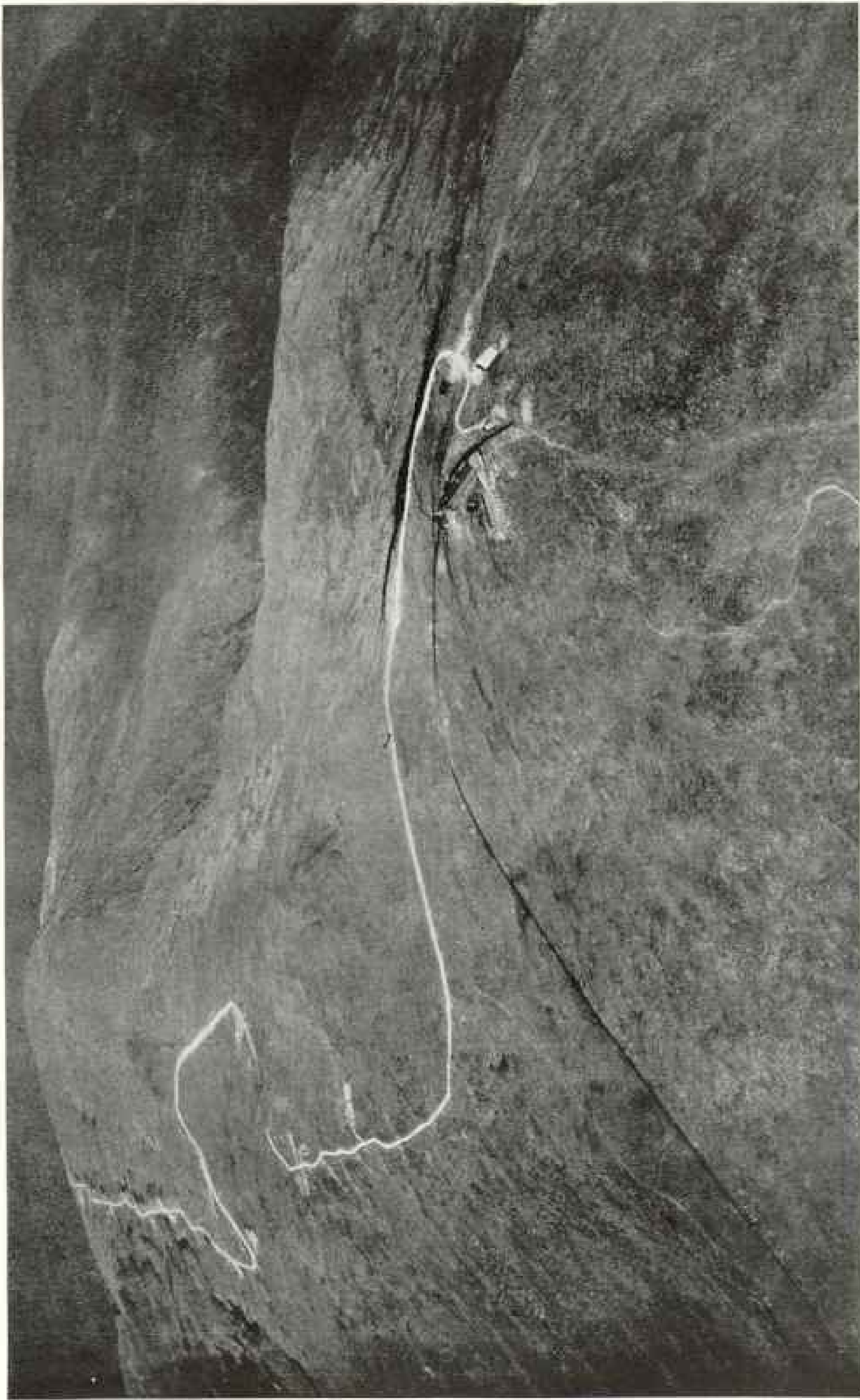
The Forest Service, of course, is primarily interested in the conservation of the trees of the White Mountains, but it also is striving to make itself a hospitable host. It maintains nearly 1,000 miles of trails, and its 10 mountain cabin developments



© C. T. Hubbell

SEEN FROM THE SUMMIT OF MOUNT WASHINGTON, THE RISING SUN PAINTS THE TOPS OF CLOUDS

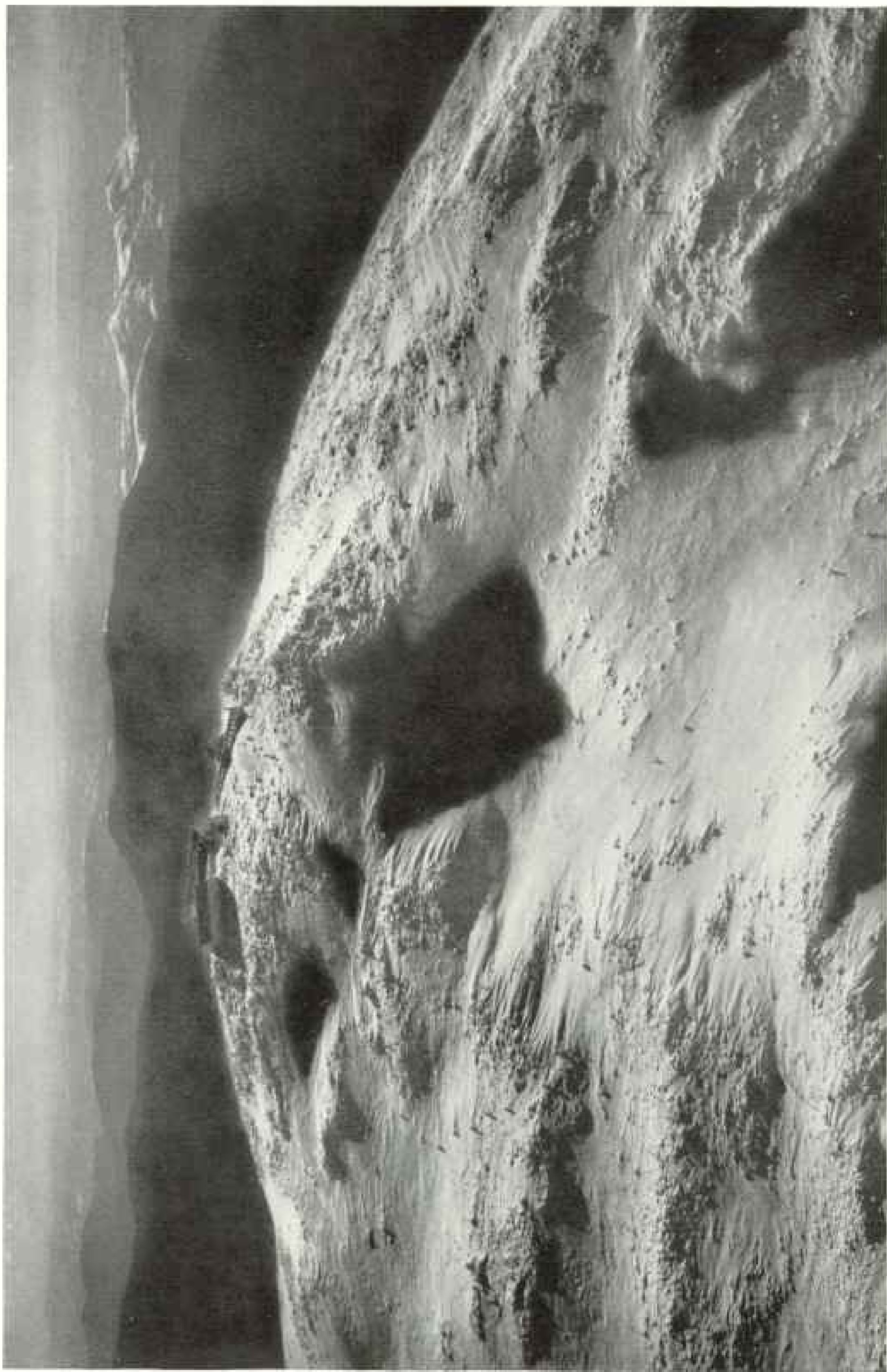
While the valleys of the White Mountains are still dim in the dawn, observers on Mount Washington watch the sun rise over the Atlantic Ocean, sixty miles eastward. The peak is famous for its fickle weather. On a sunny afternoon a visitor may be reveling in a glorious view when suddenly a bank of clouds rushes in from the northwest, dashes against the mountains like giant waves against a sea wall, and soon obliterates all but the highest crests or completely engulfs the summit.



Official Photograph U. S. Army Air Corps

WITH MORE THAN EIGHTY CURVES IN ITS EIGHT MILES, THE "CARRIAGE ROAD" WINDS TO THE TOP OF MOUNT WASHINGTON

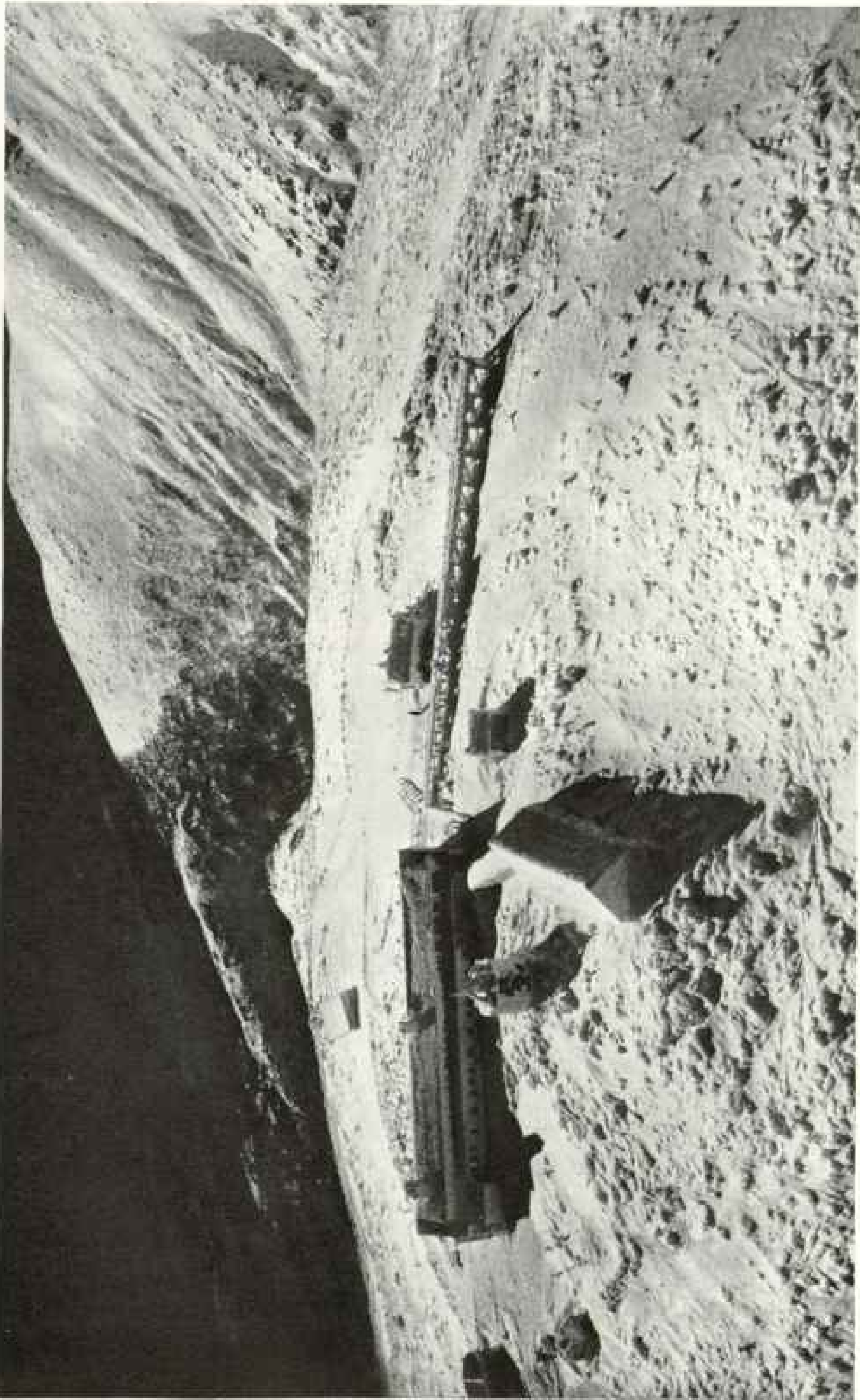
Opened in 1861, the road was first traversed by a stagecoach, but the cumbersome vehicle was not practicable, and light mountain wagons were used to carry passengers until the coming of automobiles. The first motorcar made the trip to the summit in 1899, in the "remarkable" time of 2 hours and 10 minutes. The record now is 14 minutes, 20 2-5 seconds, made in 1934 (page 79). The dark line from the lower left corner of the photograph is the cog railway (page 76).



Photograph by Bradford Washburn

LONELY AS THE MOUNTAINS ON THE MOON SEEMS THE SUMMIT OF MOUNT WASHINGTON, AS VIEWED BY THE AVIATOR

For eight or nine months of the year the rock-strewn crest is covered with snow. Yet it is not so forsaken as it looks, for each winter the observers at the weather station welcome from 200 to 300 hikers. Cairns on the left mark the trail above timberline. Wildest Mountain is in the immediate background.



Photograph by Bradford Washburn

TO SNAP THIS PICTURE OF MOUNT WASHINGTON, THE PHOTOGRAPHER FLEW WITHIN 200 FEET OF THE SUMMIT

Since Darby Field returned from the first trip to the top in 1642 (page 73), this spot has been visited by hundreds of thousands of people—by trail, cog railway, and Carriage Road. The long building is the Summit House, a mountain-top hotel, and joined by a covered corridor is another, the Tip-Top House. Beyond the trestle of the cog railway is the weather station. Cairns leading toward the end of the trestle mark one of the numerous trails to the summit. Boutt Spur rising in the background appears higher than Mount Washington, but in reality it is about 800 feet lower.



© C. T. Bodwell

A PERFECT CLIMAX TO A DAY ON THE HIGHWAYS OR TRAILS

In the White Mountain National Forest, comprising about four-fifths of the high mountain area, there are 10 cabin developments and 16 camp grounds open to the public. This fireplace is a feature of the lodge in the spacious State-developed Lafayette Place in Franconia Notch.

and 16 camp grounds, where campers find good water, parking facilities, and overwhelming views, are open to the public.

Eighty-four thousand people used the facilities of the Forest Service alone, in the mountains last year. More than 13,000 campers pitched their tents and remained an average of five days. On the shore of Campton Pond, near the village of Campton, is a large recreational area. The lake covers 40 acres and has a 1,200-foot sand beach.

The Dolly Copp Forest Camp in Pinkham Notch is the most popular of those under Forest Service jurisdiction. It has a swimming pool and sanitary facilities; winding, landscaped roads lead to picnic grounds and camp sites with tables and outdoor fireplaces.

THE FISHERMAN IS NOT FORGOTTEN

The Forest Service also stocks the streams for the sportsman with rod and reel, and maintains 26 ski trails aggregating some 66 miles. Its white and green signs, marking routes to falls, cascades, and spectacular vistas, are sprinkled generously through the area under its supervision.

In the State-owned areas also, signs mark the trails and scenic lanes to outstanding recreational spots. In Crawford Notch, on the Saco River, is the largest of the State reservations. In Franconia Notch, at Lafayette Place, the State is developing an elaborate camp ground with open fireplaces, running water, and firewood provided. At Forest Lake, near Whitefield, are accommodations for a cool dip.

On the Hemenway Reservation, near Wonalancet, is a camp ground with far-reaching views of the Sandwich Range, dominated by the bare, rocky summit of Mount Chocorua, which in shape is a miniature Matterhorn.

The hiker is not long on the White Mountain trails before he becomes aware that he is a beneficiary of the work of the Appalachian Mountain Club, an organization founded more than sixty years ago. The Club has made many peaks of the White Mountains accessible by maintaining trails and also by establishing huts and shelters.

Throughout the high mountain area the huts, managed by rugged combinations of good hosts, good cooks, and good companions, are but a day's hike apart.



Photograph by C. T. Bodwell

THE UNINITIATED HIKER'S SILENT GUARDIAN

This warning should not be taken lightly, for although thousands ramble about the summits of the mountains each year in clear weather, storms often force others—who may have started out on the trails on sunny afternoons—to spend hours and sometimes days in shelters (page 77).

The only valley hut is at Pinkham Notch, where the double-deck bunks are often reserved weeks ahead during the ski season in Tuckerman Ravine.*

A trail to the east of this hut leads to Glen Ellis Falls, probably the best known of the White Mountain falls. Another leads up Wildcat Mountain flanking the eastern side of the Notch; from it may be seen breath-taking views of Mount Washington and the Presidential Range, eight of whose peaks are more than a mile above sea level.

The trails from the base of the mountains lead through forests of maple, birch, beech, oak, ash, and spruce. As you climb higher the spruces continue into and beyond the region of the balsams and hemlocks.

These trees that blanket the mountain slopes in a variety of greens during the summer weave a magic carpet of rare colors in the autumn. The maples lend various tints of reds and yellows, the oaks reds and browns, the birches yellows, the ashes yellows and browns, the beeches yellowish russets, and the balsams, spruces, and hem-

locks contribute shades from bright green to near black. Some years the first snow falls when the autumn spectacle is at its height, presenting a study in color that only Mother Nature can so strikingly produce.

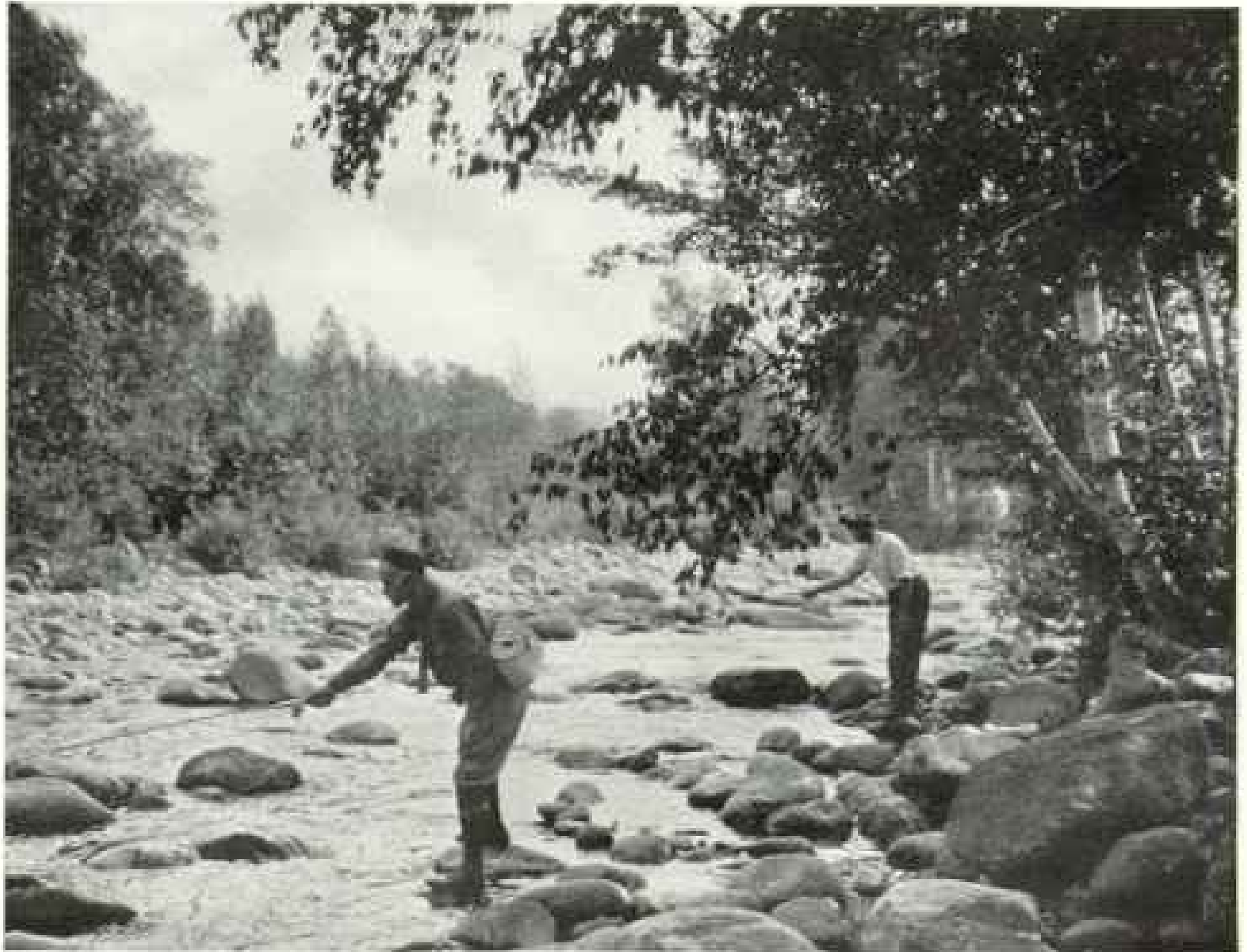
WILD FLOWERS IN PROFUSION

Scores of wild flowers—daisies, white-flowered brook saxifrage, yellow fire-finger, rose cassiope, flaming Devil's paintbrush, purple Lapland rhododendron, yellow arnica, trilliums, vetches, asters, and deep-blue gentians—burst forth in profusion along the highways and trails.

Above tree line on Mount Washington is the Alpine Garden, a "floral island" where grow many plants found nowhere else in North America south of Labrador.

While the flowers spread their blanket of color at your feet, some of more than a hundred species of birds break the silence of the forest with a joyous medley. In the Franconia region an amateur ornithologist has identified 87 summer birds, including 16 species of warblers, 4 of woodpeckers, 3 of thrushes, and 2 of wrens. He also has observed 16 kinds of birds which make the region their winter home.

* See "New England Ski Trails," by Daniel Rochford, in *THE NATIONAL GEOGRAPHIC MAGAZINE* for November, 1936.



Photograph courtesy U. S. Forest Service

CLEAR ROCK-STREWN STREAMS CHALLENGE—AND REWARD—THE ANGLER

There are few spots in the White Mountains that are not within a short ride or hike of a lively stream or a quiet lake which New Hampshire and United States Government hatcheries keep well stocked. This stream runs through Dolly Copp Forest Camp in Pinkham Notch (page 102).

Unless your stay in the mountains is long or you are extremely lucky, you may see few wild animals even on the most remote trails, although white-tailed deer, black bear, rabbits, raccoons, a few moose, and a variety of squirrels beckon to the hunter in season. Skunks, beavers, muskrats, mink, weasels, and martens thrive in the forests, too, as well as the predatory wildcat and lynx.

CARAVAN OF CARS FROM EVERY STATE

In the White Mountain caravan are automobiles from every State in the Union. Within 24 hours by automobile or train, travelers from points as distant as Washington, D. C., Pittsburgh, Cleveland, and Buffalo now may reach these mountains.

The summer automobile caravans to the White Mountains are nearly as old as the automobile itself. Winter caravans, however, are a more recent addition to the scene, for the high mountain area was often "snowed in" until New Hampshire visioned

the mountains in the role of a winter resort.

Now when two inches of snow falls on the main highways in the White Mountains, snowplows are ordered out, and they plow until the storm has ceased. Throngs come by motor and "snow trains" from New York, Boston, and other cities.

Before my first visit to the White Mountains of New Hampshire I had listened to men and women extolling the beauty of this and that area. I sat in the office of a Boston business man and saw him forget momentarily his New England reserve when he waxed oratorical as he described the region; and during my first evening in the mountains I heard a New York City debutante of a few years ago, who is a year-round resident, tell how she "would rather die" than leave the mountains, despite the fact that her words were nearly drowned out by a howling, snow-laden wind.

Would the atmosphere that had captured them capture me, I wondered.

Now I know the answer. It did.

THE SOCIETY'S SPECIAL MEDAL IS AWARDED TO DR. THOMAS C. POULTER

Admiral Byrd's Second-in-Command and Senior Scientist Is Accorded High Geographic Honor

FOR his brilliant scientific achievements as director of research of the Byrd Antarctic Expedition of 1933-35, Dr. Thomas C. Poulter received on April 27 the National Geographic Society's Special Gold Medal—a distinction which has been conferred upon such outstanding contributors to geographic knowledge as Admiral Peary, Captain Amundsen, Admiral Byrd, and Amelia Earhart.

Dr. Gilbert Grosvenor, President of The Society, presented the rarely bestowed award at a luncheon ceremony in the Geographic's Administration Building in Washington, D. C. Dr. Poulter and his fellow guest of honor, Admiral Byrd, greeted a notable gathering of scientists, high-ranking naval and military officers, Government officials, and other distinguished persons of the Nation's Capital.

Near the speakers' table hung enlarged photographs depicting highlights of the historic Expedition: an air view of Little America; Dr. Poulter's tractor party setting out to reach Admiral Byrd (page 108); and the Expedition's ship *Bear of Oakland*, homeward bound from the Antarctic, steaming up the Potomac past Mount Vernon.

Dr. Poulter's impressive career as a scientist began at Iowa Wesleyan College, where he was graduated in 1923. There he later headed the Department of Chemistry and Physics and the Division of Physical Sciences, Mathematics, and Astronomy. He holds the degree of Doctor of Philosophy from the University of Chicago, and the commission of lieutenant commander in the United States Navy, where he serves in an advisory capacity connected with engineering research. Since his return from Antarctica he has been appointed Executive Director of the Research Foundation of Armour Institute of Technology, in Chicago.

Dr. Grosvenor, in presenting The Society's Special Medal, said:

"On behalf of the Board of Trustees, officers, and members of the National Geographic Society, I have the greatest pleasure in welcoming this distinguished company to Explorers' Hall and thanking you for joining with us in honoring one of the foremost

scientists and most courageous and competent explorers of America.

"Dr. Thomas C. Poulter had achieved a notable record in education and research when Admiral Byrd chose him to prepare and direct the important scientific program of his most recent polar expedition. The confidence placed in him by the Admiral was rewarded by outstanding discoveries in many fields of investigation in the physical sciences.

"But the most dramatic and the most revealing demonstration of the unusual ability of Dr. Poulter was the extraordinary journey which he led to the advance base where Admiral Byrd had decided to pass the winter alone to make important meteorological observations that he was unwilling to ask anyone else to risk making.

"In the long history of heroic sacrifice for science, none so thrills the soul as the grim resolution of Byrd to stick it out, regardless of consequence to himself, and his deliberate concealment of his actual condition,* lest his men perish in the attempt to aid him at that dangerous season; and Dr. Poulter's equally dogged persistence and final success in traversing the ice in the blackness of polar night and storm, for the first time in polar exploration, thus saving the precious life of his leader and our beloved associate.

"And now, Dr. Poulter, I have the honor to present to you this Special Gold Medal on which is inscribed:

'Awarded by the National Geographic
Society to

Thomas C. Poulter

in recognition of his important explorations and achievements and his technical researches as second in command of the Byrd Antarctic Expedition of 1933-1935.'

In accepting the award, Dr. Poulter said:

"It is impossible for me adequately to ex-

* Before the middle of the winter night, Admiral Byrd was stricken down desperately ill from the poisonous fumes of a faulty burner on his oil stove and, for a number of weeks, there did not seem to be any chance of survival. He had made some slight gains when Dr. Poulter reached him, twelve days before the end of the long Antarctic night.

press my appreciation for this great honor that the National Geographic Society has conferred upon me in presenting me with this Gold Medal.

"As I sat here and listened to these most generous remarks, my mind has gone back to 1931 when we first started working on the scientific program and I recall the great numbers of scientists all over the world who rightfully should share these honors today. Just to read the list of their names would require more time than we have at our disposal, but as I look around the room I see several of those men here today.

"There is another group of about twenty men without whose efforts there would have been but little of scientific importance to report. They are the members of the scientific staff who carried out the program in the Antarctic.

"There is one member of that staff whom I would like to mention for three reasons: first, because of the large amount of scientific data that he himself collected under almost impossible circumstances; second, because he would not tell you himself; and third, to show you what a democratic organization that scientific staff was. This man is none other than Admiral Byrd himself.

"You can imagine our surprise when we reached the advance base and found him in the frightful condition he was, for not only had we not had a call from him for help, but it was with some reluctance that he gave us permission to make the trip and then only after I had explained to him the great scientific value to be derived from it.

"Of course, towards the end of the long night I realized that something was wrong from the weakness and unsteadiness of his radio signals, but I had no idea he was in such a desperate condition.

"It is only since returning from the Antarctic that I have been able to get far enough away from the intimate details of the Expedition to see the different phases of it in their proper perspective and to single out the thing of greatest value.

"It was the opportunity that was offered to be intimately associated with Admiral Byrd."

ADMIRAL BYRD'S TRIBUTE

Following the presentation ceremony, Admiral Byrd spoke as follows:

"I am delighted that the National Geographic Society is honoring my second-in-

command and senior scientist, Dr. Poulter. It seems fitting that his first honor for his polar work should come from this Society, without whose help none of my expeditions would have been possible. I am always glad of an opportunity to acknowledge my debt to this great organization, and I am glad this honor is coming to you from the hand of a great American, Dr. Grosvenor.

"Dr. Poulter is the hardest worker I have ever known. He started two years before the departure of our last expedition, working with the greatest possible enthusiasm. Through his own efforts he raised nearly \$100,000 worth of scientific equipment, and he made a thorough plan of the scientific work to be done. Every day he arose at six and worked far into the night on the scientific preparations.

"Then, during the Expedition he continued his hard labor, averaging at least sixteen hours a day on the job. That is why we completed our scientific mission nearly 100 per cent. Dr. Poulter easily had more endurance than any man on the Expedition.

"He has been working just as hard since the Expedition ended, and it will be several years before the scientific work is completed, and it will require twelve good-sized volumes for the results.

"Dr. Poulter and his scientific staff served 20 branches of science. It naturally takes a very long time to work up and study and correlate the enormous amount of data obtained on our last expedition. A number of scientists have been going full speed ahead since our return to this country two years ago, and today men are working in many countries on this data. This, of course, includes many members of our Expedition. Work is still going on with the following branches of science:

Meteorology—for example, six men are engaged in this work;

Meteorite Observations—seven scientists;

Geophysics is another example. In this, six men are engaged;

Radio Research—two radio engineers.

"There are about thirty scientists working on the following branches: Magnetic Soundings, Terrestrial Magnetism, Cosmic Radiation, Oceanography, Geography, Zoology, Aurora, Bacteriology, Lichens, Algae and Fungi, Plankton and Invertebrates, Ice Studies.



© Harris & Ewing

FOR HIS ACHIEVEMENTS IN ANTARCTICA, DR. THOMAS C. POULTER RECEIVES THE SOCIETY'S SPECIAL GOLD MEDAL

Dr. Gilbert Grosvenor, President of the National Geographic Society, makes the award to Dr. Poulter (second from right) in the presence of Rear Admiral Richard E. Byrd (right) and Dr. John Oliver La Gorce, Vice President of The Society. Distinguished guests who attended the ceremonies in The Society's Administration Building in Washington, D. C., on April 27, 1937, heard Dr. Grosvenor and Admiral Byrd describe Dr. Poulter's valuable work as second-in-command and senior scientist of the Byrd Antarctic Expedition of 1933-35.

"Specifically speaking, Dr. Poulter himself made some notable contributions to science. In the field of astronomy he made the striking discovery that millions more meteorites hit the earth's atmosphere than was suspected. He was able to make this discovery because of the great clearness of the atmosphere, where there is almost no dust or dirt.

"The meteorite watch was kept very conscientiously throughout the whole winter night, and at times Poulter and his men counted as many as one shooting star a second. This shows that there are many more meteorites shooting through space than we had any idea of.

"Another notable achievement of Dr. Poulter was his work in the field of glaciology. Now, the Antarctic Continent is in the clutches of an ice age such as existed at the top of the world 30,000 years ago, which covered a large part of the United

States with an ice cap hundreds of feet thick.*

"As you know, the Ice Age up north has almost completely receded. Down south it is full-grown and complete, since the whole land is covered with this enormous ice sheet.

"By the use of a seismic sounding apparatus, Dr. Poulter was able to get the thickness of the ice cap of this ice age and to solve the mystery of the great Ross Ice Barrier.

"By exploding dynamite on the snow and getting the time it would take for the echo to return, Poulter was able to get the thickness of the ice. It was this seismic work that did much to solve the greatest remaining geographical riddle. We managed to show by our flights and by proving where

* See, in THE NATIONAL GEOGRAPHIC MAGAZINE, "The Society Honors Byrd Antarctic Expedition," July, 1935, and "Exploring the Ice Age in Antarctica," by Richard Evelyn Byrd, October, 1933.



© Byrd Antarctic Expedition

DR. POULTER'S TRACTOR PARTY ABOUT TO LEAVE LITTLE AMERICA ON THE HEROIC DASH TO SUCCOR ADMIRAL BYRD

At his isolated advance weather base—southernmost and coldest spot ever inhabited by man—the Admiral had become seriously ill from oil stove fumes during his five months' lone vigil. Suspecting his predicament, Dr. Poulter (center), with E. J. Demas (left) and Amory H. Waite, Jr., fought their way 123 miles through the treacherous Antarctic night to their leader's tiny shack.

there was land under the snow, that Antarctica is one great continent, and not two, as many had thought.

"Dr. Poulter many times landed away from base in airplanes and took these soundings. This was the first time in history that there have been obtained accurate data regarding the thickness of the ice of a glacial period.

"It is clear that Dr. Poulter deserves recognition for his notable contributions to science, but I have another and more personal reason for being delighted at any honor that he may receive.

"It was Dr. Poulter, with two assistants, Demas and Waite, who risked his life to come out to me during my lonely vigil,

when I became so grievously ill from the carbon monoxide poisoning from my faulty oil stove. The crevasses, the pressure ridges, the darkness, and the cold made this a very hazardous journey. For this he has my deep and enduring gratitude.

"Four of us were jammed together in that little two-by-four shack under the snow for two months, when the temperature at times got lower than 70° below zero.

"Under those conditions you get to know a man—to take his measure—and I want to tell you that he stood the test in every sense of the word. He would always stand every test. He has stuck by his leader through thick and thin. He made a great second-in-command and senior scientist."

Notice of change of address of your NATIONAL GEOGRAPHIC MAGAZINE should be received in the offices of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your September number, The Society should be notified of your new address not later than August first.

ADVENTURES WITH BIRDS OF PREY

BY FRANK AND JOHN CRAIGHEAD

With Illustrations from Photographs by the Authors

FALCONRY—taming, training, and flying the most spirited and courageous birds alive! It seemed almost supernatural to us, a feat accomplished in ages long past but surely impossible for modern boys.

Then one day, in an old NATIONAL GEOGRAPHIC MAGAZINE, we came across an article on falconry by that great artist-naturalist, Fuertes.* Soon afterwards, we saw a trained hawk owned by a resident of our home city, Washington, D. C. So falconry wasn't impossible after all! We decided we would give it a try.

With THE GEOGRAPHIC as a starter, we began reading up on falconry, and with the coming of spring, the time for getting hawks, we had a fair theoretical knowledge of the subject.

PIERCE COOPER'S HAWK IS HARDEST TO TRAIN

Judging from descriptions of European hawks, our American Cooper's hawk would be the best bird for hunting in the mixed woods and open country of the eastern United States. The books, however, failed to mention the fact that, of all the birds used in falconry, the short-winged hawks, such as the Cooper's, are by far the hardest to train (pages 110 and 112).

Unknowing and consequently undismayed, we were starting at the age of 14 on the most difficult task of falconry, training the fiercest of the short-winged hawks.

Up along the Potomac River, not far from Washington, we finally found what we sought—a pair of Cooper's hawks, hunting. These birds are about the size of a crow, with short wings and long tail. They are not falcons, and they differ decidedly from those long-winged, high-flying birds. Instead of depending upon endurance and speed of flight, they hunt low through the bushes, catching their prey by a stealthy approach and sudden, lightning-like dash. These tactics are effective, and the birds are highly efficient hunters.

On the rare occasions when they fly up above the trees, they flap three or four

times and then glide. This they were doing when we sighted them.

At once we began to look around for possible nesting sites. There were several old crows' nests in the vicinity, clearly visible through the leafless branches of early spring. With a pair of telephone line-man's spurs which had been given to us, we began climbing the various likely-looking trees and peering into the nests.

This, we found, was an ambitious program, as climbing with spurs is hard, tiring work until you get the knack of it. The novice hugs the trunk so hard he is worn out before he gets up twenty feet; he feels that the spurs will not hold. Confidence comes with experience.

At last, after clambering up four or five tall, straight trunks, we found four pale bluish eggs with very faint brown splotches lying in an abandoned crow's nest high in a pin oak tree, overlooking the wooded valley. We let them alone, of course, and climbed down. The parent birds now were nowhere in sight.

During our trips to the nest on subsequent week ends, the old birds never showed themselves. Unlike some other kinds of hawks and falcons, which circle around, hawl you out loudly, or even dive at your head, the Cooper's hawk will not often visit its nest if a human being is near it. If it is on the eggs or feeding its young, it sneaks off, unnoticed, before you can get close.

BABY HAWKS GET A NEW HOME

For some four weeks we watched and waited until the young birds were about ready to leave the nest. In fact, when we climbed up and peeked at them, they fluttered out of it and down to the ground.

Carefully picking up all four, we put them in a basket and carried them home. Cooper's hawks are not noisy birds, and, although they showed plenty of footwork, they made no loud disturbance. Young duck hawks would have been raising the roof.

Two of the birds we gave to some other boys who had been going out to the nest with us. The two females we kept. Among hawks the female is "deadlier than the

* See "Falconry, the Sport of Kings," by Louis Agassiz Fuertes, in THE NATIONAL GEOGRAPHIC MAGAZINE, December, 1920.



PIERCE YELLOW EYES GLARE AT HUMAN INTRUDERS

The young Cooper's hawks: a male (left) with his somewhat larger sister, have just left the nest, though their tail feathers are not yet half grown. These birds often fly for some time before they are fully feathered, and seem to develop more strength than do many other species at the same age. The two shown challenging the camera were caught and trained by the Craighead boys.

male"—bigger, stronger, more spirited, and hence far better adapted for use in falconry.

Comfortably established in a cloth-canopied basket, first under the stove and later in the cellar, our two little hawks devoted themselves to the business of eating and growing feathers. By the time they began to jump up on the edge of the basket and act restless, we knew they were almost ready to train.

It is important not to begin training too soon, however. The first step is teaching the bird to come to the hand for food, and it is necessary that the hawk be hungry—

not starved, of course, but possessed of a good, healthy appetite. If training is started before the feathers are all grown out, "hunger streaks" will appear in the plumage and the bird's flying ability will be impaired.

Our hawks were well fed on beef and liver, with finely ground greenbone to keep them from getting rickets, and an occasional mouse, starling, or sparrow.

TRAINER MUST AVOID SCARING THE BIRDS

About three weeks after we had brought our birds home we were able to begin their actual training. The first step was to fasten to the legs the leather straps, about six inches long, called jesses; to these a leash was attached (page 114). It is im-

portant not to scare the hawks by any abrupt movement, as they may become chronically timid and nervous.

We spent more time training those first hawks than we gave to half a dozen later ones. We carried the fierce, untamed birds on our gloves for several hours each day, then took them out again after dark, when they perched more quietly on our wrists.

Teaching the birds to come to the hand for food was the next step. Standing a few feet from the perching hawk, one of us would hold out his gloved hand with a piece of meat on it and whistle for the bird

to jump or to fly to its food.

Plenty of patience was needed as we waited from five to ten minutes at a time for these nervous Cooper's hawks to come to us, and we flew them half a dozen times to a feeding. Each day the distance was slowly increased until they would come a hundred yards to our fists.

A good deal of this work was unnecessary, but we were inexperienced and could only guess when our birds were sufficiently trained. For two months we flew them to our fists on long strings before finally turning them loose with considerable apprehension.

Now, after six years of experience with hawks, we fly our birds loose after a week of training at the most. Moreover, we do not worry whether they will return to our outstretched hand. We know they will.

We can still recall vividly turning our first hawks loose—the birds skimming along the ground, then rising, up, up, to the topmost branches of a pin oak tree.

TRAINED AT LAST!

They ignored us while taking account of their surroundings, and then tested their wings with a few short flights directly away from us. Were we really going to lose our hawks after months spent in patient training? Of course not. It was the way of all



DROPPING IN ON DUCK HAWKS

Lowering himself down the jagged cliff on the large rope, husky John Craighead has a smaller one tied around his waist and legs. This "life line" enables him to rest and acts as a safeguard should the climbing rope become frayed on the sharp edges or a falling rock knock him out. On this 300-foot precipice in northern Pennsylvania the authors found a nest with four young hawks (page 123).

hawks on being released for the first time, though we did not realize it then. They were just seeing how it felt to be free.

After nearly an hour, sure enough, hunger and habit brought them back. They were flown on a string for two days before we again gathered courage to release them. It is well to fly them free for at least a week before flying them at game, so that they can grow strong and learn to handle themselves.

Our great triumph came when our hawks caught their first wild quarry, for from that time on we could consider ourselves falcon-



ONLY THREE WEEKS OLD, COOPER'S HAWKS ALREADY "FEEL THEIR OATS"

Of all the birds trained by the Craigheads, these fierce and aggressive hawks were the most difficult to handle (page 109). With a week's growth of feathers, the young on this nest in Virginia, near Washington, D. C., are able to flutter from limb to limb and will soon be flying from tree to tree.

ers. Incidentally, in hunting with falcons, the game has a lot more than a fifty-fifty chance; probably nearer eighty-twenty.

A PIGEON FOOLS A HAWK

The first time one of our hawks flew at game she was fooled completely. Her keen eyes sighted a flock of pigeons in a wheat stubble field, and she headed for the spot at top speed. Seeing their danger, the pigeons were off, "every man for himself." The hawk went for the one that had been the last to take the air.

The pigeon, with at least a hundred yards start, flew straight for a barn. With the hawk in pursuit, he whizzed through one door and out another on the opposite

side. There the wily old bird banked sharply, flew around the barn, went in the first door and hid up among the rafters.

The inexperienced hawk was utterly baffled. She had lost the pigeon when it made the turn. She flew to the edge of the barn and perched there, as if too ashamed to come down. Finally she did return, and thereafter she gave a much better account of herself, turning out to be a far more effective hunter than her sister. We named her "Comet."

COMET LIKED RABBIT HUNTING

Hawks, we found, vary individually as much as people. Some are lacking in spirit, puny, slow. Some are much faster than



"COME ANY CLOSER AND YOU'LL FEEL MY CLAWS!"

If the photographers had approached a few more steps, the young barn owl would have flipped back on his tail so he could use his needle-sharp talons for defense, kicking his feet in the air like a spoiled child. When tamed, these birds make attractive pets and have even been trained to hunt (page 124). The Craighheads had one which they named "Windy" because of his hissing.



KEEN-EYED PRAIRIE FALCONS, EAGER TO LEAVE THE NEST

Though able to fly, they were so far above the ground in their cliffside home in Wyoming that they were afraid to take off, even when the authors climbed down to the eyrie. The Craighheads found that this bird, when trained, was not so fast as the duck hawk, but seemed shiftier on the wing.



LASHING THE AIR WITH POWERFUL WINGS, ULYSSES TAKES OFF ON A HUNT

Dangling from his legs are the jesses, six-inch leather straps, which have just been disengaged from the leash in Frank Craighhead's hand. Though free to fly where he pleases, the trained duck hawk always returns to his master. Ulysses has been a favorite of the authors for nearly four years (pages 116 and 117). Usually they let their hawks return to the wild after one season of hunting.

others; they are just born faster, or else they try harder. Such an exceptionally able hawk was Comet.

Rabbit hunting was her favorite sport. Often, as we tramped along through the brush with Comet on our glove, her remarkable eyes would spot a rabbit wholly invisible to us and she would be off. At first, in her eagerness to make a kill, she would swoop at her prey even in thick undergrowth, hitting the bushes a terrific blow and damaging her feathers. Later she learned the trick of following her quarry until it reached a clearing.

Flying from tree to tree, Comet followed one rabbit in this way for more than half a mile and at last struck it in a small, open

space. But Mr. Cottontail was wise and quick. He dived through a narrow crotch in a small locust tree, leaving his attacker tightly wedged there.

Sometimes, when shaken off, the hawk would catch up to a rabbit on foot, her long, powerful legs enabling her to make surprising speed. Once the rabbit ducked under a wire fence. The hawk, hotly pursuing, hit the wire and all but knocked herself out. Another time she chased a rabbit halfway down a groundhog burrow.

Since a full-grown rabbit weighs three times as much as a Cooper's hawk and can kick out vigorously with all fours or plunge into a brier patch, Comet took plenty of punishment even when she made a direct hit



"WHAT'S GOING ON DOWN THERE?" WONDERS THE MOTHER BROAD-WINGED HAWK

Her sharp eyes have noticed a movement in the blind at the foot of the tree. From there the camera, fastened to a limb near the nest, was operated by a string. The Craigheds did not capture the two fluffy nestlings, photographed near Washington, D. C., because they had learned from experience that broad-winged hawks are not fast and fierce enough to train as hunters.

from the air. Before long, all of her tail feathers were broken so badly that it was hard for her to fly and almost impossible to make quick stops or turns.

GIVING COMET NEW TAILS

The only thing to do was to give the bird a new tail. As we had no Cooper's hawk tail feathers, we "imped in" those of a male marsh hawk by inserting small needles in the old stubs, fitting them into the new quills, and putting glue on the junction.

This improvised tail worked well until it went the way of the original one. A crow's tail was used next and then the soft, flexible tail of a barred owl, which proved most satisfactory because it would

bend without breaking, but it made poor Comet look like no bird the world has ever seen.

Since that first year, we have procured and trained for falconry some ten species of hawks. Some, because they were slow and sluggish in flight or had very little intelligence, we found to be of no use. Others were swift and courageous, intelligent and keen.

On the honor roll we would put the duck hawk, prairie falcon, Cooper's hawk, goshawk, pigeon hawk, sharp-shinned hawk, and even the little sparrow hawk.

At the foot of the class are the red-shouldered, broad-winged, and red-tailed hawks. These are soaring hawks, compara-



CYCLONE, TRAINED PRAIRIE FALCON, CLUTCHES THE LURE

To call him back from a flight, the trainer swings in the air a padded horseshoe with meat attached. Cyclone's ferocity in striking this lure suggested his name. Sometimes he knocks it several feet along the ground. The trainer then picks up the bird, whose talons grasp the torn padding of the horseshoe.

tively sluggish in flight, and they rarely hunt anything but rats, frogs, and snakes. Even these hawks can be trained, however, and we have found that owls, as well as hawks, can be taught to do man's bidding (pages 113 and 124).

A FEATHERED THUNDERBOLT STRIKES

Of all the hawks we have trained, the duck hawk remains our favorite. One of the best stoops or dives we have ever seen a trained bird make was shown us by Ulysses, one of our duck hawks, when chasing a crow (pages 114 and 117).

In flying our falcons we usually put two or

more birds in the air at once. They circle above our heads anywhere from a hundred to several thousand feet and then drop on their quarry as it passes beneath them.

Ulysses had been soaring for almost an hour and was barely perceptible to the human eye. But he could easily distinguish the crow that came flying past, three or four hundred feet above us.

For a few seconds we thought the crow was going to pass unmolested, but when Old Corvie was in the exact center of the field, and farthest from cover, Ulysses banked and started down, dropping earthward in a perpendicular dive. As he gathered momentum he pumped his wings in a few short, powerful

strokes that seemed to double his already terrific speed.

He dropped so fast that from directly beneath him it looked as if a speck had suddenly expanded into a large, hurtling wedge of streamlined feathers. His feet were back against his tail, which was closed; his wings were half closed to his sides; his beak cut the air, and his eyes seemed to blaze straight ahead at the seemingly motionless crow.

The whistling and whining sound of the diving hawk's wing feathers warned the crow, and he turned over to head for the safety of the ground. But so great was the

speed of the falcon that before the crow had completed this maneuver the pursuer had struck and zoomed above his quarry, ready for another attack if necessary.

There was no need of a second stoop, for the impact of the direct hit had sprayed crow feathers in every direction. They drifted down in zigzag circles behind the falling crow. Before the last had reached the ground Ulysses was standing beside his fallen quarry.

SOME HAWK PERSONALITIES

We called this hawk "Ulysses" because of his habit of wandering a long way off.

A prairie falcon captured in Wyoming was named "Cyclone" because he hit so hard. He usually hurt himself when he struck the lure, the heavy padded horseshoe with a piece of meat attached which is swung around to call the big falcons back after they have been hunting (opposite page).

Another memorable bird was Bad Boy, a male sparrow hawk, so named because when small he had a way of getting out of his box and then digging his talons into our hands when we tried to put him back. He became so tame that he lived in the house with us like a dog and in fact became great friends with Spike, the family hound.

On his favorite perch on the dining room door he would catch small pieces of meat tossed to him, shooting out his claws at



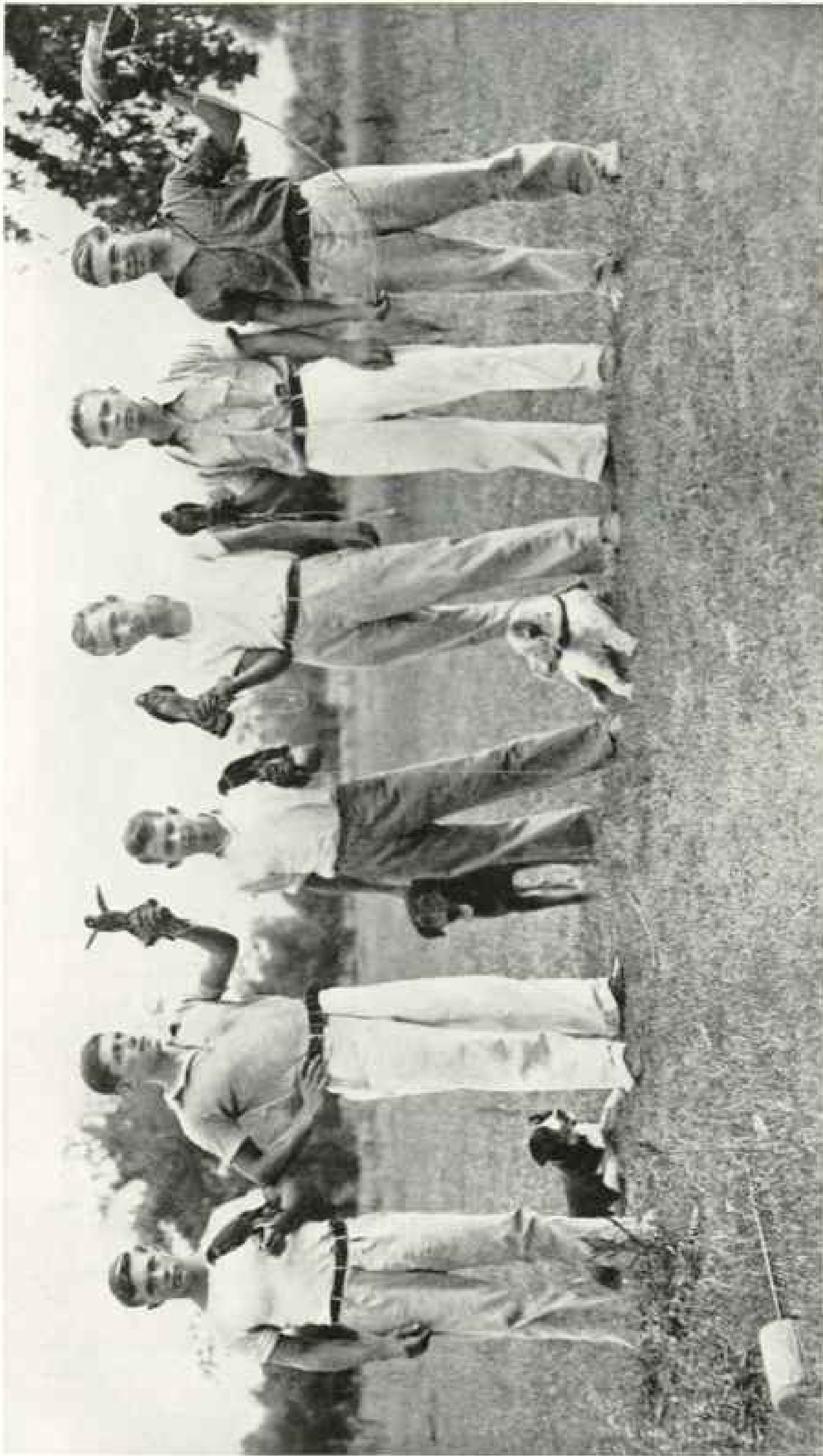
A WINGED THUNDERBOLT PERCHES ON HIS TRAINER'S HAND

Ulysses, so named because of his propensity for wandering, is the duck hawk whose swift attack on a crow is described on the opposite page. This is an American counterpart of the noble falcon of Europe's age of chivalry. Technically, only the female is called a falcon; the male is termed a tiercel.

just the right instant or flying off to snag them in the air.

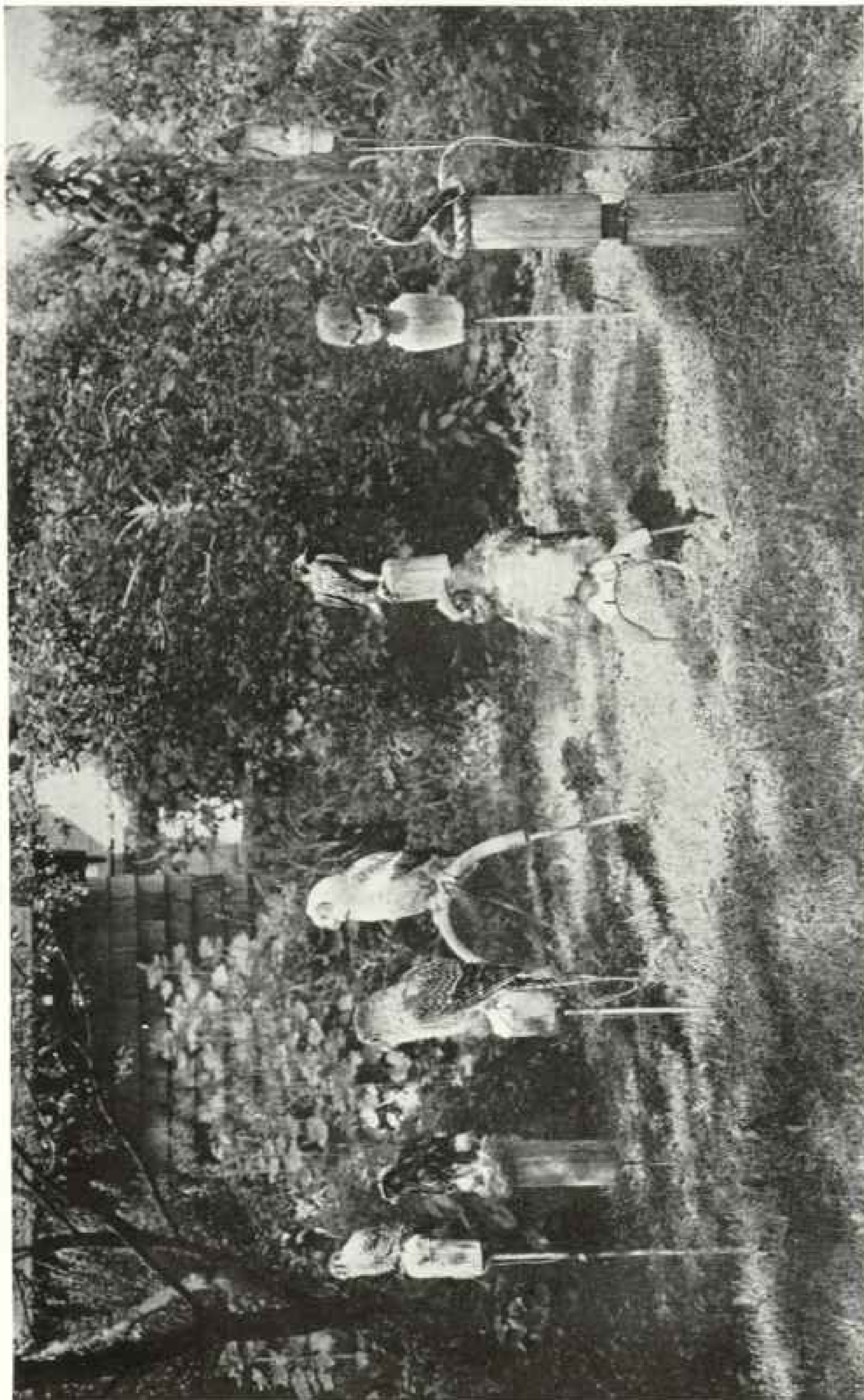
One day, when hungry, he made a murderous dive at a neighbor's pet canary, stunning himself against the unseen glass window and scaring the poor bird almost to death.

Sometimes one hawk will attack another. Once Comet, perched in a maple tree, launched herself at a male Cooper's hawk which one of our friends was carrying on his fist. A quick yell saved the hawk's life. The boy whirled just in time—and Comet's talons ripped a long rent in the back of his sweater.



YOUNG AMERICA TAKES UP THE ANCIENT SPORT OF FALCONRY—TAMING AND FLYING THE MOST SPIRITED BIRDS ALIVE

In Washington, D. C., as in other parts of the country, interest in hawking has grown rapidly in recent years (p. 120). This group of falconers of the Nation's Capital comprises (left to right) Frank Craighead, with a trained pigeon hawk; Chestin Eshleman with a sparrow hawk; Morgan Berthrong with a pigeon hawk; Larry Huffy with a Cooper's hawk; Robert Stevenson with a pigeon hawk; and John Craighead with a fierce duck hawk. Except the pigeon hawks, all the birds were found at nests within a few miles of the White House. The falcons are friendly with the dogs, which help scare up quarry in the field. In the left foreground is a perch on which a hawk is placed when not being flown.



BIRDS OF A DIFFERENT FEATHER FLOCK TOGETHER AT THE AUTHORS' HOME IN WASHINGTON, D. C.

Nine birds of prey, captured by the Craighead boys and their friends, perch together peaceably enough so long as they are kept apart. When hungry, the larger ones would attack the smaller if allowed within reach. The backyard aviary includes, left to right: a sparrow hawk, young female duck hawk, barred owl, two great horned owls (on arched perches), old male duck hawk, another sparrow hawk, and a screech owl. All the birds are trained in falconry except the two young duck hawks.



LEARNING TO FLY, YOUNG SPARROW HAWKS ARE FEARFUL OF THE TAKE-OFF

Not yet old enough to hunt, these residents of Jackson Hole, Wyoming, are fed grasshoppers by their parents. By eating caterpillars, beetles, spiders, and other insects, as well as mice, this smallest of North American hawks benefits farmers. One, owned by the authors, was named "Bad Boy" (p. 117).

For a number of years now a small group of boys has been practicing falconry in Washington, D. C. We catch, train, and fly our hawks together. We use the old falconers' terms, and train our hawks much as they did, but we do not employ the same kind of equipment nor hunt the same kind of game. We fly our small hawks at English sparrows instead of larks. Our large falcons we fly at starlings instead of grouse, and at crows instead of rooks or herons (page 118).

Falconry in this country is by no means confined to Washington. It is being practiced by enthusiastic followers in all parts of the United States and is rapidly gaining favor. We falconers receive numerous let-

ters from all parts of the country asking us how to train a hawk and where we get our birds.

PHOTOGRAPHING HAWK AND RAVEN HOME LIFE

One spring, a very good ornithologist friend of ours, Mr. Richard Rauch, of Harrisburg, Pennsylvania, gave us some valuable pointers in cliff climbing and told us of a cliff in northern Pennsylvania where a duck hawk and raven nested close together. We were especially anxious to photograph an old raven, because we could find no record of this having been done.

On April 24, with provisions for several days, we arrived at the cliff. Inside of



HALF ANGRY, HALF SCARED, IS THIS MONTH-OLD RED-SHOULDERED HAWK

The Craigheads caught and trained one of these birds, but found that it was too sluggish in flight to be desirable for falconry. When hunting, red-shouldered hawks perch on a dead tree or other convenient lookout post, or soar in wide circles while watching for prey.

three-quarters of an hour we located both the ravens' and the duck hawks' nests within seventy-five yards of each other.

The falcon was sitting close, incubating her eggs, and did not fly until the loose end of our rope dangled in front of her. She then left her eggs with a startled cry and dived at us as we hurried down the rope. Her screaming and diving only served to guide us to her four mahogany-colored eggs.

We left the hawk to return to the eggs while we hunted the north face of the cliff for the ravens' nest. We found several old nests before locating the one containing four scrawny, bedraggled-looking young that seemed to be all mouth and voice. The wise old ravens had slunk off and did

not give their nest away by futile diving and screaming, as did the bolder duck hawks.

In photographing birds, we have found it pays to gain their confidence step by step, so instead of immediately building a blind near the ravens' nest we roped our cameras on the cliff near by, camouflaged them with stones and moss, and arranged to snap the shutter by means of a string running to a blind at the foot of the cliff.

The northern raven of the Eastern States is one of the shyest, rarest, and smartest of birds, so it was with a great deal of foreboding and doubt that we entered our blind to await the arrival of the old raven.

The damp cold numbed our cramped limbs and the minutes dragged away like



A GREAT HORNED OWL HIDES FROM ITS ENEMY, THE CROW

On its first flight from the nest, the young bird has taken refuge in the hollow of a gnarled black oak, in Virginia. Owls and crows seem to be natural enemies, like cats and dogs. A good way to hunt owls is to listen for the hubbub of rasping caws that crows make when teasing a victim.

hours. At last, after a three-hour wait, the raven returned and we snapped the shutter of the concealed camera. We thought of our discomfort no longer in the realization that we had a picture of an old raven, the bird that we had been told would test the skill of any nature photographer.

However, we knew that getting good pictures in this way would be largely a matter of luck. An outcrop of rock almost completely hid the nest, and we could tell when the ravens returned only by the gurgling sound of the young ones being fed. Our chances of pulling the string at the right time were very slim.

On our second trip to the ravens' nest we decided to leave no more pictures to chance. Hoping the birds had become accustomed to us, we built a blind about seven feet from the nest. There we succeeded in taking both movies and stills. It seemed as if we could almost reach out and touch the old raven as she regurgitated food to the young (p. 129).

HOW RAVEN FENDS OFF HAWK

The raven is not only smart but courageous. When we disturbed the duck hawks they would vent their anger on the poor ravens. Instead of turning tail as most birds do when a duck hawk stoops, the raven would wait until the hawk was about to strike, then turn

over on its back and thrust its feet straight up into the face of the speeding duck hawk.

It is hard to say whether the duck hawk was afraid to hit the raven or merely wished to frighten it. At all events we never saw the hawks strike while the ravens were in the air, although they often raked feathers out of the backs of the big black birds while the latter were perched in a tree.

While we were putting up our cameras near the nests the ravens would fly from tree to tree, tearing bark off dead limbs and breaking twigs and buds with their strong beaks in such a frenzy of rage that it seemed as if they would like to tear down the whole

mountainside. The female duck hawk on the other side of the cliff screamed and circled above us, giving an occasional backward glance over her shoulder to see if her eggs were unharmed.

If she did not return quickly after our departure, the male would drop from the sky hundreds of feet above the cliff and force the female back to her nest by a series of lightning stoops. Every time the female flew away from the cliff, the tiercel would head her off and drive her back.

Finally she would return, subdued, to incubate her eggs, while the raven, near by, hastily fed her young, both unaware that their family life was being recorded by the big bright camera eye that had frightened them so much.

After frequent visits, we saw the young ravens safely out of the nest and on the wing, but fate decreed that the young duck hawks then forming in the egg were never to feel the swish of air on their streamlined bodies. We climbed the cliff one day to find that some predatory animal, probably following our trail across the cliff, had eaten and destroyed the eggs of this monarch of the skies.

We were disappointed that we couldn't get our pictures, but it was worse to know that four young duck hawks, of which there are already too few, would never hunt over those valleys and mountains.



A HAWK'S-EYE VIEW OF THE PHOTOGRAPHERS' BLIND

The burlap hides a seat built in the top crotch of a leafy tulip tree in Chevy Chase, Maryland. From this blind the authors took motion pictures of red-shouldered hawks (page 121), beside whose nest Frank Craighead stood when he made this photograph of his brother.

We soon located another nest, high on the face of a particularly dangerous cliff overlooking a small town, and with two friends we set out to climb the steep mountainside.

DANGLING IN SPACE

When we finally reached the top of the cliff we were tired and hot, but one look over that perpendicular drop of 300 feet sent our temperatures down a number of degrees. It was like looking straight down the side of the Washington Monument. We were used to climbing cliffs, however, and realized that once over the edge we would



A YOUNG FALCONER TRAINS OWLS AS WELL AS HAWKS

Two great horned owls, eager to be on the wing, are perched on Frank Craighead's gloved fists. The dangling loop is a leash attached to leather jesses fastened to the legs. Using the same methods employed in training hawks for falconry, Frank and his twin brother John trained owls as pets and even taught some of their barn owls to fly at mice. But the short, unspectacular flights of the owls lacked the thrill of the lofty spiraling and swift stooping of the falcons. Besides, owls do their best hunting at night when the trainer's eyes cannot follow them. The birds shown here, a little more than two months old, were captured along the Potomac in Virginia and later were freed in Rock Creek Park, in Washington, D. C.



WITH EXCITED CHIRPS, TWO DOWNY EAGLETS GREET THEIR MOTHER'S RETURN

The young bald eagles know that mealtime is at hand. On the menu is the catfish (lower left) which the majestic parent will tear into small pieces and feed to her little ones. Eaglets are covered with a fluffy, whitish down for two or three weeks before their feathers appear. To photograph this eyrie, the authors had to climb 80 feet up a big sycamore tree on an island in the Potomac near Washington, D. C. (pages 127 and 132). The bald or American eagle, officially designated as an emblem of the United States in 1782, appears on the Nation's seal and on many coins. Benjamin Franklin objected, accusing the eagle of "bad moral character." He nominated a "much more respectable bird," the turkey gobbler!



FIERCE AND ALERT, THIS YOUNG GREAT HORNED OWL SCARED THE AUTHORS' DOG

"She had just left the nest, near Great Falls, Virginia, but was too weak to fly far. We chased her until she perched on a small limb, which she was unable to grip tightly enough to keep upright, and caught her while she was hanging upside down. Placed on the ground, she fluffed out her feathers, snapped her beak, and glared at us with bright yellow eyes. Our dog was sufficiently impressed to do his barking from a safe distance."

lose all fear in the thrill of the climb.

After tying our ropes to a stout tree and getting our camera equipment in readiness for the descent, we argued as to who would go first. As we all wanted the honor of the first climb and the thrill of finding the eyrie, we flipped a coin. I (John) won the flip and went over first (page 111).

Once over the cliff I could not hear a word from above. Morgan Berthrong went over to the far end of the crag, where he could hear my voice, and relayed my instructions to tighten or slacken the rope.

We had overlooked the fact that the cliff was overhung. When dangling on the end of a hundred feet of rope, with the ground two hundred feet below, I found myself ten feet to the left of the nest and fifteen feet away from the cliff. As I hung there in space I wondered if I had not been hasty in taking first chance.

Frank and Morgan were afraid to attempt swinging me for fear of loosening rocks, and they had about decided to haul me up when I solved the problem myself by taking a deep breath, shoving

off a projecting rock, and swinging in a large semicircle which landed my body squarely on the nesting ledge but left my stomach falling in space. Like the parent birds, I had flown to the nest.

The nesting cavity was so small that it barely contained the four half-grown hawks. There was no place to stand, so I signaled and was quickly hauled up by a series of jerks, drops, and bumps.

ONLOOKERS CALL AN AMBULANCE

I explained the difficulty of photographing and we decided instead to bring up two hawks to train. This would be a help to the father of the family, as the female had been shot three days before our arrival and the tiercel was having a difficult time feeding his ravenous brood.

According to the flip, Morgan was second, so over he went. He was busily engaged in putting a screaming, fighting hawk into his knapsack when an ambulance far below came whizzing in to the foot of the cliff. Nervous spectators, on seeing me make the descent, had telephoned for an ambulance,



DOWN COMES JOHN CRAIGHEAD ON A ROPE AFTER PHOTOGRAPHING BALD EAGLES

He spent several hours aloft taking pictures of the birds in their eyrie, 80 feet above the ground in a huge sycamore (page 125). The boys usually climbed the tree with spurs, but in descending it was easier and quicker to tie a rope around the waist and be lowered by friends on the ground. Once, in trying to climb up the rope, Frank nearly fell (p. 132). A true American, the bald eagle ranges north to Alaska and northern Quebec and south to central Mexico. One of these "birds of freedom," named "Miss America," was taken to England and trained in falconry by Captain C. W. R. Knight, who has also flown British and African eagles.



A MOTHER FALCON COCKS A KEEN EYE AT THE LENS AS THE CAMERA CLICKS

Starting to incubate her splotched mahogany-colored eggs, the female duck hawk squats down behind them and slowly shuffles forward, quivering all over to fluff out her feathers so that the warm down next to her body will cover the eggs. This was the first bird of prey photographed by the Craighead brothers in the wild. To focus their camera, the boys had to lie on their stomachs with one foot dangling over the cliff overlooking the Potomac River.

and there it remained, a disturbing element, until we had finished climbing.

Frank insisted on going over to select his hawk and we hoped we were not tempting fate or the rope by letting him go. Nevertheless, the staring spectators and the ambulance worried us. But Frank said, "To heck with them. If we fall, a broom is what they need, not an ambulance."

NO PLACE TO BE CARELESS

Frank was lowered, picked a lively young falcon, and started to climb up, but the hawk had other ideas. She got her head and one foot out of the knapsack and when he tried to shove her back she clamped on

his hand with her talons. While we held him suspended he pried his hand loose and then climbed to the top, much to our relief.

We have found it never pays to be careless or overconfident while undertaking to climb a cliff. Several summers ago, while quite inexperienced in such work, we climbed to the eyrie of a prairie falcon in Wyoming, about fifty miles south of Yellowstone National Park. As we discovered too late, a steel helmet would have been a valuable piece of equipment.*

Frank, who is always lucky on flips,

* See "Week-Ends with the Prairie Falcon," by Frederick Hall Fowler, in *THE NATIONAL GEOGRAPHIC MAGAZINE* for May, 1955.



A RAVEN "GLEE CLUB" SINGS LUSTILY AT MEALTIME

The three hungry young birds, their mouths agape, wait impatiently while their wary mother and her mate (right) make sure that the camera is harmless. Carrion and other food, swallowed and partly digested by the old bird, is regurgitated to the young, which are fed in this way until they are able to fly. The nest is made of large sticks and lined with horsehair, taken probably from dead animals on which the ravens have fed (page 120).

climbed over the cliff, while Steve, Julian, and I held tightly to the rope, with our feet braced against a large boulder. In our haste and ignorance, we forgot to remove the loose rocks near the rope. We saw the danger only after a large rock had hit Frank a glancing blow on the leg.

In attempting to remove the rocks, we loosened several others which fell the fifty feet to the ledge before we could utter a warning and then crashed on down the eight-hundred-foot slope. We could not see Frank from the top and we feared to call to see whether he had been struck. We were certainly relieved when we heard a string of cuss words come from the ledge.

We got our pictures and hawks without further mishap and started to pull Frank up, but we loosened so many rocks that we decided to lower him instead. The rope was fifteen feet short, so we threw Frank a piece of clothesline to tie to the lower end. The clothesline broke when Frank was ten feet from the bottom.

This incident taught us that a cliff is no place to practice trial and error methods. Whether photographing from a tree or a cliff, our motto now is: "Try to be careful. It is not likely that you can be careless more than once."

Between trips to the duck hawk and raven eyries we spent our time photograph-



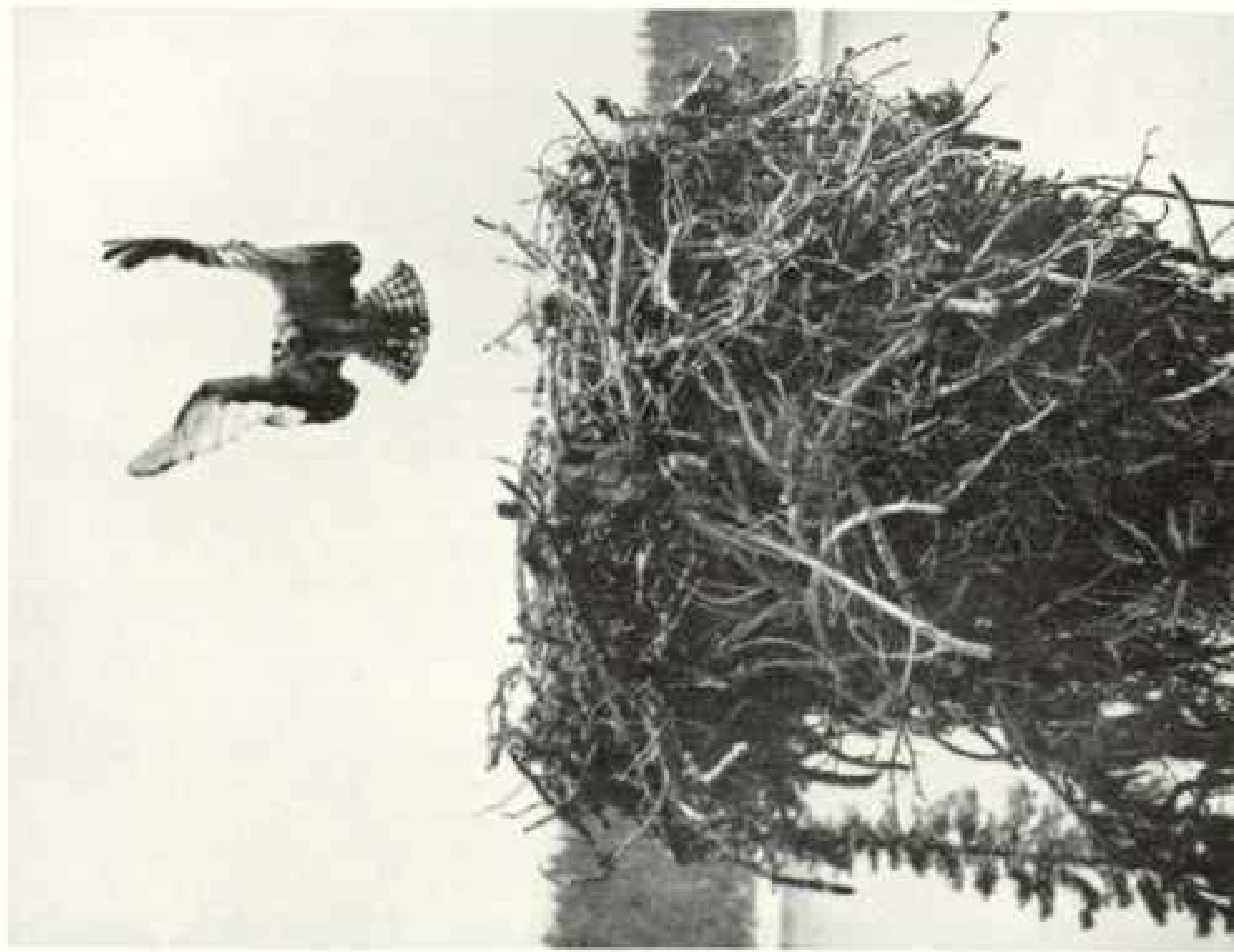
DIRECT HIT! A MOTHER OSPREY STRIKES A CLIMBER ON THE HEAD, ALMOST KNOCKING HIM OUT OF THE TREE.

Luck and a quick hand at the shutter combined to make this striking picture. Swooping down upon Morgan Berthrong's bare head, the furious bird raked furrows across his scalp with her sharp talons. The boys had heard—but apparently *she* never had—that ospreys won't hit a man. Dazed, Morgan could not remember afterward how he had scrambled to the ground. John Craighead, at the nest, leveled his motion-picture camera, while Frank shot the scene from below (page 134).



SETTING UP CAMERAS TO BE OPERATED BY REMOTE CONTROL

Near a pigeon hawk's nest in Minnesota, Frank Craighead fastens a standard-sized motion-picture and two still cameras. The branches were too weak to support a blind, so the photographers concealed themselves on the ground and operated the cameras by pulling strings (page 132).



WINGS AND TAIL CHECK SPEED AS AN OSPREY LANDS

She hurries back to the nest in Yellowstone National Park to protect her two young from the hot sun by spreading her wings over them like a tent. Along the Atlantic coast, ospreys often carry wet seaweed to the nest to keep their little ones cool.

ing a bald eagle that had its nest on an island in a lonely stretch of the Potomac River near Washington (pages 125 and 127).

Although the eagles did not show as much anger at our intrusion as the duck hawks, they were far more difficult to photograph because they returned to the nest only once or twice a day to feed their young. Their nest was 80 feet up in a huge sycamore tree that took almost an hour to climb. To save time we sometimes used a rope instead of spurs.

ALMOST AN ACCIDENT

We had a near calamity when I (Frank) started to climb to the nest to take down our cameras. I had just arrived on the island after a strenuous paddle through a half mile of rapids when I started up the rope.

Ten feet from the limb I began to slow down perceptibly; five feet more and I was almost at a standstill. I was straining every muscle, realizing that I had to make the limb or fall. There was no going down, for it would require more effort to do so than it would take to make the remaining five feet.

My arms were numb and my stomach muscles quivering as I finally got opposite the limb, but still I was by no means safe, for the limb was three feet to one side. I had to throw out my feet and swing myself up over it. My first attempt failed as my feet slipped off the smooth sycamore branch. My arms, now feeling like dead sticks and not a part of my body, slowly straightened out.

For a second I thought how easy it would be to let go, but I did not give this thought time to grow. With a desperate attempt I again swung my legs up against the limb, gave a shove away, and came swinging back onto the branch and safety.

To add to our hardships, the eagle assumed a stubborn attitude and would not return to the nest until nightfall, when it was not practicable to take photographs. Several pictures were finally obtained by waiting all day, sleeping beneath the tall trees at night and waiting until five o'clock the next evening.

HAWKS ATTACK THE CAMERA

We had an interesting time photographing a sharp-shinned hawk. This nervous hundred-yard dasher was the first bird we

had photographed that attacked the camera. Both male and female hit it so hard that we feared they would tear the bellows. Ten feet after taking off from a limb they were going at a terrific speed and they did not slow down a particle when they hit the camera.

The fast, shifty sharp-shin is a wonderful hunter. One morning we found six small birds, all of them fresh and completely de-plumed, lying on the edge of the nest. We have watched the sharp-shin dodge through the thickest brush after its quarry and know it to be one of the most ruthless and expert of all bird killers, yet we found a nest of young whippoorwills directly under the hawks' nest, and, not a hundred feet farther on, a towhee's nest containing four eggs.

These birds that would have been easy prey for the sharp-shin were living in perfect harmony with the hawk.

This was not our first experience with peaceful birds nesting near predators. Almost invariably we found phoebe nests on duck hawk cliffs, and wrens and several starlings were nesting in the lower part of an eagle nest we photographed.

We had our hardest luck with the sparrow hawk and Cooper's hawk. Out of the four sparrow hawk nests we located, the eggs of two were destroyed by animals before we had even begun photographing; a third was taken by an egg collector, and the fourth was impossible to photograph. We especially wanted a picture of an old Cooper's hawk at her nest, but we were unable to locate a nest until too late in the season.

TO CANADA IN QUEST OF THE PIGEON HAWK

When the hawks and owls in the vicinity of Washington had finished their annual nesting, we decided to take a trip to Canada and photograph the pigeon hawk, which is a northern bird and a late nester. With two falconer and photographer friends, camping and camera equipment, and \$35 apiece, we started out in a '28 model car purchased with funds obtained from the sale of our first pictures for publication.

Out of seven nests that we located, some with the help of Frank and Bill Powell, two well-known naturalist guides whom we met at Saganaga Lake, Ontario, we found only one nest suitable for taking still pictures and only one for movies. The ma-



A BIRD IN THE HAND IS WORTH TWO IN THE AIR, THINKS THE FALCON

After an unsuccessful chase, the female pigeon hawk flies back to John Craighead's glove to be consoled with a dead starling. This pugnacious bird of prey was captured by the authors in Minnesota, near the Canadian border. They named her "Lucifer."

majority of the nests were constructed in the topmost branches of swaying evergreen trees, where it was impracticable to put up a camera. The nest we finally decided to photograph was on an island in a Minnesota lake, just this side of the Canadian border (page 131).

The pigeon hawks were very aggressive and dived and screamed at us as we put up our cameras on a near-by tree. The male pigeon hawk, although hardly bigger than a sparrow hawk, hit the opened metal film slide of our camera with his talons, bending it at right angles. The female struck us so often on the head as she flew past us that we ducked unconsciously every few minutes while changing the films in the cameras.

One of our friends was struck on the leg so hard that the hawk drew blood in spite of heavy trousers.

Being very pugnacious, the pigeon hawk returned readily to the nest, even when three cameras were placed six feet away.

The male did the hunting while the female perched near by, ready to protect her young.

The female usually fed the young, so the male had to transfer his prey to her. We saw this done in several ways. On one occasion the male returned with a small bird, transferred it from his feet to his beak, and perched on a spruce limb. The female then flew past and took the bird out of his beak with her feet while flying.

FOOD TRANSFERRED IN THE AIR

At other times both birds would be in the air when the transfer was made. When the male returned with food we heard him call to his mate while he was still invisible to us across the lake. The female, on hearing the call, flew over the lake and the male then dropped the bird from above. The female turned over in the air, caught the bird, and carried it to the nest. At times we saw these same hawks catch

dragonflies in the air and eat them while on the wing.

After getting our still pictures, we started taking movies of a more suitable nest, located on a low, swampy peninsula. Our blind was a brown mosquito netting camouflaged with leaves and branches. It served to hide us from the hawks, but not from the millions of mosquitoes, black flies, and "no-see-ems."

FULL OF MOSQUITO POISON

We camped a whole week in the mosquito-infested swamps near the pigeon hawk nest. We fought mosquitoes all night, only to rise with the sun, enter our blind swarming with insects, and fight them again.

We laugh now to think of those sleepless nights and those hours of misery in the blind, but at the time we were considerably worried over our swollen ears and neck glands. We did not know they were caused by the large amount of mosquito poison injected into our systems. Instead, we visioned a number of terrible diseases.

We had found one place where photography was not fun. Once in the blind, although dressed in heavy clothes, with a mosquito netting over our heads and an insect gun in our hands, we were eaten alive. We sprayed dope, slapped mosquitoes, cursed the whole insect class, and did everything but keep still. The pigeon hawks paid little attention to the slapping and mumbling within, so we got our movies for the Biological Survey and they turned out fine.

HIT ON THE HEAD BY AN OSPREY

Last summer we went to an island off the Eastern Shore of Virginia to photograph the fish hawk, or osprey.

The first nest we picked—a huge affair of sticks—was about forty feet above the ground in a dead pine tree. As we approached, the old ospreys screamed and dived at us, but at first their diving did not excite us, for we had learned that all hawks resent a visit to their homes.

These birds, however, dived so often and came so close that Frank decided to stay on the ground and try to get a picture of the parents swooping at us, while Morgan Berthrong and I (John) climbed up to the nest to take pictures of the young birds.

When I climbed into the nest with the

young ospreys, Morgan crawled out on a dead limb to take a picture. He had his legs wrapped around the limb and was looking through the ground glass of his camera.

I was busy taking movies of the young ospreys when I heard a sudden swishing noise and a dull, solid thud. I looked up and saw Morgan slumped on the limb, with one hand up to his head. He clutched a dead stub, righted himself, and then managed to mumble that the osprey had hit him.

I could hardly believe him at first, although the female hawk had dived at us several times and had come very close, so close, in fact, that I could see her large, scaly feet only a few inches from my face.

With a little help Morgan managed to crawl back down the limb. I saw that his forehead was bleeding. Somehow he got safely to the ground and we examined his wound. Besides two cuts that started on his forehead and ran the length of his head, he had a very large bump and a severe headache that lasted all day.

JUST SAVED HIS EYES

Morgan said he had heard the hawk coming while he was focusing the camera. He dropped the camera and looked up to see the hawk only a foot away. He just had time to turn his face down before the osprey struck. He didn't remember how he got down the tree, but he had seemed to realize that he must not let go, for if he fell it was a long way to the ground.

Frank, who was below when the accident occurred, had taken a picture just as the osprey struck (page 130). Morgan felt much better when he learned that being hit by a fish hawk had brought some reward as well as discomfort, although he resented Frank's enthusiastic remark that it would have made an even better picture if he could have snapped Morgan falling out of the tree.

We went back up to the nest and got our pictures, but we kept a wary eye on the old hawk.

By this time we had assembled quite a bit of material, so we managed to scrape up a little more nerve than it requires to go over a duck hawk cliff, and took our pictures and the story of our observations down to the Editor of THE NATIONAL GEOGRAPHIC MAGAZINE.

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Articles and photographs are desired. For material which The Magazine can use, generous remuneration is made. Contributions should be accompanied by addressed return envelope and postage.

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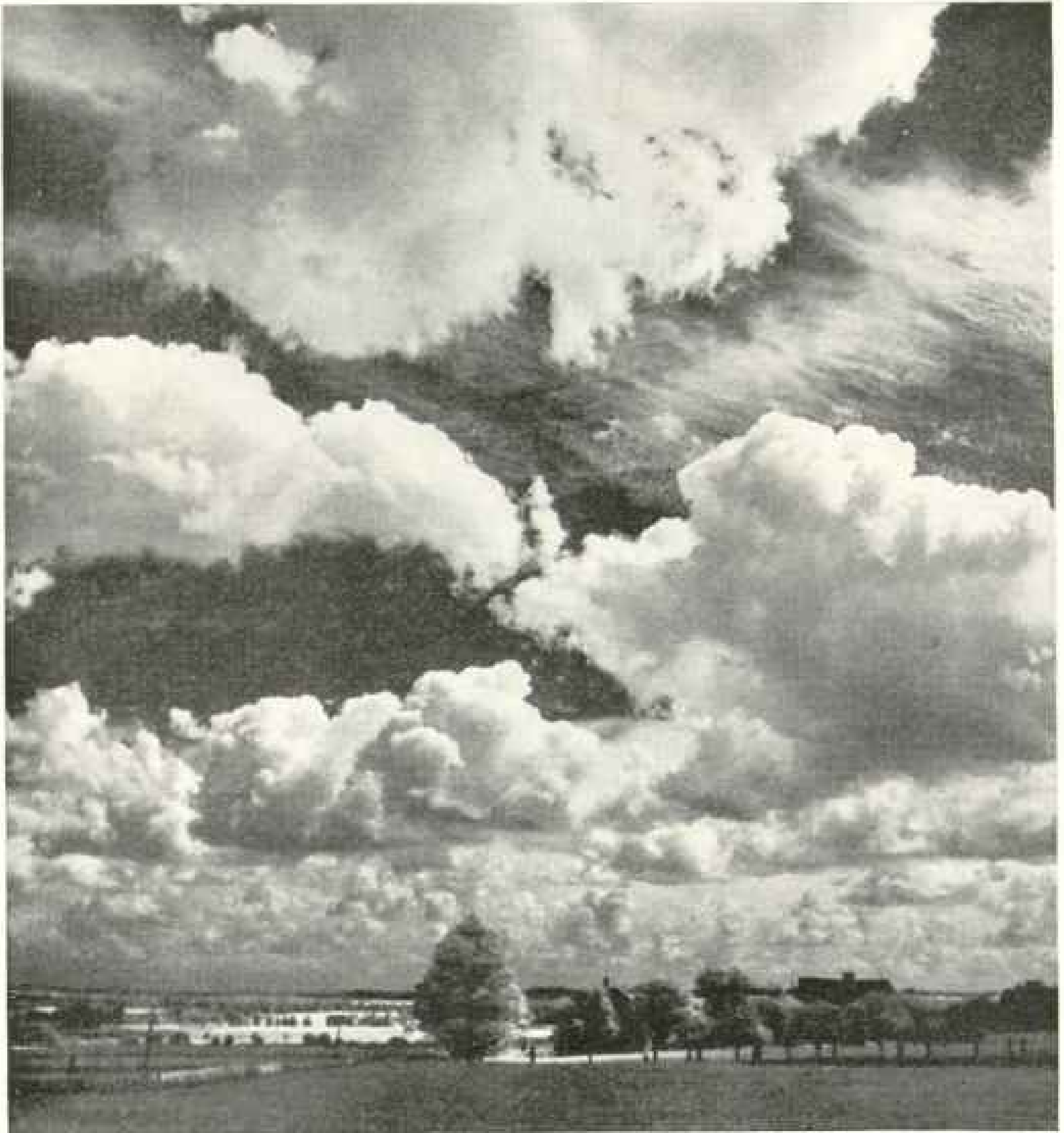
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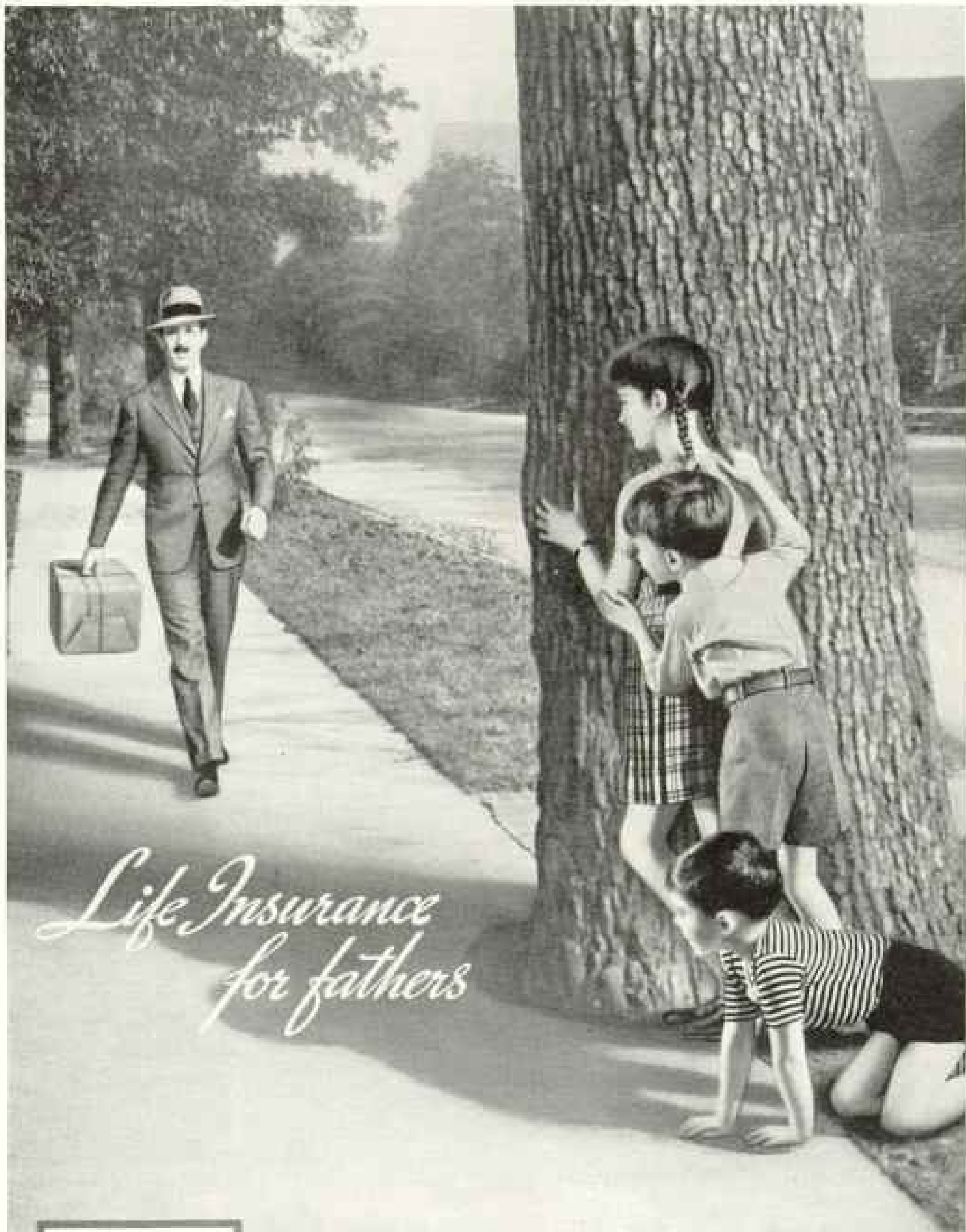


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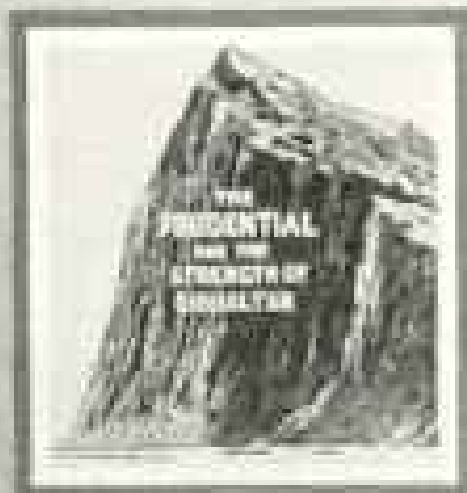
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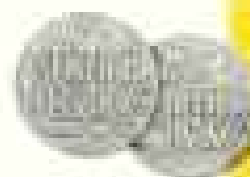
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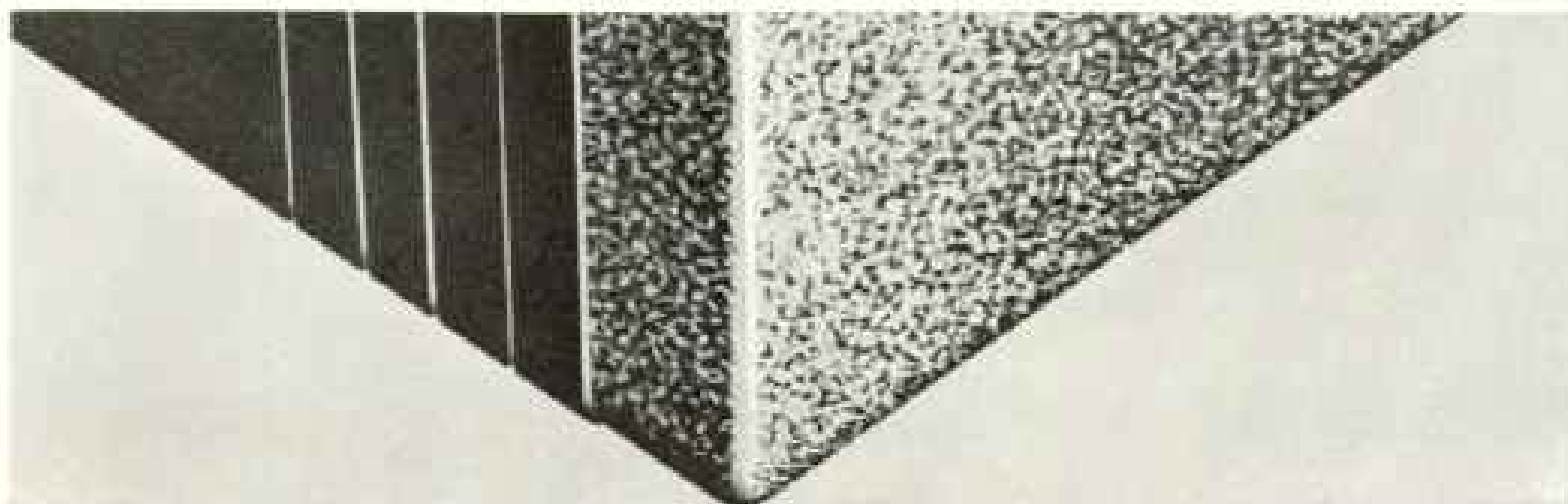


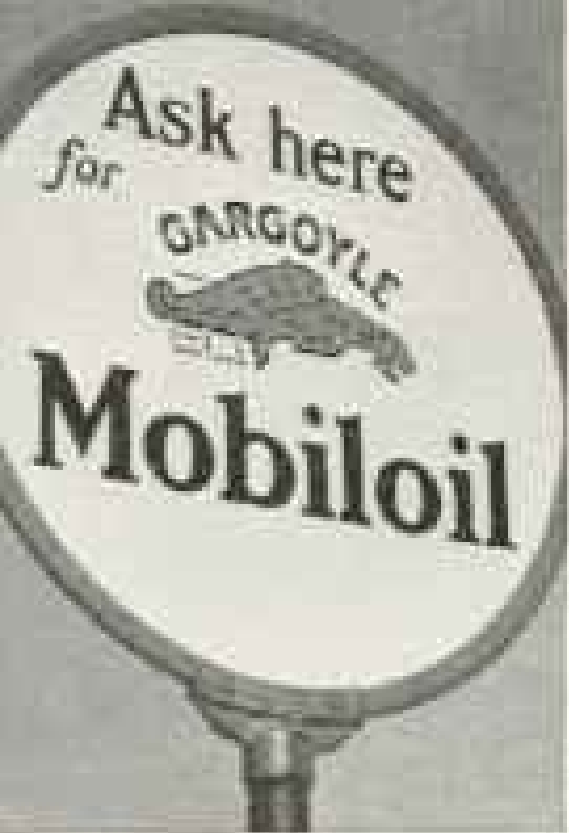
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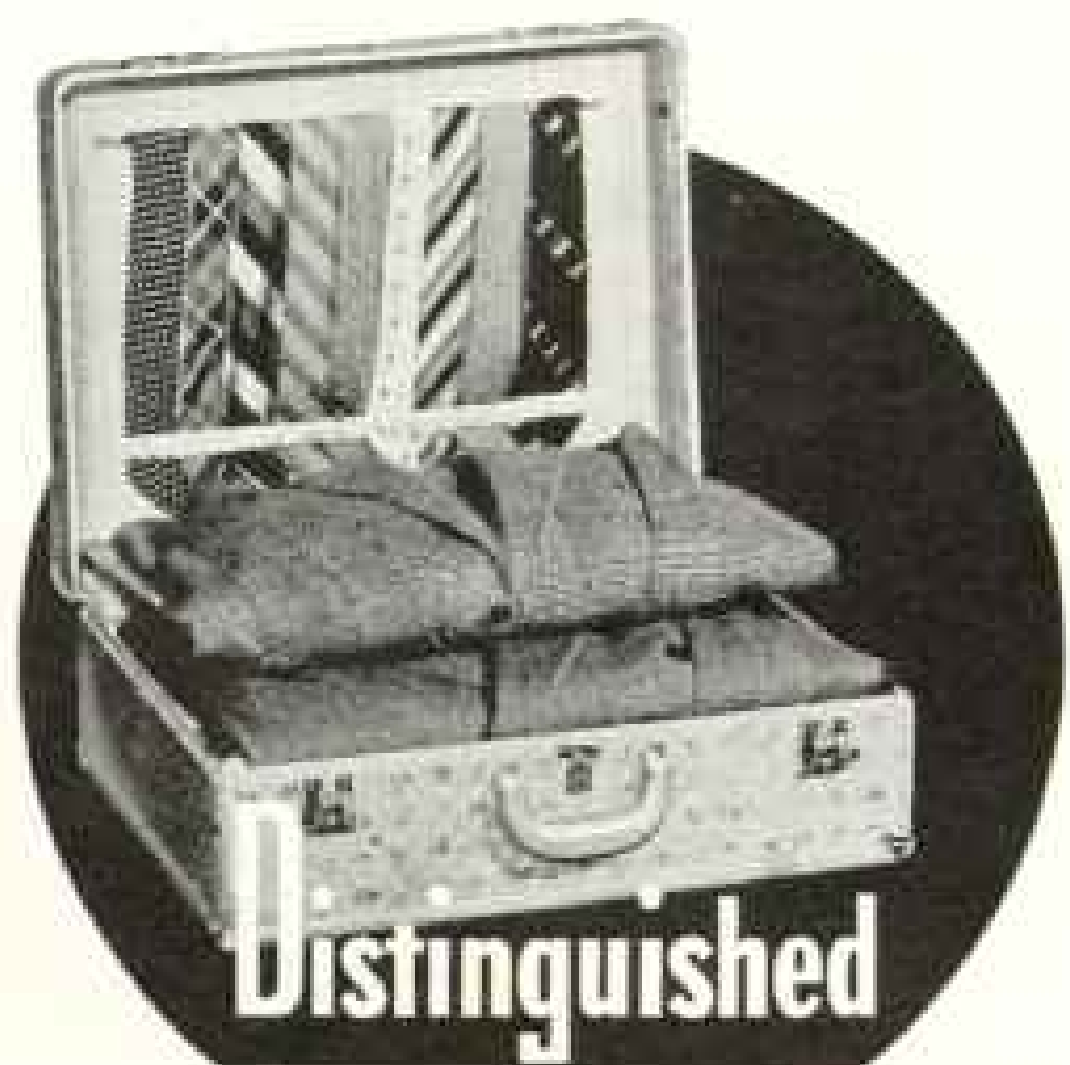
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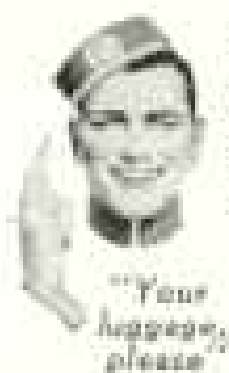
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Sleep and Rest. Older people need more frequent periods of rest. While you sleep or rest, Nature does her best repair work—restoring the energy you have used up.

Food. Eat less as you grow older. Three "square" meals a day, easily digested in earlier years, may not be necessary as time goes on.

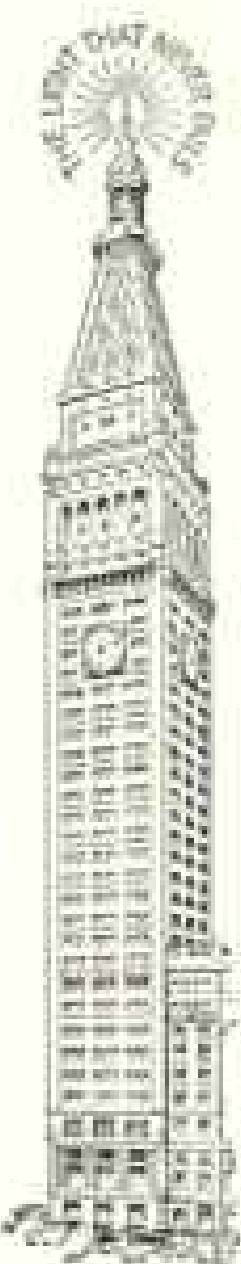
If you eat moderately your meals will probably be just as enjoyable and more healthful.

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It's a *billion dollars less* than it would have been in 1936 if the revenue per ton-mile had stayed the same as it was fifteen years ago.

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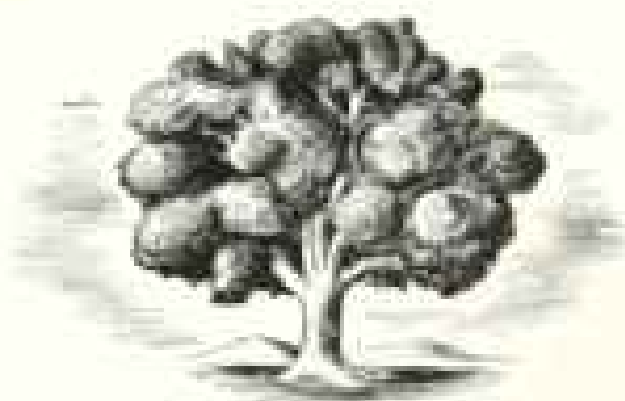
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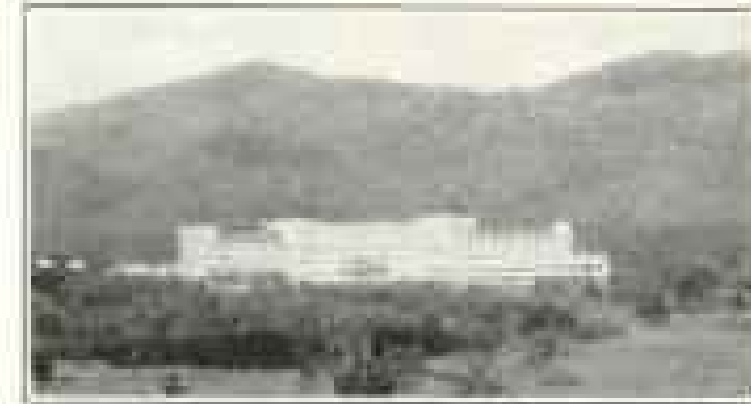
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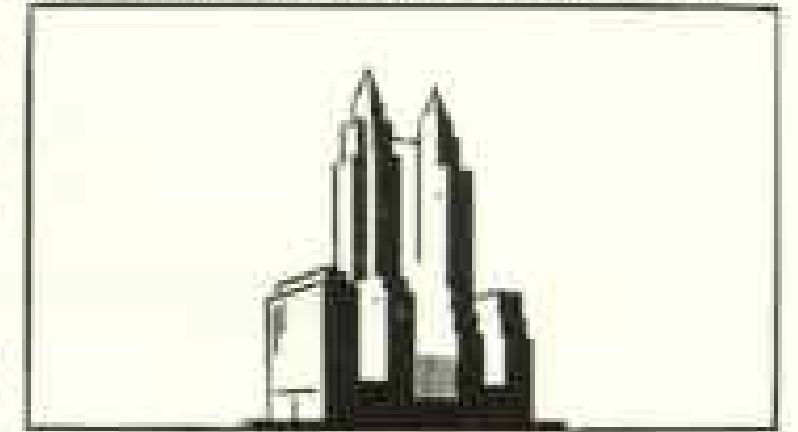
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The successful and profitable use of a metal calls for even more than accurate knowledge of its characteristics.

After the flash of inspiration has suggested a new application; after the engineering calculations comes the sober necessity of *knowing how* to fabricate successfully and profitably.



Know-how is the guide to making things, and know-how is just an accumulation of things-found-out-in-practice. Sharing know-how thus becomes the most practical form of cooperation.

One of the ways to accumulate know-how is to collect facts about successful practices as they crop out. Another way is to develop new products and new methods deliberately.

For years we have set aside a particular part of our factory for what we probably should call a "clinic," but which we actually call our "job shop." It is a place where beginnings of commercial production are started; where products never before made in aluminum are turned out virtually on a handmade basis. Thus the "kinks" common to most new industrial operations are straightened out.

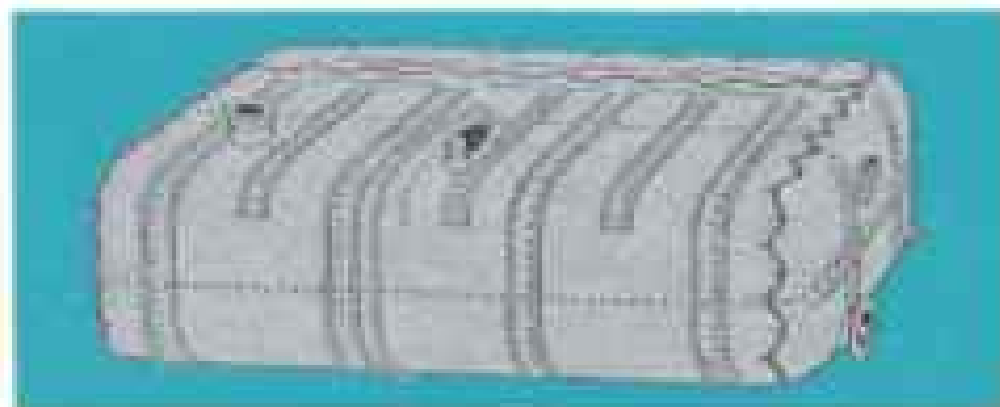
Some of these products are even taken through initial stages of production by making commercial runs, until the technical problems involved have been mastered and sufficient volume developed to make quantity production profitable.

This shop, in effect, functions as the proving ground for fabrication techniques, the theories for which originated in our Research Laboratories. For instance, it was in this "clinic" that the technical problems of manufacturing aluminum chairs, aluminum barrels and aluminum gasoline tanks for aircraft were successfully solved; here that the machinery and methods for spot welding aluminum were developed.



Not only does this shop create a manufacturing procedure, and make it work on a production run, but it refines the process to assure its performance on a profitable basis. Many articles now commonly made in aluminum had their beginnings, either in this shop or in the know-how it has developed.

That know-how is accumulated for the benefit of manufacturers who are thinking in terms of saving weight, improving design or finish, reducing costs, or any one of a dozen



things men look for to improve their product next year or the year after. This is not a spectacular way to improve business, but we have found it a successful way. Sharing know-how is practical cooperation which helps us because it helps our customers.



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