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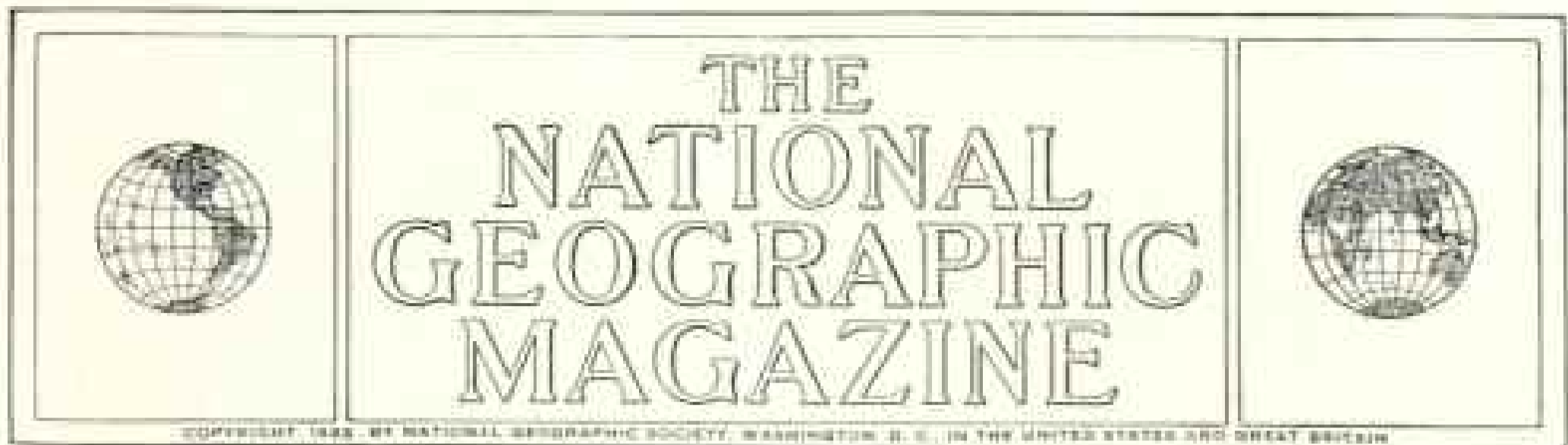
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EXPLORING THE VALLEY OF THE AMAZON IN A HYDROPLANE

Twelve Thousand Miles of Flying Over the World's
Greatest River and Greatest Forest to Chart
the Unknown Parima River from the Sky

BY CAPTAIN ALBERT W. STEVENS, U. S. ARMY AIR SERVICE

With Illustrations from Photographs by the Author

MAN'S conquest over Nature was never more forcefully asserted than when members of the Alexander Hamilton Rice Scientific Expedition recently flew to the headwaters of the Parima River, in northwestern Brazil.

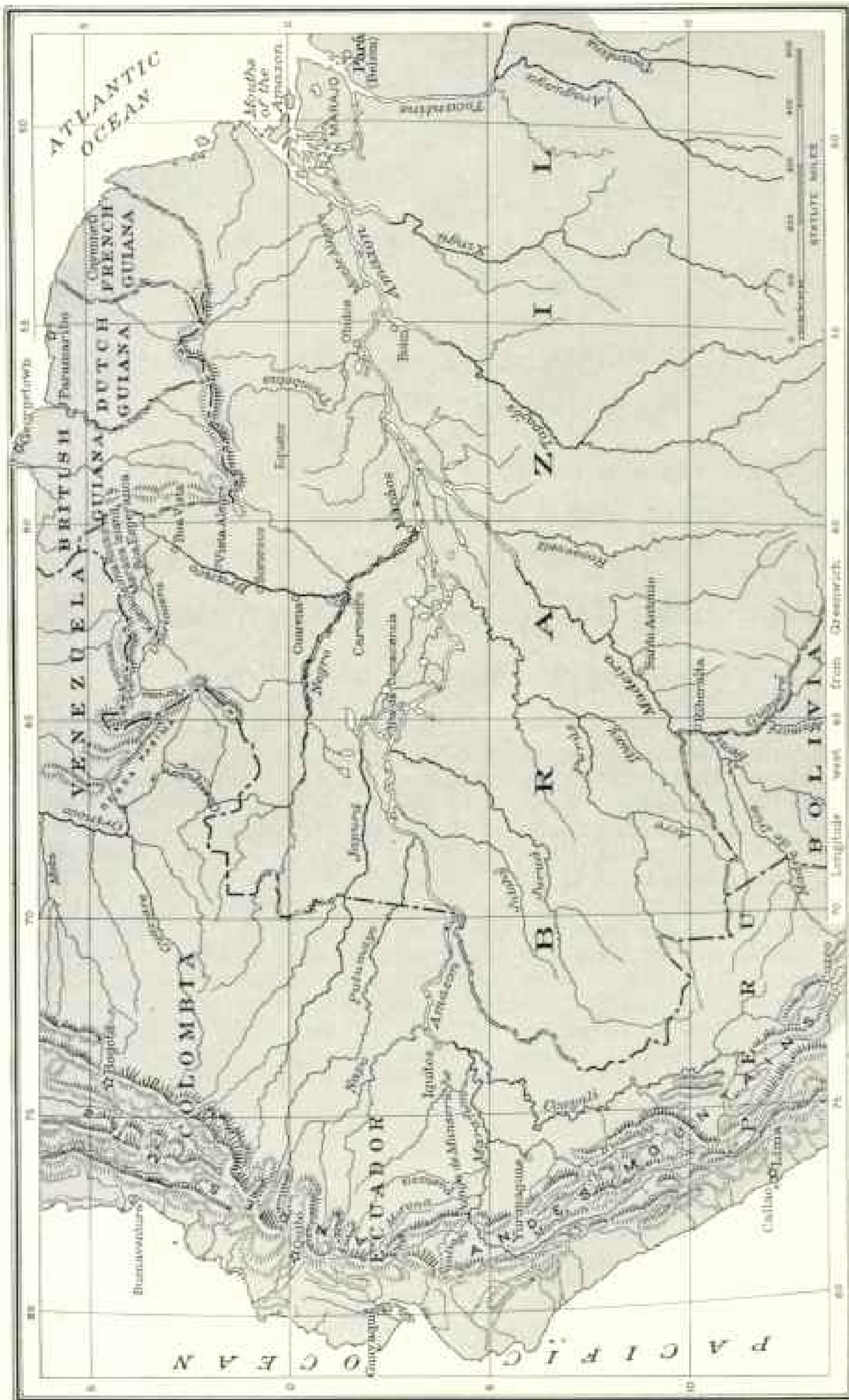
The upper Amazon Basin is one of the last of the world's blind spots to succumb to the persevering curiosity of the explorer. For many years attempts had been made in vain to penetrate the dense jungles which cover it, and to navigate the seething rapids that block its rivers, but the undertaking has now been proved entirely feasible from the air.

Where the untrodden jungle presented a matted and almost impenetrable wall to men on foot, it surrendered its secrets readily to men in the sky. The hostile Indians who had hindered previous expeditions could not obstruct a plane flying 3,000 feet above them, and no ground scout, however skillful, could match an aviator in ferreting out the easiest trails to be followed and forewarning of obstacles to be met and overcome. Our hydroplane served as the eyes of the expedition.

Our party assembled in Manaus, Brazil, on July 6, 1924, and consisted of Dr. Rice, director; Dr. Koch-Grünberg, ethnologist; Dr. George Shattuck, physician; Weld Arnold, cartographer; Charles C. Bull, assistant; John C. Couzens, engineer; Walter Hinton, airplane pilot; John E. Wilshusen, airplane mechanic; John W. Swanson and Thomas S. MacCaleb, radio-telegraphists; Hermann Dengler, draftsman; Silvino Santos, film operator; Ramundo Camara, assistant; and myself, as observer and aerial photographer. With the Indian porters and paddlers, our party numbered more than 100.

The variety of professions represented on its staff suggests the variety of the objectives of the expedition. Dr. Rice set the following program:

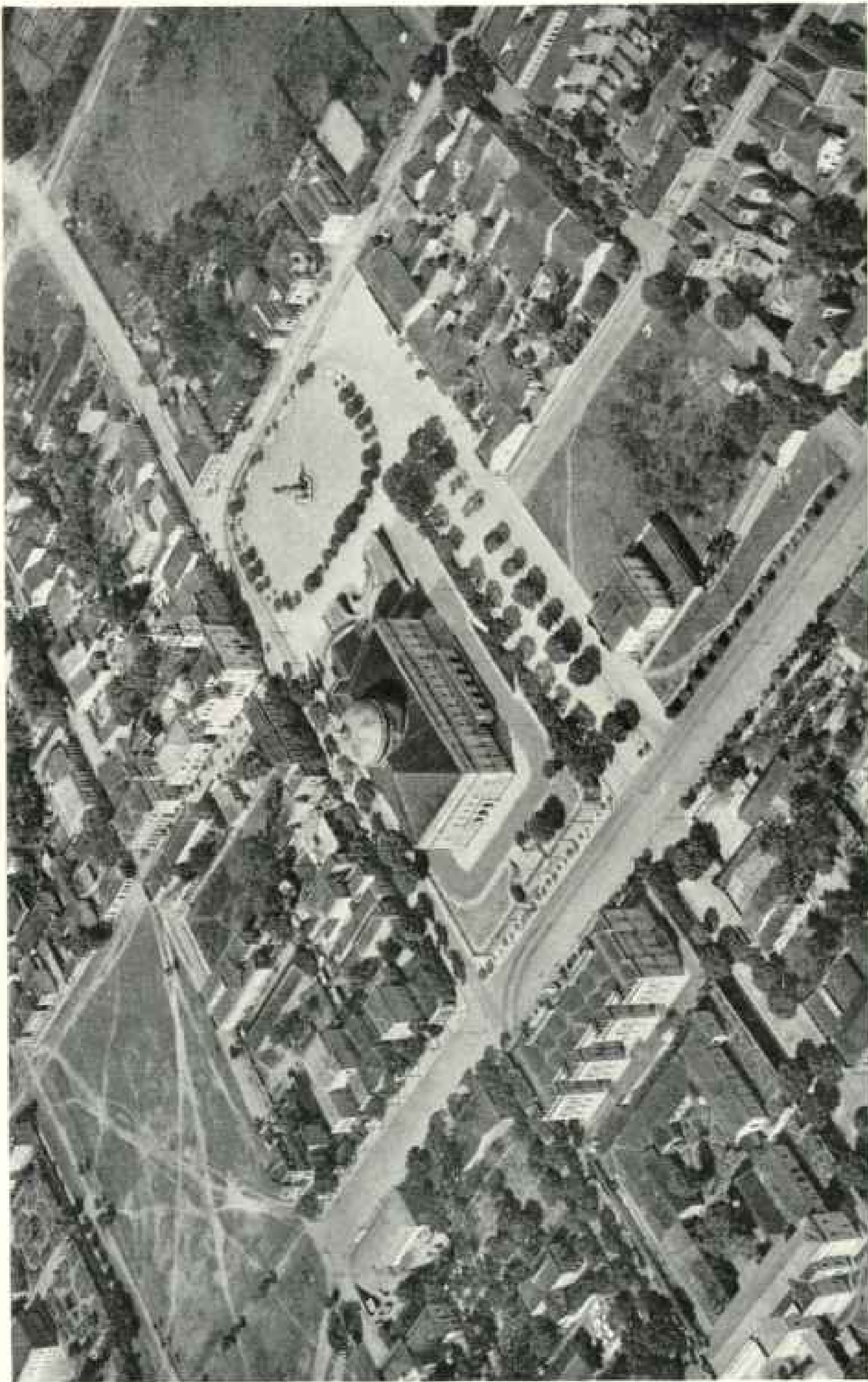
To survey and map the Rio Branco and its western affluent, the Rio Uraricoera, following the latter to its source in the Serra Parima, and to ascertain whether any passage existed between the headwaters of this river and those of the Orinoco, thus tying this survey to the one carried out on the leader's 1919-20 expedition.



Drawn by A. H. Denmark

THE BASIN OF THE AMAZON, THE WORLD'S GREATEST RIVER

The Rice Expedition began its exploration of the Amazon Valley by hydroplane at Matúos. The route followed was: Up the Negro to Carvoeiro, thence up the Branco to Boa Vista, then to Boa Esperança on the Uruicoera. The party continued along this roaring river to the confluence of the Parima and the Aracatia, and up the former to its source in the Serra Paríma (see pages 353 to 420). For an account of the wild life and vegetation of the Amazon Basin, see pages 444-463.



THE OPERA HOUSE IN MANAÓS

This city is located in the midst of the world's greatest forest, nearly 1,000 miles from the mouth of the Amazon. Its electric cars are owned and operated by an English company. To the upper right is a square paved in mosaic stone. The Opera House, with its gilded dome, was erected during the rubber boom, a decade ago.



BRINGING IN A LOAD OF PALM BRANCHES: MANÁOS.



AMERICAN MOVIES ARE POPULAR IN MANÁOS.

The posters are in English, with the Portuguese translation of the title above.



KILLING ANTS WHOLESALE IN A BRAZILIAN CITY

Fumes of burning sulphur and other chemicals are forced into an ant hill and through its honeycomb passages underground, by means of a hand-manipulated blower. Hundreds of feet away fumes may be seen coming through holes in the ground, other entrances to the same hill.

We also proposed to test the usefulness of a hydroplane in survey work, especially in regard to map sketching, traversing and aerial photography, scout maneuvers and reconnaissances, and in effecting communication between the various units of the party that might be temporarily separated.

We were, further, to try out a more expeditious and accurate way of making astronomical determinations by means of theodolites equipped with prisms; to experiment and test specially designed radio apparatus; to study the geology of the region; to gather anthropological and ethnological data; to make a medical survey.

Our expedition started off with a bang—with several bangs. On the night following our arrival at Manaus a revolution broke out.

The city looked peaceful enough at the time and most of our party had gathered for dinner in the lobby of the Grand Hotel, when a troop of soldiers marched by, carrying rifles and dragging some light fieldpieces and machine guns. We thought twilight a queer time for a parade, but, after all, it was their country.

It was not given us to dine without interruption that night, however. During the first course a regular Fourth of July celebration broke loose outside. Fright-



VEILS WORN FOR COMFORT, NOT STYLE

Charles Bull (at the left) wears an American mosquito net, while Walter Hinton (on the right) masquerades under an English type of protector against winged insects. The American style of mosquito armor, less bulky, providing better ventilation, and affording the wearer better vision, was used by a majority of the members of the expedition. While paddling and flying, a net is not necessary.

ened hotel attendants, slammed doors, banged down windows, and pulled the shades.

The unmistakable spatter and whistle of bullets in the near-by main street made it plain that the explosions were not harmless firecrackers. We were at the ringside of a full-fledged revolution! A hotel employee rushed to close the window by our table. We waved him away. Wild gesticulation and a flood of unintelligible Portuguese had no effect on our determination. For most of us this was our first revolution and we had no intention of missing any of it.

CABIN MATE STARTED REVOLUTION

Through the window I looked out upon a street as empty as if a cholera epidemic had decimated the town. Everybody had shut up shop and pulled the curtains. Our hotel was just off the avenue which was

being swept with intermittent squalls of musketry and machine-gun fire. Now and then a bullet would carom off a wall into our street.

While we debated whether or not to resume dinner, a man came running into the side street at full speed. He zigzagged back and forth, wildly searching for a place of refuge. The yellow light streaming out of our window caught his eye and he made for it.

The window was high, but he threw himself against the wall. He could not reach the sill. Bull and I leaned out, the scared Brazilian gave a big jump, and we caught him by the wrists and pulled him to safety. He collapsed on the floor, his teeth chattering audibly.

I am now convinced, and so are the rest of our party, that my cabin mate on the way up from Rio de Janeiro set off this revolution. At every port this Brazilian



A TANGLE OF ROOTS CONVERTED INTO A PHOTOGRAPHER'S DARKROOM

Santos, the motion-picture photographer, discovered this huge tree growing on the river bank, where water was handy. He saw its natural advantages and converted it into his "laboratorio." At night, with a bit of canvas wrapped around the roots to keep out stray light, he would develop strips of film in order that he might test the result of his day's exposures. An enthusiast in his work, he would go about the camp with a lantern or a candle and a foot or two of movie film, showing everyone what luck he had had. If he failed to appear, his associates knew that the day had been a failure.

politician had donned a silk hat, arrayed himself with the scrupulous perfection of a diplomat bound for a state reception, and vanished ashore for the day. And at every port at which we stopped a revolution subsequently broke out. A plague ship could not have spread disease any more thoroughly than our ship spread revolution. But events proved that we were fortunate to have come on that boat, since shipping on the lower Amazon practically ceased for more than two months after the outbreak.

REVOLUTIONISTS, WITH LATIN FERVOR, EMBRACE A STALWART ENEMY

The fireworks died down later in the evening, so we decided to venture out to look over the field of carnage. The streets were still deserted, but soon we came to a soldier on guard. Could we go on? He assured us we could. A few blocks farther along another guard let us pass into the public square where most of the fight-

ing had occurred. The police barracks facing the square had been riddled by gunfire.

The police had defended Manaus from the unpaid soldiers, but when their barracks fort became too hot all had fled save one—an old police colonel, who held out doggedly against the attackers. His return fire from the barracks finally ceased and the troops closed in.

The old colonel was found inside, down, but not disheartened. In picturesque Portuguese he told his captors that he would still be picking them off if he could, but four bullet wounds through the legs and arms had laid him out.

With true Latin spirit, the besiegers promptly embraced their prisoner, praised him to the skies for his gallant defense, and then packed him off to the hospital to be patched up.

Manaus had changed hands with not more than a dozen casualties.

One morning a few weeks after the

revolution our steamer and hydroplane started up the Rio Negro, and for nine months thereafter we were in, beside, and over the world's greatest forest.

To take advantage of the cool, steady air and good observation conditions, Hinton and I took off in the early morning hours, as a rule, flying about 100 miles up the river, taking photographs and sketching as we went. By nightfall the chartered steamer carrying the rest of the expedition usually arrived at our anchorage.

THE BLACK MIRROR OF THE RIO NEGRO IS A PERIL TO AVIATORS

The Negro is well named; it is glossy black. When government engineers wanted to make a mirror basin between the Washington Monument and the Lincoln Memorial in Washington, they coated the bottom of the long pool with pitch. When it is smooth the Negro, by its blackness, produces the same sort of mirror.

To a person on a steamer deck the beauty of the tropical scene is heightened by this phenomenon, but to a hydroplane pilot it offers grave danger, because he cannot accurately gauge his distances. Whenever possible Hinton came down in the wake of a boat whose waves broke the mirror.

For 200 miles we followed these waters, from Manaus to Carvoeiro, where, to our great relief, we saw the milky waters of the Rio Branco pouring into the Negro like cream into black coffee (see, p. 386).

At Sioroco, some distance up the Rio Branco, I gratified a desire that was born in the days when I wore knee breeches and the wonders of geography were first being revealed to me. I stood on my own shadow! Sioroco is one degree off the Equator, and we arrived there at the time of the autumn equinox, when the sun was crossing The Line on its swing to the Tropic of Capricorn. At noon, therefore, the sun was directly overhead.

Here we had to make our first repairs. We had begun to suspect that all was not well with the bottom of our plane several days previously, and this fear was confirmed when we flew over the steamboat and Wilshusen noted the "blister" spots which appeared where the hull covering had become loose.

Knowing that trouble was in store, he got out our airplane first-aid kit, which

contained glue, canvas, mahogany, and screws, and had it ready when the boat caught up with us that afternoon. We pulled the plane up on a mud bank and Wilshusen replanked a section of the hull about 6 feet long, tapering from 4 feet to 2 feet wide.

This part of the hydroplane hull was veneer. Under ordinary conditions veneer is stronger than mahogany planking, but we soon found it had no place in the moist Tropics, where the glue became soaked and the thin strips warped and parted.

By the most strenuous work day and night, amid swarms of gnats and mosquitoes, and in beating rain, Hinton and Wilshusen stripped off the veneer and replaced it with solid planking. Two days later, with the help of 20 Indians, the hydroplane was eased into the water.

For the next six months two thin strips of mahogany with canvas between them were all that separated us from the water. However, six months proved to be just about the limit of their endurance, as the hull was practically water-logged when we landed at Manaus on our return journey, the latter part of March, 1925.

WEATHER WORKS ON SCHEDULE ALONG THE AMAZON

The weather has a set schedule of performance in the Amazon Basin. The days usually dawn bright and clear. By 9 or 10 o'clock clouds gather and in the afternoon it often rains. The blanket of clouds, however, serves to temper the sun's heat and makes the days really less uncomfortable than many of those of July and August in the Temperate Zones.

The nights are very beautiful; the air is often so clear that the stars have the sparkle and snap of our coldest winter nights. The Southern Cross and Milky Way are much in evidence, while directly overhead in November, in the hours just before daylight, is the great constellation of Orion.

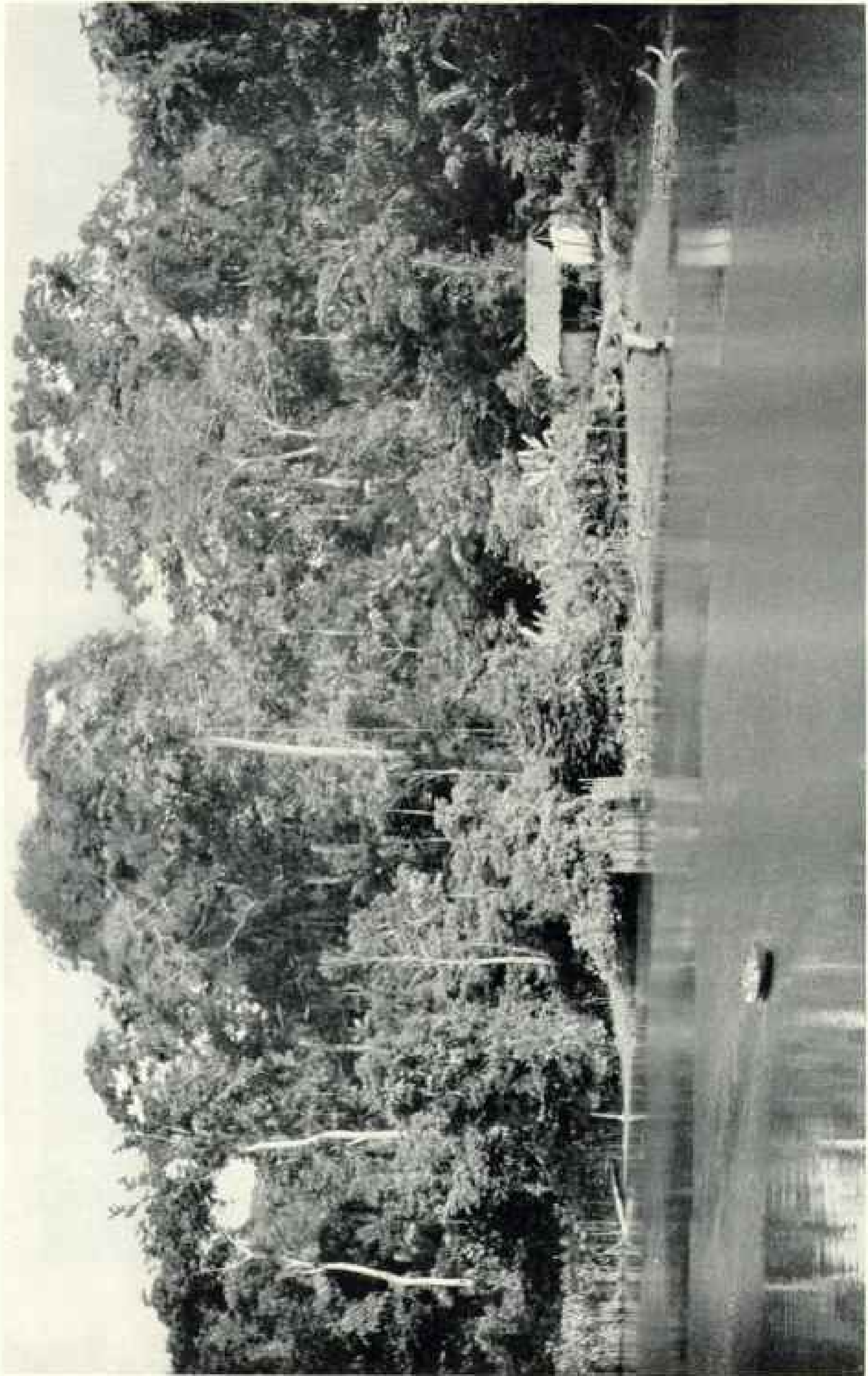
At this time of year, too, many of the planets and first-magnitude stars shine with great brilliance, and when the full moon is in the sky the night transforms the Amazon Basin into an illimitable fairyland of delicate light and shadow.

On the rivers, the rush of the water by the tangled jungle, the distant murmur



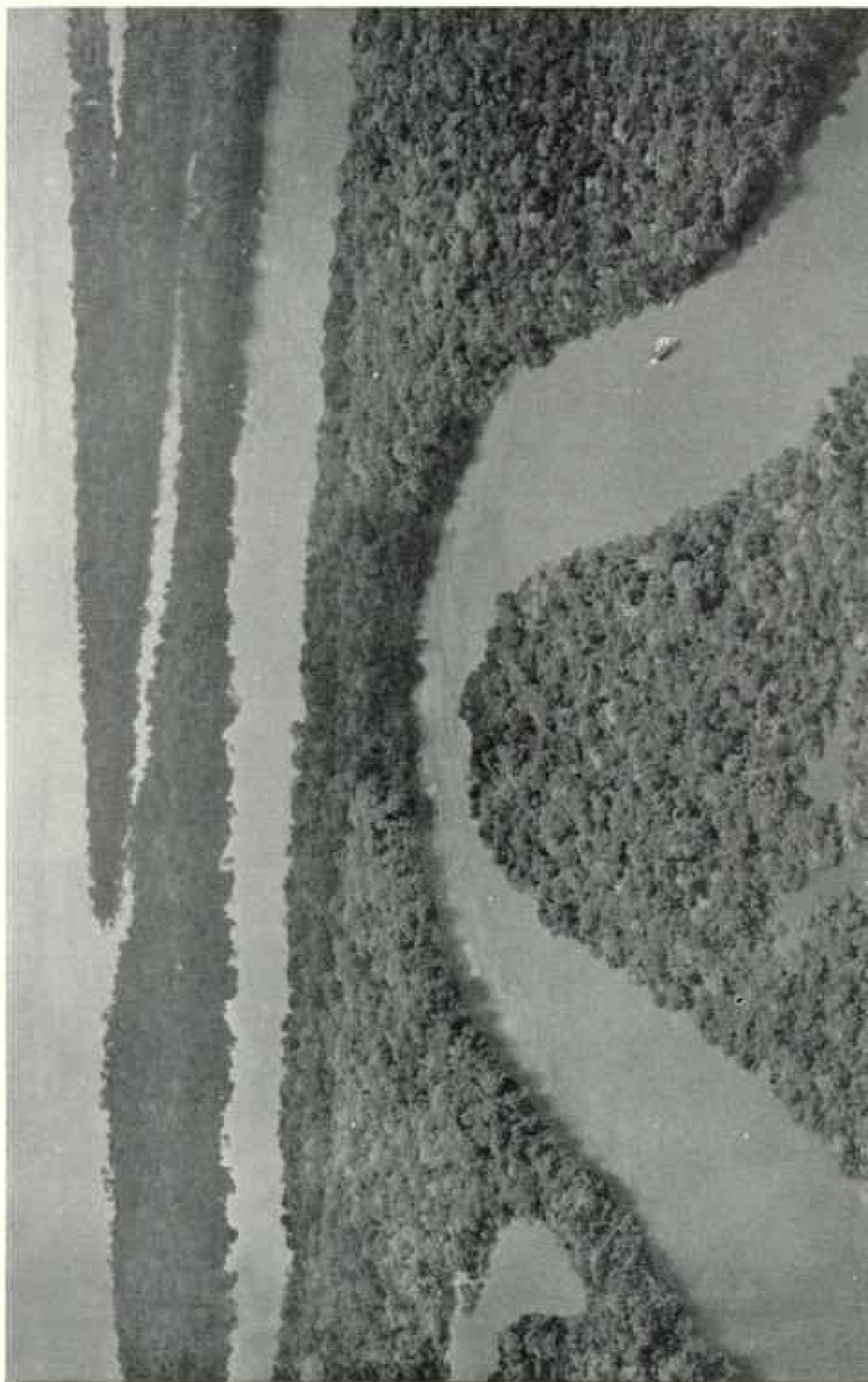
A GIANT OF THE AMAZON FOREST

This huge ceiba tree, supported by buttressed roots, towers 40 feet above the general level of the jungle. Note the wisps of vines swinging from the limb at the left, like a string of beads. Sometimes these parasitic growths resemble washing hung out to dry.



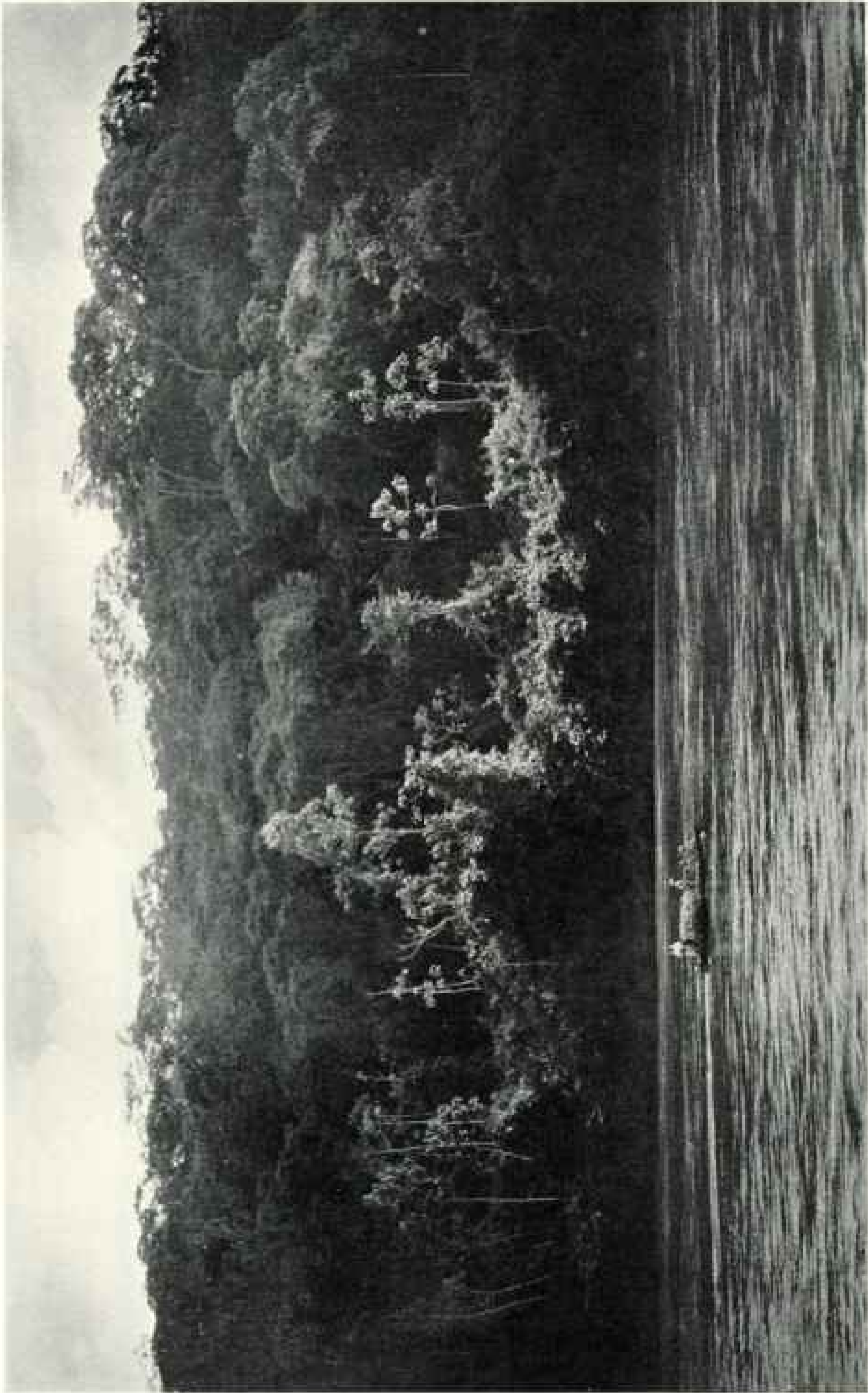
THE AVERAGE EXPLORER'S VIEW OF AN AMAZON FOREST (SEE, ALSO, PAGE 366)

"A high canopy of trees from whose branches hang vines and moss which spread their greedy fingers downward; beneath this, dense underbrush shrouded throughout the day in green twilight" (see text, page 365). Note the turtle pen in the center (see, also, page 383).



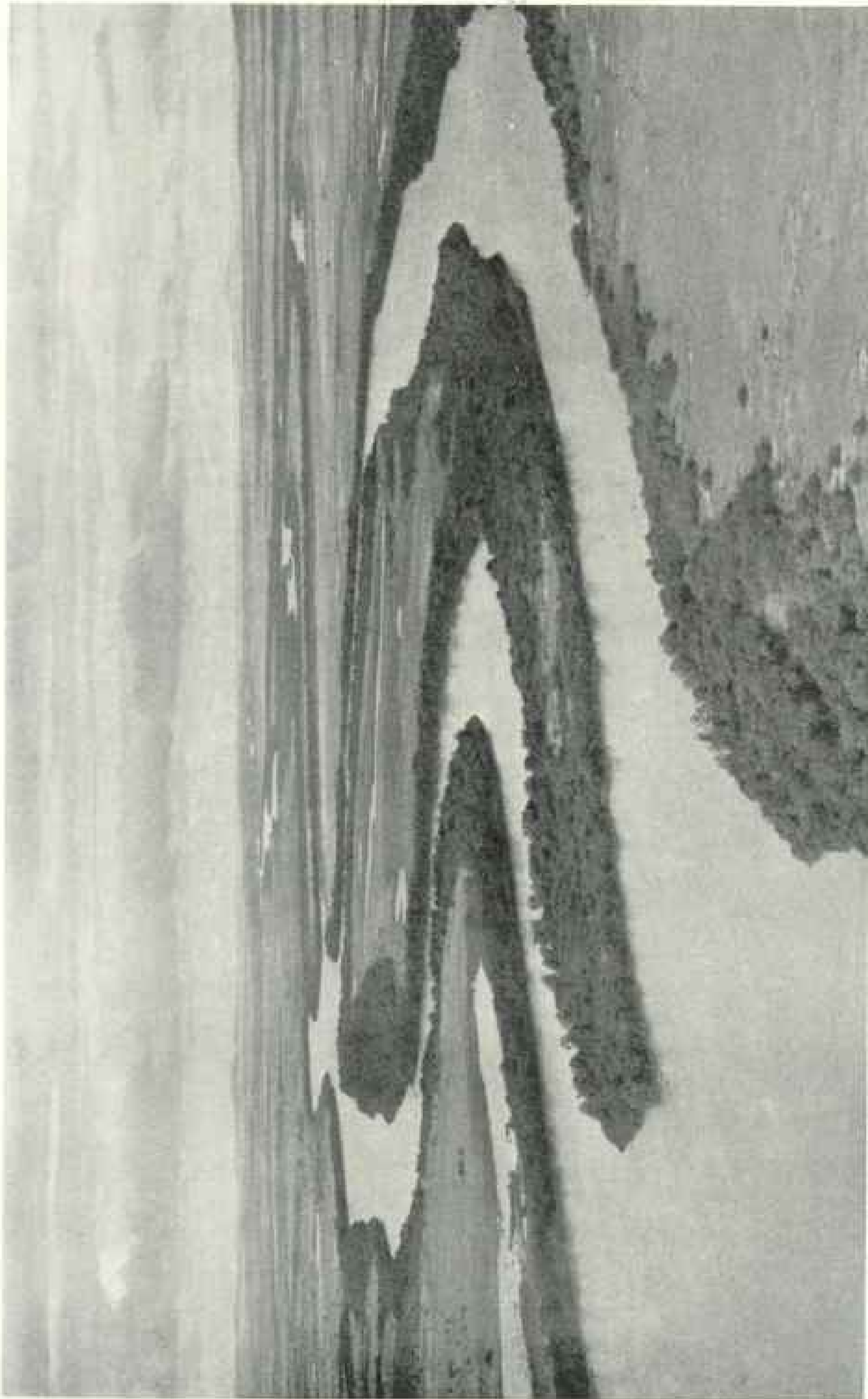
ISLANDS IN THE RIO NEGRO

In the right foreground the river steamer conveying the Rice Expedition is seen proceeding at five miles an hour up one of the narrow channels. Viewed from the hydroplane, the Negro appears as 15 miles wide for a distance of 50 miles above Manáos, the stream being filled with long, narrow islands, from which, after sunrise, wisps of vapor rise and almost exactly overlay them. Here and there the forest growth on the islands completely surrounds small bodies of water, thus creating apparent lakes in the river.



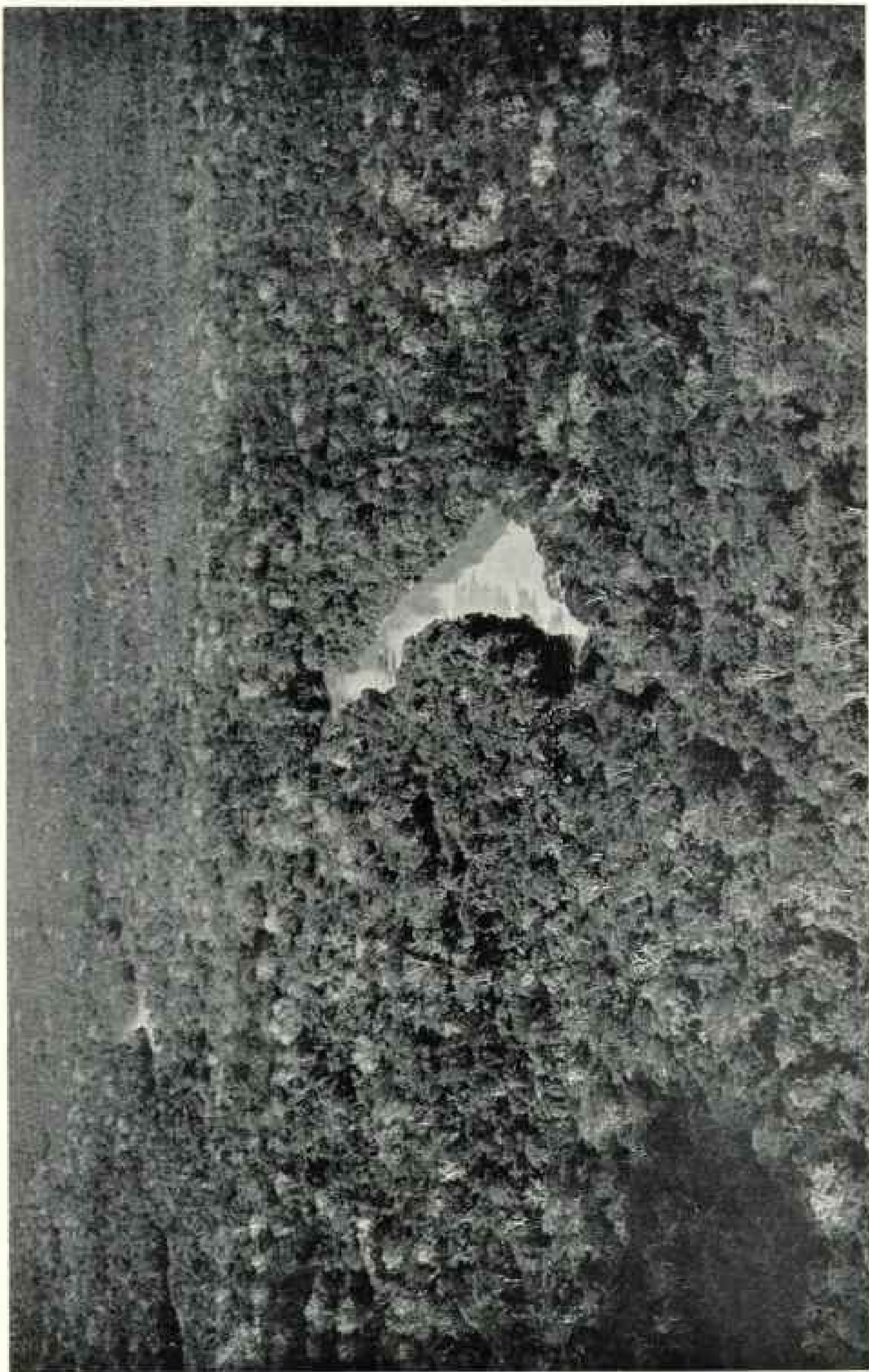
CANOEING UP THE URAHICOERA RIVER WITH THE HELP OF AN OUTBOARD MOTOR

The open patch in the forested bank was probably caused by a tropical hurricane, such as that which occurred while the Rice Expedition was approaching the mouth of the Branco.



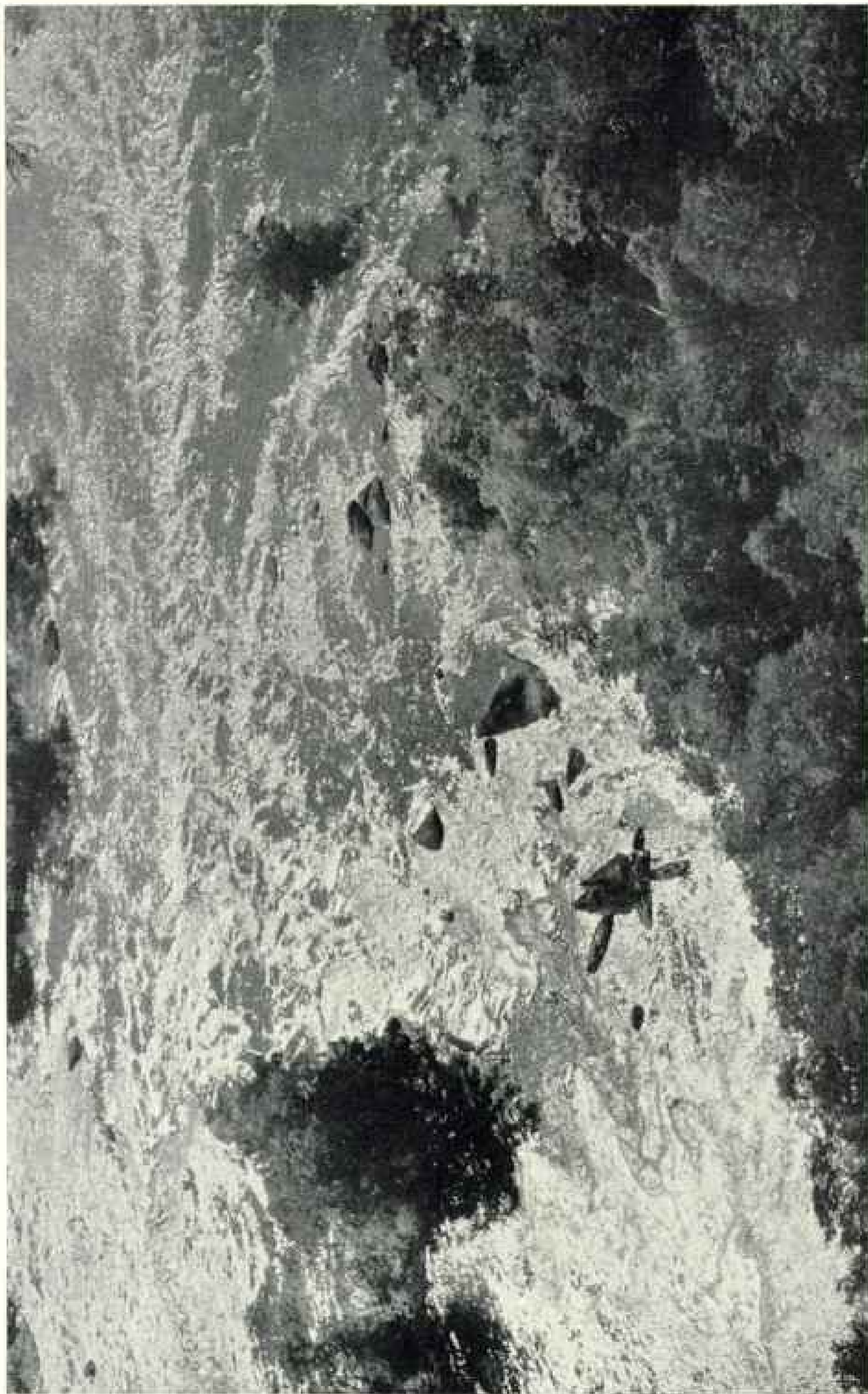
A COMMA-SHAPED ISLAND ON THE URARICOURA RIVER NEAR ITS CONFLUENCE WITH THE BRANCO

A single house, occupied by a Brazilian cattleman, surrounded by several huts for Indian cowboys and helpers, is known as the settlement of Alagadico. On all sides stretches the campos, a cattle-grazing region of 10,000 square miles or more, where wild birds roam and are rounded up once a year. The only fences are watercourses fringed with rows of palms.



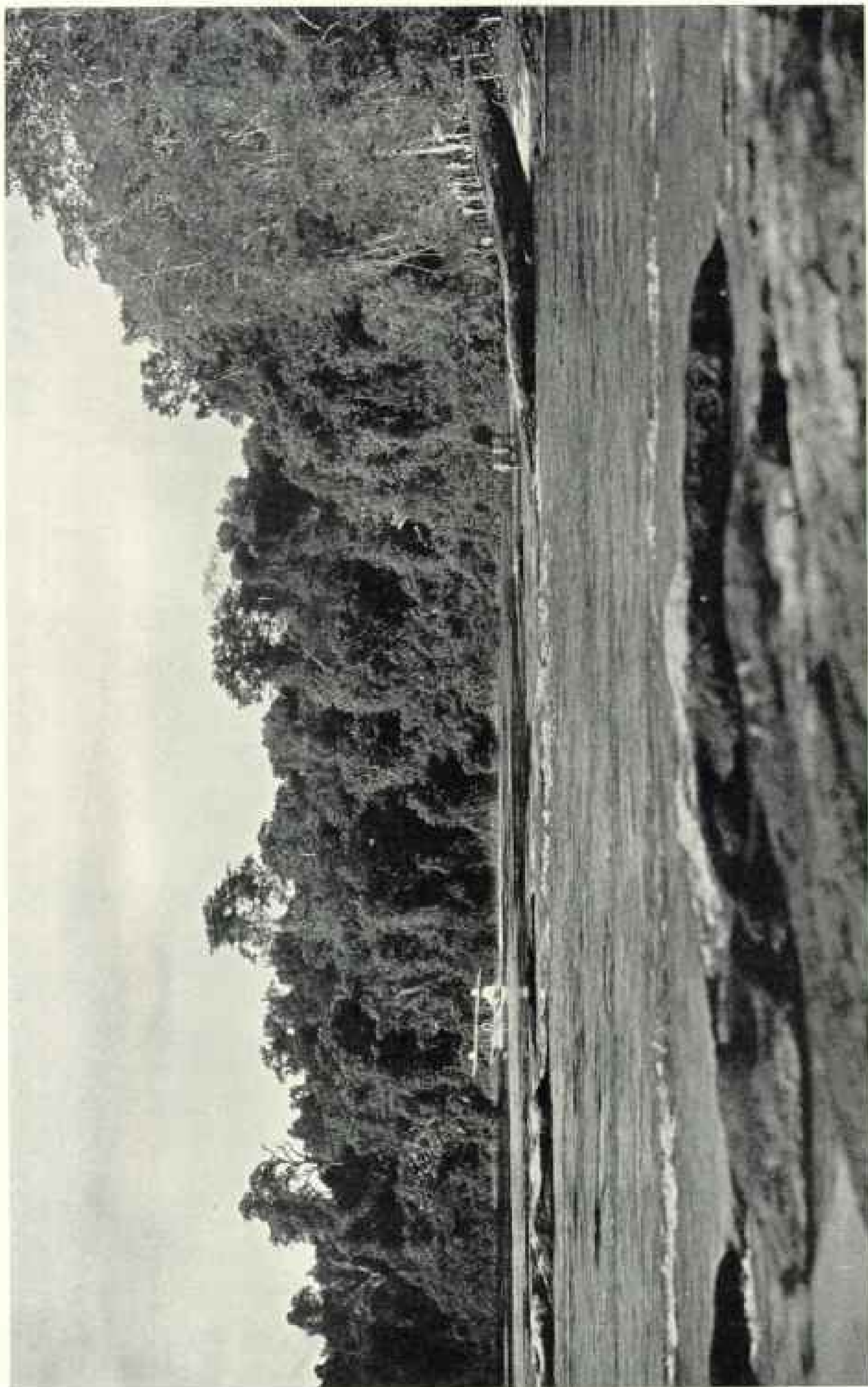
THE AMAZON JUNGLE FROM THE AIR (SEE, ALSO, PAGE 352)

"A sea of green billowing away over low hills, with palms scattered through the forest below, resembling hundreds of starfish at the bottom of an ocean, their lighter green focusing in strong contrast against the dark tones of the jungle" (see text, page 387). Following an unknown river through the tropical forest in a hydroplane is great sport, but one must keep an eye on the channel. A mile or two to the right or to the left and the river disappears. All that remains then is the unbroken sea of forest. After once following the river up its course, it is often possible to cut across bends coming down and fly by compass.



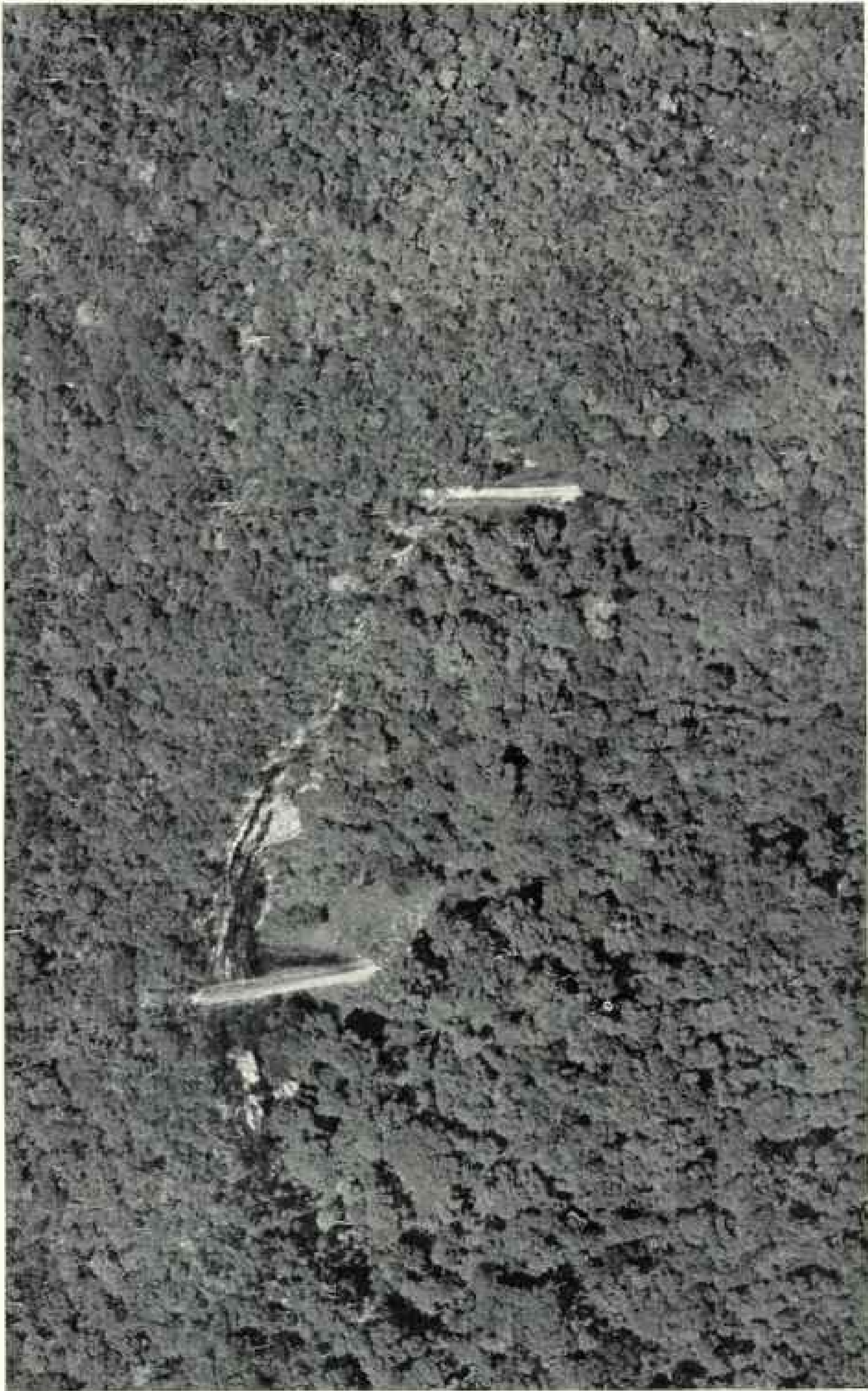
THE EXPEDITION MAKING ITS WAY UP THE ROARING WHITE CHANNEL OF THE RIO URARICOERA

On a rock in the lower center may be made out the figures of half a dozen men and two canoes. Rapids such as this extend for 100 miles on the Uraricoera above Maraca Island. They are not especially difficult for canoes, but require time, as the craft must be pulled up by long ropes (see, also, illustration, page 407). The heavier-laden canoes, requiring more water to float, were forced up through the swiftest water and frequently were swamped. Cases of gasoline, foodstuffs, and trade goods floating downstream were rescued by Indian helpers. On one occasion the expedition's entire stock of cigarette papers disappeared in swirling waters, and thereafter the thin bark of a certain tree, split into thin, flexible layers, had to be used for the "makings."



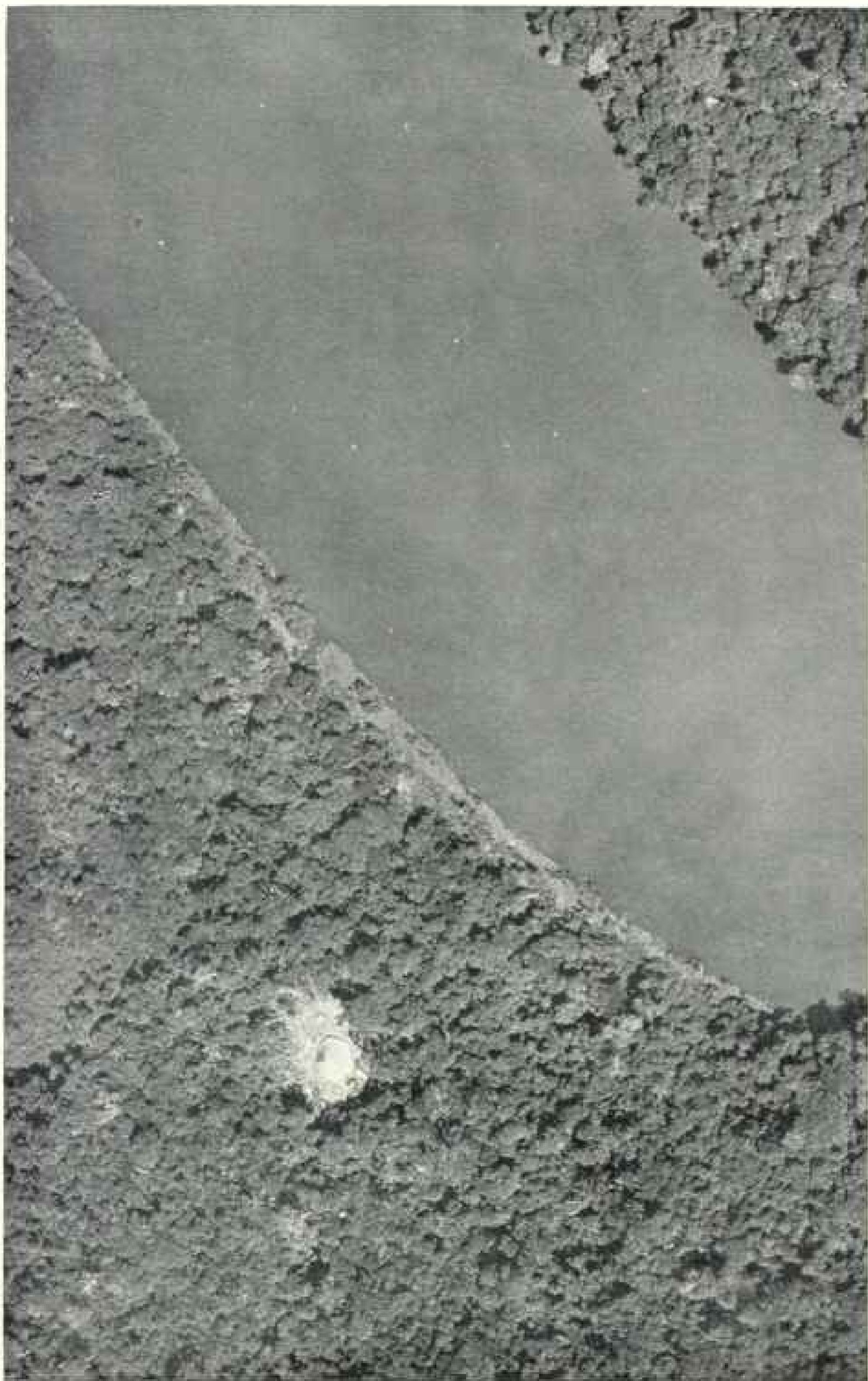
KULEIKULEIMA ROCKS, A PLACE OF DISASTER (SEE TEXT, PAGE 388)

This photograph, taken after the members of the Rice Expedition had reached the point where the hydroplane came to grief, shows the leader's shelter at the extreme right. The plane is about to take off from the only available landing spot for a hundred miles in either direction. The party remained here for two weeks, while gasoline was sent ahead by canoe and portage (see page 413).



LOOKING DOWN ON A HORSESHOE CLIFF

White ribbons of water dehydrate these forest-clad rock walls of the Aracaca Valley. The source of the stream or streams back of these falls is hidden in the dense tropical growth (see text, page 415).



THE FLIERS DISCOVER THE CAMP OF AN UNKNOWN INDIAN TRIBE, SKILLFULLY CONCEALED FROM ALL EXCEPT THE ARMEËN

This photograph is characteristic of many other hidden Indian malocas in the warring country of the upper Parana. Note that the hut, holding probably 30 men, women, and children, is located several hundred yards from the river, and that no canoes or other evidences of life are visible at five hours. Close by is seen a small stream, which appears, from canoes paddled by passing Indians of other tribes, just like any other small stream on the river. Up it, probably around the first bend, are likely to be found the dugout canoes of the tribe whose hut is seen so plainly from the hydroplane. The trail from the hut leads, therefore, not to the river directly, but to the place where canoes are tied.



A NEARER VIEW OF THE CAMP ON THE UPPER PARIMA (SEE, ALSO, PRECEDING PAGE).

The hydroplane alighted in the river after circling several times over the camp. The Indians, realizing that their home had been discovered, shortly came out of the inlet in a canoe. Their faces were painted with red ochre and long sticks were thrust through their ears. In the canoe were spears and bows and arrows, but they made no hostile gestures. With a sack of old clothes and other articles of trade, the pilot and the author climbed from the plane into the canoe and were paddled into the inlet (see, also, next page).



THE OCCUPANTS OF THE COMMUNAL HUT ON THE PARIMA (SEE PAGES 370 AND 371.)

Pilot Hinton is seen in the center of the group, trading clothes and knives for bows and arrows and blowguns. Note the way in which the arms of the man and woman at the left are bound above the elbow (see, also, illustrations, pages 396 and 411). With some Indians leading the way, and others falling in behind, the airmen had followed a faint and narrow trail through the dense forest to the maloca. Because of the white men's greater height, they had to bend continually to get under vines and limbs, but the Indians, of shorter stature, slipped along very easily.



THE ARMEN REACH THE HEADWATERS OF THE RIO PARIMA

Note the steepness of the canyon walls in the center foreground. Just to the right are white vertical streaks, showing water from a mountain stream falling over a cliff into the river below.



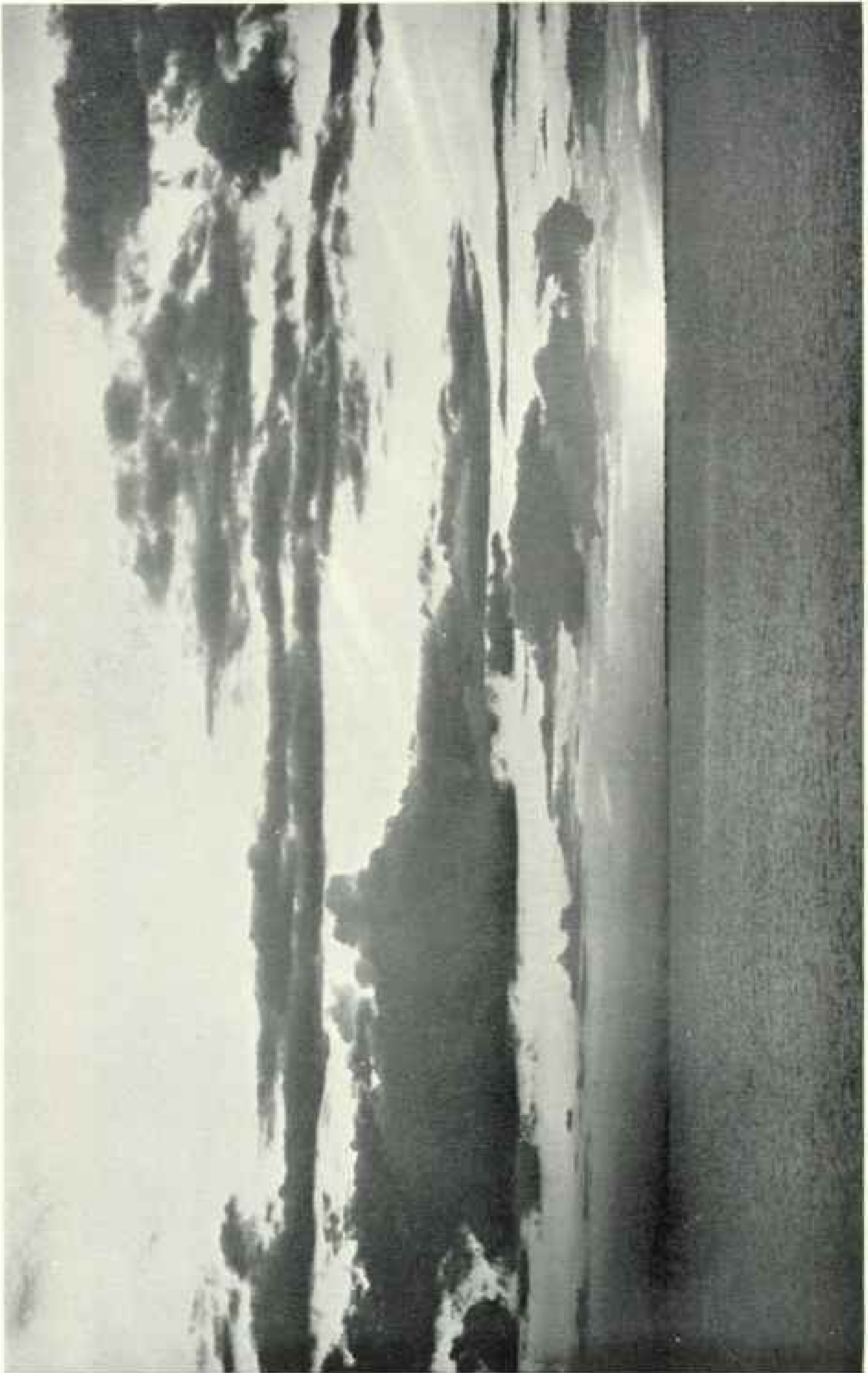
LIGHT SUN SPOTS ON THE FACE OF THE SUN

As the plane flew into the higher country of the Parimas, black spots appeared ahead from time to time. At one angle of view they looked like holes into the interior of the earth, and at other angles like dead black lakes of pitch surrounded by perpendicular walls. As the plane approached these spots it was seen that they were really huge cliffs, over which, in many cases, tiny streams fell like ribbons for hundreds of feet, disappearing in obscurity below.



THE AVIATORS ARE TRAPPED IN THE PARIMA GORGE.

With an engine near the boiling point because of the excessive heat of the region, the aviators could do nothing but follow the curves of the canyon for miles, until they struck smooth water at the Aracusa River, steadily losing elevation in the meantime. The photograph was made at a sharp angle, and therefore does not show the steepness with which the sides of the gorge rise from the river. Note that the forest grows to the very edge of the water. Pilot Hinton and the author were the first white men ever to gaze on this section of the Rio Parima (see text, page 415).



SUNSET ON THE AMAZON

of the rapids, the peculiar odor characteristic of all the forest, and even the harsh roar of the howler monkeys far inland, all add to the fascination of this wilderness.

MANY ASK MEDICAL ATTENTION

Our expedition was a progressive medical and dental clinic as well as a party of exploration. We had not only our own sick to attend, but also the ailing for miles up and down the Branco. Word that our leader was a physician magically flew before us along the river, and although it was aside from their purpose, Dr. Rice and Dr. Shattuck could hardly refuse the requests for dental, medical, and surgical treatment, which was given to Portuguese and natives, alike.

To reduce the transportation of supplies, we lived off the country wherever possible. The chief foods obtainable were farinha (a sort of flour) and beef. Oranges, pineapples, and bananas grow wild along the river and they often provided welcome variety for our diet, while fish of many kinds also graced our board. The cowfish of the Amazon tributaries is similar in line and color to the American catfish, but sometimes grows as large as a tarpon.

Vicious piranha always offered good sport as well as good food, but these ferocious flesh-eating fish make swimming dangerous. Attracted by a little blood from a scratch or cut on any living thing in the water, or sometimes even without this invitation, these razor-toothed creatures take only a few minutes to strip the flesh to the bone of either man or beast. Many a native has one or more fingers missing at the first joint, due to the voracity of a piranha, which took a bite while a hand pushing a canoe paddle was left carelessly in the water (see illustration, page 412).

THE INDIAN STAFF OF LIFE IS MADE FROM A POISONOUS ROOT

Farinha, made from the mandioca root, which closely resembles our parsnip in appearance, is the Indians' staff of life, and it became an important addition to our own diet.

Eaten raw, this root is poisonous; but the natives have learned to pull the

mandioca's "fangs." Each family has a piece of tree trunk pared slightly concave on one side, and this shallow trough is studded with pieces of flint set in pitch. The women shred the mandioca roots on this grater, then pack the white fluff in long woven mat tubes (see pp. 414-415).

After soaking these tubes in river water the contents are partly drained by suspension and by pressure primitively applied on the principle of the tourniquet. This operation, which washes out the poison, is repeated a number of times before the farinha can be used as a coarse flour for bread.

We found this food satisfying and wholesome, but rather tasteless. Its link with Indian religion shows its importance in the scheme of jungle life, for the natives believe that their principal deity taught their ancestors the method of extracting the mandioca's venom.

FEVER SMITES THE EXPEDITION

Disease came closer to arresting the expedition than any other obstacle encountered. Despite the best mosquito nets, the use of quinine in 5-grain doses, and the presence of two physicians, many of us contracted fever. Our greatest loss was in the death of Dr. Koch-Grünberg, who was stricken early in September and died 10 days later, at Vista Alegre.

Besides Dr. Koch-Grünberg, both surveyors, one of the two wireless men, Dr. Grünberg's assistant, the airplane pilot and the mechanic, the launch engineer, and the cook, all had fever. Furthermore, the captain and almost all of the crew of the river boat that brought the expedition to the head of steamship navigation were stricken with the malady on their return to Manaus.

I escaped the fever for nearly a year, but finally contracted a "walking case." Prompt use of quinine in doses totaling 150 grains in three days proved effective.

The worst zone of disease is the lower river. After the mountainous region is reached, fever is no longer greatly dreaded; but, once contracted, it recurs from causes ordinarily insignificant. For instance, a flight by Hinton for a little more than an hour, at 6,000 feet elevation, put him flat on his back, although the temperature encountered was only 55



VIEW FROM THE HYDROPLANK OF THE RIO NEGRO FLOWING INTO THE AMAZON:
PHOTOGRAPH TAKEN AT AN ELEVATION OF 5,000 FEET

The black waters (right) of the Negro are mingling with the yellow waters (left) of the Amazon. This is the way the water appears, too, to the traveler gazing down from the bow of an ocean-going steamship, as it passes up the Amazon, just before turning into the Rio Negro. Manaus is located on the north bank of the Negro, less than ten miles from the junction.

degrees. When one has been experiencing 85 and 95 degrees for many months, this temperature seems very cold and is sufficient to offer the fever a foothold if the system is weak.

BOA VISTA, A REFUGE FROM MALARIA

On October 25 we were glad to skim the waters before Boa Vista (Good View), the only considerable town on the

Rio Branco. The same reasons that make Omaha the biggest city of Nebraska and Simla, in the hills of India, the British summer capital, make possible Boa Vista. Its population, we were assured, is "over 500."

Like the Nebraska metropolis, Boa Vista is the shipping point of a cattle country, and, like Simla, it is high and relatively free from malaria. Close to the



A MISHAP TO THE AÉRIAL

Santos, the motion-picture operator of the expedition, performs an unpremeditated acrobatic feat when he pulls the wrong rope while rigging the radio apparatus.



"LISTENING-IN ON PITTSBURGH" FROM THE DEPTHS OF THE BRAZILIAN JUNGLE

Left to right: Hinton, the pilot; Wilshusen, the airplane mechanic, and Dr. Rice, leader of the expedition; in the foreground, MacCaleb, one of the radio telegraphists. During the expedition's work in the field, messages were exchanged with San Francisco, Chicago, London, and New Zealand, and for months a regular schedule was maintained with New York. A small canoe radio set was taken to the headwaters of the Parima, and even here communication was established with the United States.



THE "ELEANOR III" ANCHORED IN MIDSTREAM: RIO NEGRO

In the foreground is the canoe which ferried the pilot and the author back and forth between ship and shore.



HINTON PAINTS CARVINGS WITH FRUIT RIND, SO THEY WILL PHOTOGRAPH

Apparently these Indian pictographs on the banks of the Rio Negro are old, but no guess has yet been made as to their meaning.



THE EXPEDITION'S STEAMER, THE "PARAHYBA," ON THE RIO NEGRO

Early in the morning the hydroplane usually flew up river for 100 miles, sketching and photographing; in the evening the steamer would arrive.



A CLOUD OF YELLOW BUTTERFLIES

In the Amazon Basin these lovely winged creatures often pack in a solid mass wherever a salty liquid has been spilled.



TURTLE SOUP IN THE RAW.

These huge reptiles, caught in the Rio Negro at Carvoeiro, are to be shipped to Manaus.



A "HOTBED" ON STILTS

Not designed to protect the plants from frost, but from an excess of moisture, which at certain seasons of the year causes seed to rot before sprouting. The elevated platform enables the growing plants to receive plenty of sunlight and fresh air.



TURTLE PEN ON THE AMAZON

This is much like turtle pens that were seen elsewhere on the Negro and Branco, except that this one is some four times larger (see, also, page 362).

town rises Serra Grande, a lone mountain six miles long at the base and a welcome sight after the flat lands of the lower Amazon Valley.

The mountains on the Brazil-British Guiana border 75 miles to the east raise a low barrier to the northwest winds, which drop much of their burden of water on the tangled forests to the windward side of the ridge. West of this ridge, therefore, the great Amazon forest shreds out to grassy plains which provide a cattle range as big as the State of Vermont. Boa Vista is situated at the edge of this parklike *campo*, which enjoys a much drier climate than is to be found anywhere down river.

Here, free from the sapping effects of malaria, we were able to recuperate, to

repair and paint the plane (page 384), and even to enjoy such a civilized pleasure as a dance. A "baile" was given by the senior soccer team to celebrate our arrival in the first plane Boa Vista had ever seen.

We were now on the fringe of a new frontier. Much in and around Boa Vista reminds one of bygone American frontiers. There are the scraggy, half-wild cattle driven in to be shipped down river, and there are open ranges where creeks alone serve as fences. The lariat is a conspicuous ornament and the horse reigns supreme, while a round-up is the year's great event.

In the town five Benedictines, reminders of Marquette and the Jesuits, were building, with their own hands and some Indian help, Boa Vista's first hospital.



LOWERING DR. KOCH-GRÜNBERG TO HIS LAST RESTING PLACE: VISTA ALEGRE

An old explorer in this region, the jungle called him from Germany and finally claimed him (see text, page 377). To the right is the grave of an Englishman and the graves of Portuguese and Brazilians, most of whom had died of malaria.



IN "DRY DOCK" AT BOA VISTA: REPAIRING THE HYDROPLANE HULL

This was the best place on the Rio Branco for pulling out a plane, as there was a good slope, a clay bottom, and plenty of help to push the heavy machine well out of the water. The hull and fuselage were sandpapered and repainted and the wings patched wherever holes were found.



DR. SHATTUCK CONDUCTS A CLINIC IN THE JUNGLE

After the Indians have been given some clothes to protect them from insect bites, the physician examines them for tropical diseases. The ladies at the left, having just been garbed for the first time in their lives, look askance at their still naked sister.

Boa Vista was our base for three months.

On November 1 Hinton and I made an experimental flight up the Tacutu, an eastern tributary of the Branco, and on November 3 we flew 140 miles up the Uraricoera, to civilization's last outpost, the two-hut settlement of Boa Esperança, where the river divides to form Maraca Island, 50 miles long and 30 miles wide. This brought us out of the campos region and into the forest again.

At Caracarahy Rapids, between Vista Alegre and Boa Vista, gasoline and oil had been transhipped and carried as far as Boa Vista in launches, but beyond this point the rapids became so rough that we had to rely upon canoes to advance the hydroplane's fuel and lubricant. Sometimes we used a portable motor canoe and sometimes, particularly in the upper stretches, Indian rowers.

The gasoline was in five-gallon cans, which had to be carried around falls and the worst rapids. The heavy loads very nearly sunk the canoes more than once (see pages 406-407), and only 50 per cent

of the fuel cargo taken on board at Boa Esperança ever reached the Parima-Aracaca junction, 250 miles upstream.

Up to this point the river had nearly always offered a landing place, but beyond Boa Esperança broad reaches had to be hunted. Sometimes we did not see smooth water for 90 miles at a stretch.

FLYING OVER WILD JUNGLE

About 6:30 one morning we took off from Boa Esperança for a flight over the wildest country we had yet encountered. The jungle forced itself upon our consciousness now more than ever before, because there was no safe water below.

Those who have only a ground's-eye conception of a tropical forest think only of a high canopy of trees from whose branches hang vines and moss which spread their greedy fingers downward. Beneath this they conjure a picture of dense underbrush shrouded throughout the day in green twilight (see page 362).

We were privileged to view the jungle from the air, and so escaped from the moist, heavy atmosphere at the surface



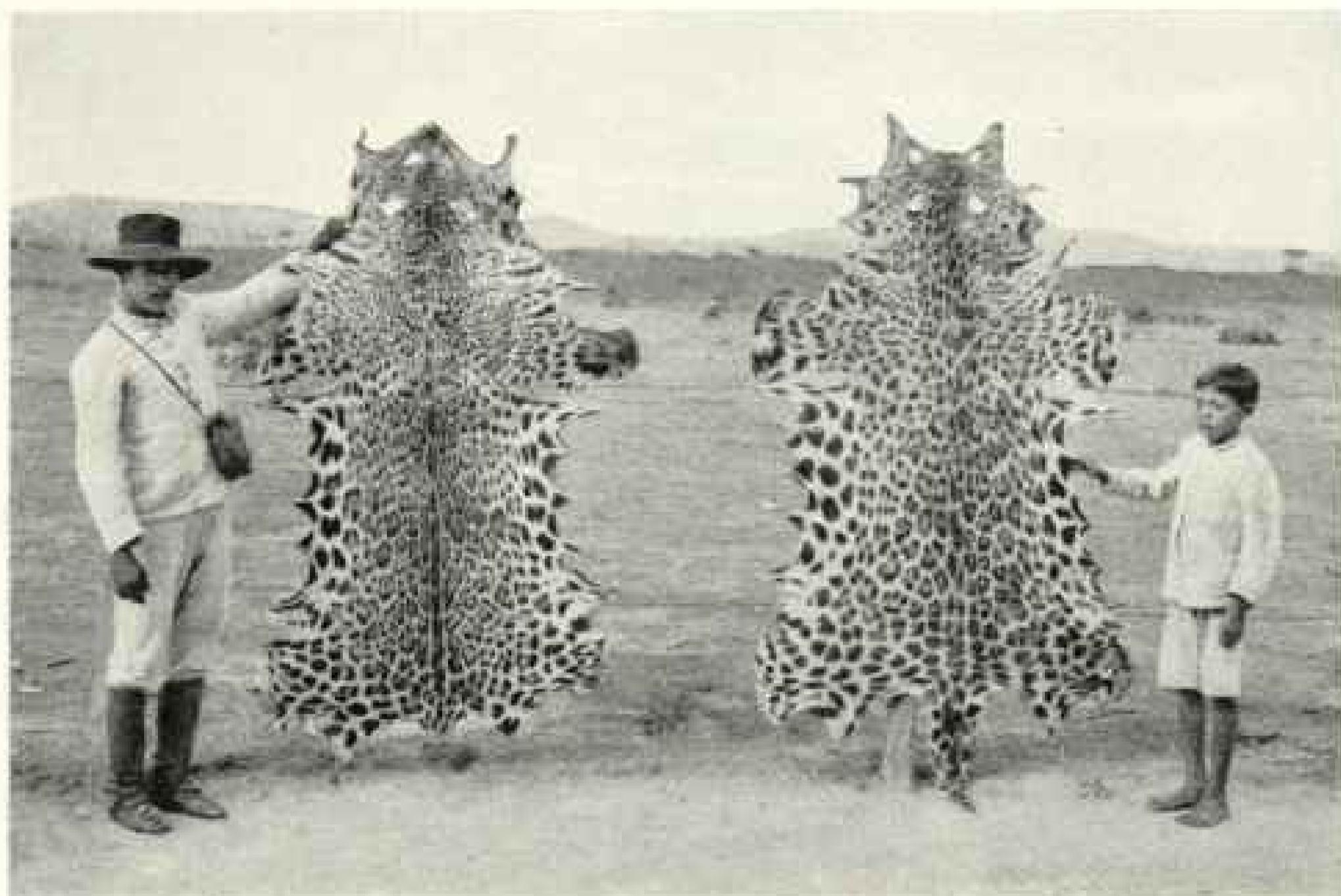
WHEN THE WATERS RECEDED

The captain of this boat came down river when the Amazon was at high stage. He thought he was in the channel, but stuck on what apparently was a sand bank. The river dropped rapidly, and in two weeks he found that his steamer was really on dry land, and there to stay for another year, until the river should rise again.



UNLOADING SUPPLIES FOR THE EXPEDITION AT BOA VISTA

These stores had been transferred by launches from river steamers 100 miles to the south, at the Caracaraby Rapids, the head of navigation (see text, page 385).



JAGUAR HIDES

In the cattle country along the banks of the upper Rio Branco the calves attract many jaguars from adjacent patches of forest. The ranchers hunt the big cats with packs of lean, scrawny dogs whose chief asset is a terrifying bark. The jaguar climbs a tree, and the rancher comes along and shoots it down. The hides are valueless, as the fur is sparse, coarse, and short.

into a temperate region at an altitude of 5,000 feet.

Below us a sea of green billowed away over the low hills to a slender blue-black shore of mountains far to the west. From our elevation the palms scattered through the forest below looked like hundreds of starfish at the bottom of an ocean, their lighter green focusing in strong contrast against the dark tones of the jungle (see illustration, page 366).

At first we could pick out creeks, streams, and rivers, over a tremendous expanse of country, by the lines of thin white vapor hanging a thousand feet or less above them. Three-quarters of an hour later this vapor was burned off by the hot sun; but while it lasted it enabled me to get the compass bearings of many watercourses and to note them on our sketch maps.

From the head of Maraca Island the south channel of the Uraricoera divides into many narrow streams studded with islets and thickly spotted with rocks, over which the water pours in foaming white

masses. Then comes a series of three cataracts, having a total drop of 80 feet, known as the Purumame Falls. Our supply canoes, which came on later, required from eight to sixteen days to pass this 40-mile stretch, over which we flew in 30 minutes! (see page 367).

Beyond Maraca Island the stream was still divided by jagged islets and outcropping rocks with angry rapids in the narrow channel. Not even the Indians seem to frequent this wild section. In three hours and ten minutes of flying we saw not a single sign of human life.

Having reconnoitered for landing places upriver, we returned to Boa Vista to wait until the expedition could push forward, as we could not outfly our gasoline and supplies.

THE HYDROPLANE COMES TO GRIEF

It was not until January that we again took the air over the Uraricoera on what proved to be a most eventful trip. We swooped down to the surface of the river at a previously selected spot, called Ku-



BRAZILIAN GIRL OF THE "BEST FAMILIES": BOA VISTA, RIO BRANCO

leikuleima by the Indians and Kuleikuleima Rocks by us, intending to make further reconnaissance for the location of a supply base. Hinton made a perfect landing and was taxiing toward shore when suddenly there was the sound of splintering wood. The hydroplane careened, hung for a moment at a drunken angle, and then slowly righted herself. We had run onto a submerged pinnacle of rock!

The two layers of wood planking of the hull were only a quarter-inch thick; so that, weight for weight, the hydroplane's sheath was far thinner and more delicate than the shell of an egg.

It seemed probable that the plane was mortally hurt, and even if we succeeded in getting the craft to shore, it would be many weeks before our companions could reach us.

A RACE WITH THE SUN

It was a time for quick decision. Hinton risked tearing away part of the hull and gave the ship "the gun." We rose from the river and headed toward Boa Esperança and safety, 150 miles away.

Our race was with the sun, for it was already late in the afternoon. Twilight

began to settle as we came to Maraca Island, and Hinton turned the plane full speed down the north *furo* (channel). Darkness comes quickly near the Equator, and we soon realized that if we did not come down in a few minutes we would be flying over a dead-black jungle without a landmark to guide us.

With the prospect of a crash among the trees before us, there was no alternative but to descend. Three small islands came into view, the middle one flanked by a sand bar, and we decided this was the safest place to beach the plane. Down we dived to the river's surface, Hinton driving the plane as high up on the sand as possible.

When the plane came to rest, we climbed out of the cockpit to explore the jungle isle where we were to establish squatter sovereignty for eleven days.

Our "Robinson Crusoe Island" was a mile long and a quarter mile wide, heavily forested with a great variety of trees, and apparently uninhabited.

Choosing the most likely spot for a camp, we stretched a cord between two trees for a ridge pole and suspended a canvas over it to make a shelter. Under this we hung our hammocks; for, like

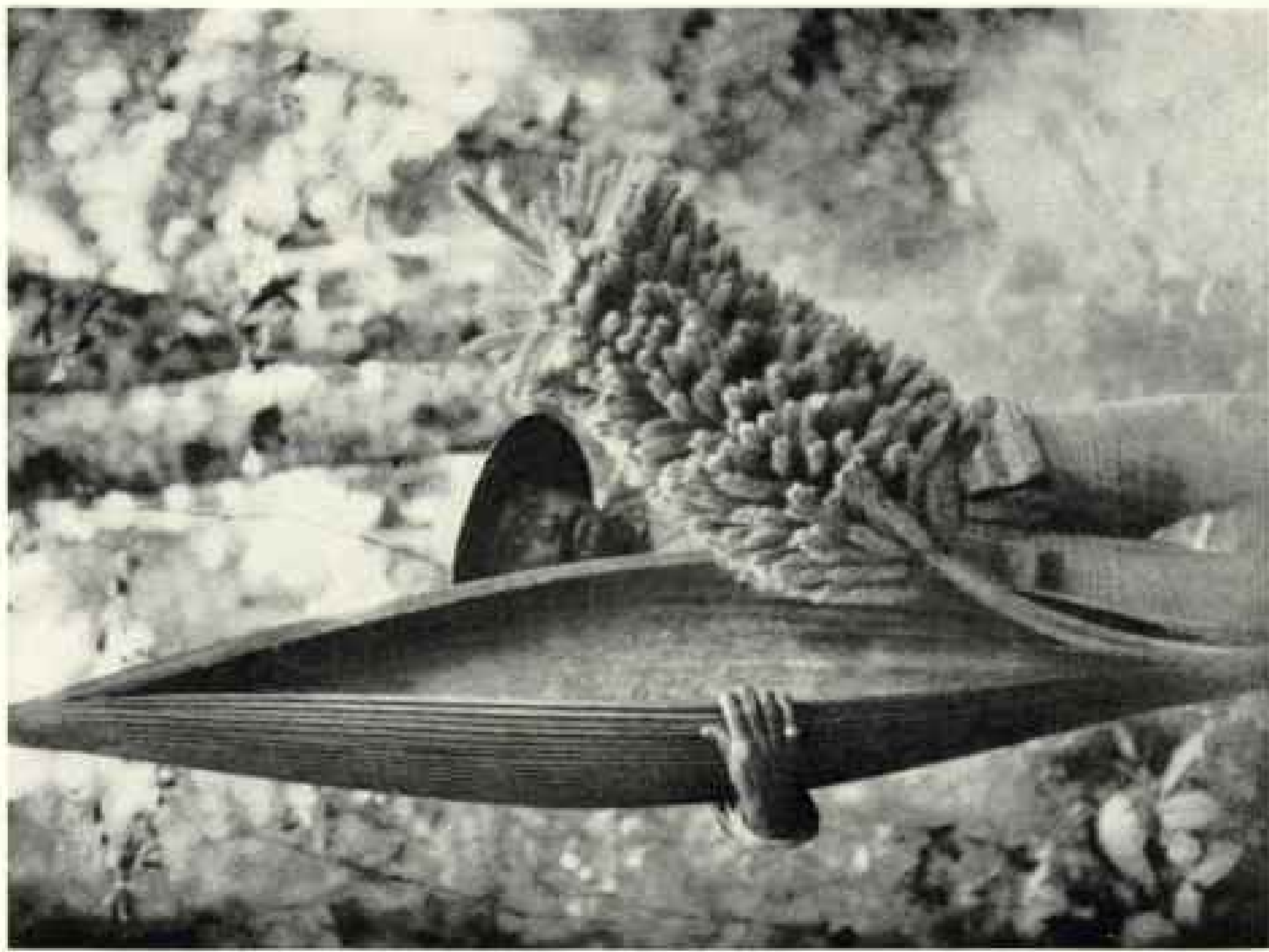


BEFORE A BRAZILIAN RANCHER'S HOUSE ALONG THE RIO BRANCO
Poles plastered with mud form the walls and the roof is a thatch of palm.



A STENTORIAN TEAM ON THE RIO BRANCO

The natives purposely refrain from greasing the axles of these carts, in the belief that the terrific screeching and groaning as the vehicle shudders along serve to encourage the oxen to greater effort. On narrow trails the noise warns other drivers of the approach of a conveyance which is extremely difficult to maneuver.



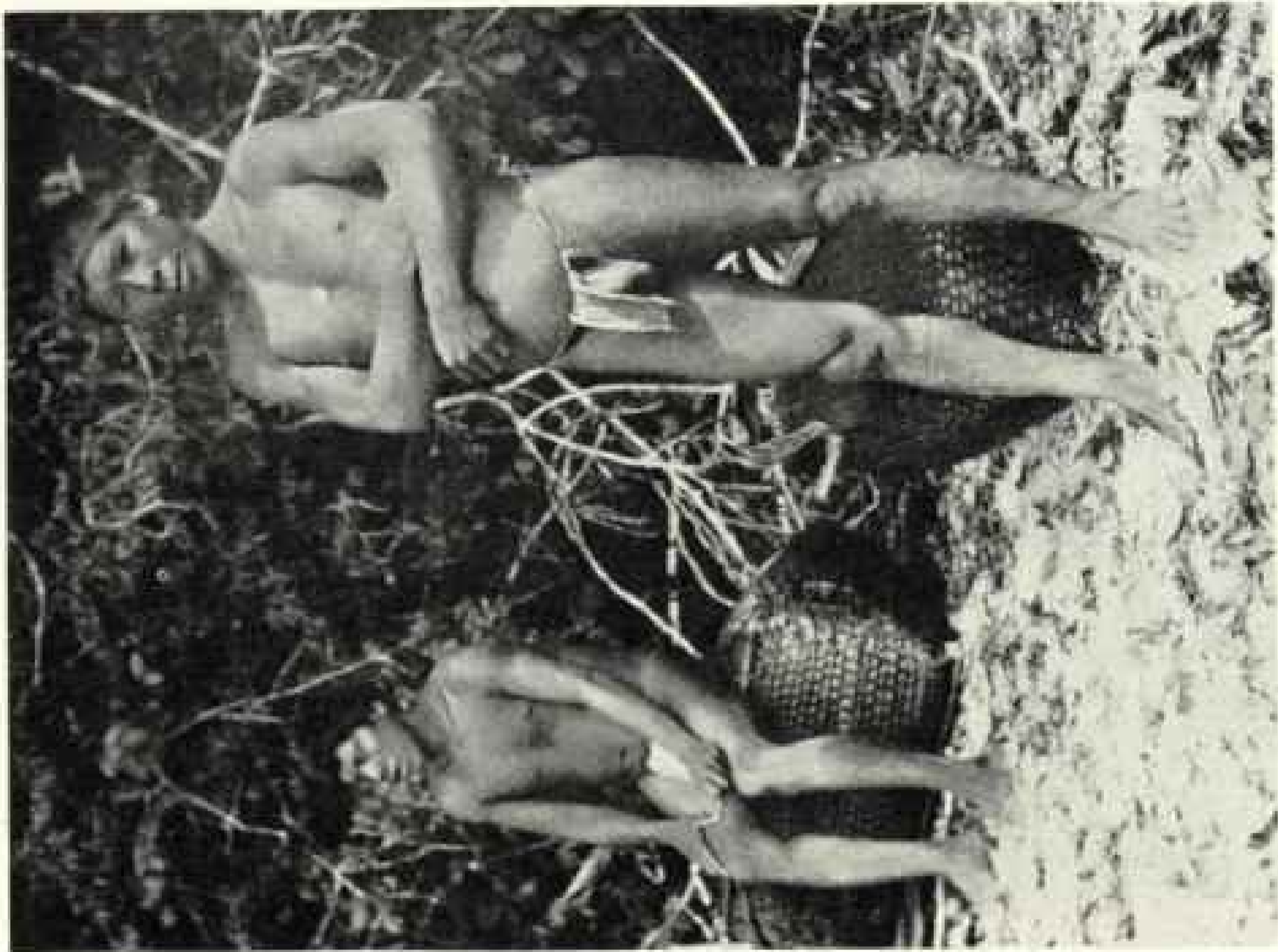
A PLUME OF THE JUNGLE

There is a curious fancy among the Brazilians that the palm tree defends this, its soul, which is "pointed to heaven." In time the husk breaks open, but in this case it was cut free and brought to the ground and split up the side with a knife to allow the plume to be seen.



AN ANT HILL ON THE CAMPOS ALONG THE RIO BRANCO

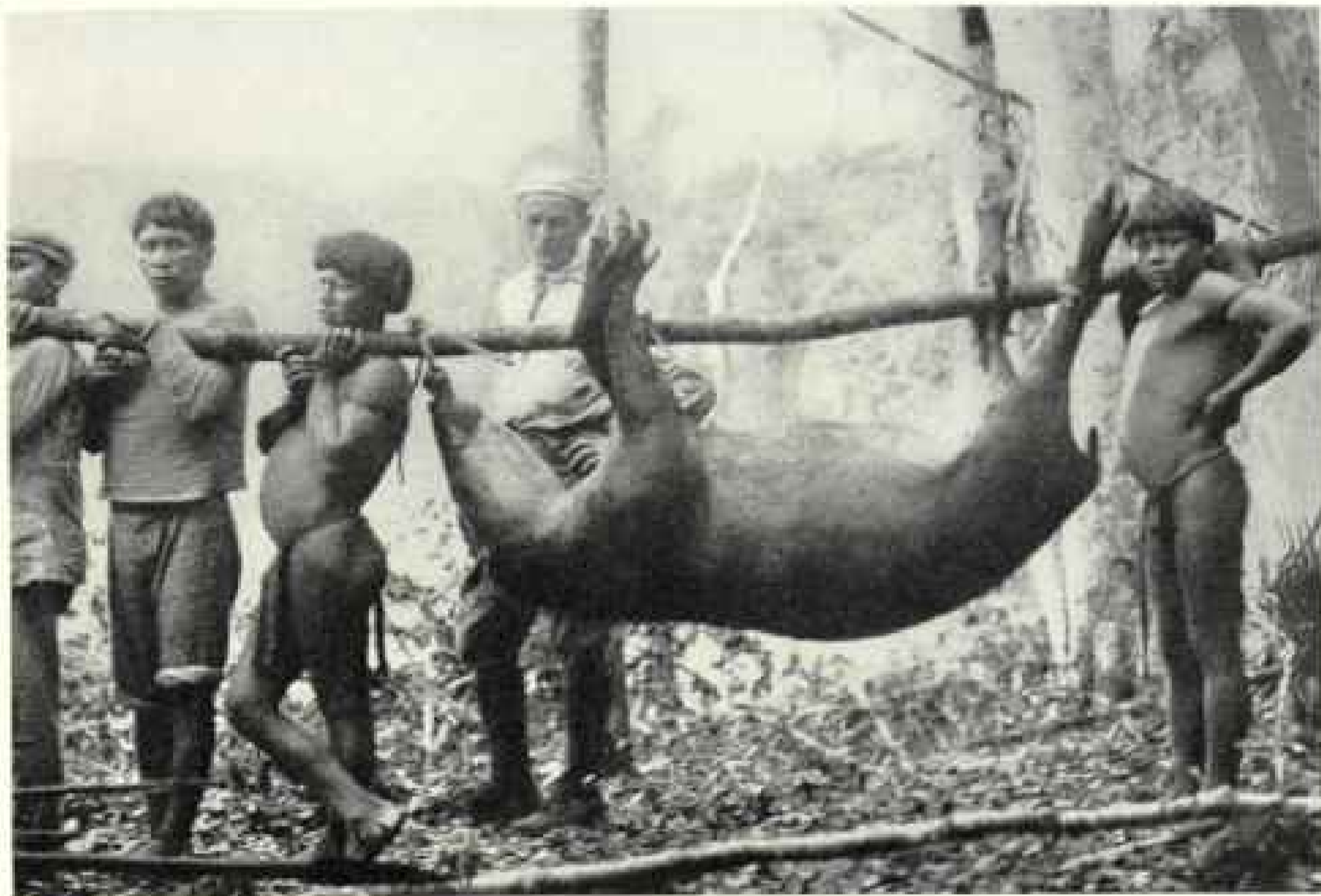
These huge, sun-dried clay heaps have the hardness of cement, and their vertical sides prevent the rain from soaking in. From a hydroplane the sight of thousands of these ant hills gives aviators the feeling of flying over a vast cemetery, the heaps appearing like tombstones.



RESTING AFTER A HARD PORTAGE (SEE, ALSO, ILLUSTRATION,
PAGE 416)



BOTH FEET AND HANDS ARE EMPLOYED BY THE INDIAN CRAFTSMAN
MAN IN FASHIONING HIS PADDLE



BEARING A 500-POUND TAPIR INTO CAMP

These animals were very common and provided the expedition's principal meat supply. The flesh tastes much like beef, although the animal resembles a pig to some extent.



AN AMAZON ABATTOIR

This native butcher is curing his tapir meat with smoke.

true sailors of the sea, navigators of the green jungle always sleep in hammocks. They are the universal Amazon bed for a very obvious reason—only a limited number of crawling insects can walk the two supporting tight ropes in one night. It is a problem of traffic. And we had learned that by creosoting the ropes we could set a "stop" signal on the crawlers.

OUR CAMP IS VISITED
BY A MYSTERIOUS
MIDNIGHT MA-
RAUDER

The first night passed uneventfully, and next morning we started work on the hydroplane. With marine glue, canvas, and mahogany strips, which we always carried in the tail section, we were able to patch up the broken hull, for the damage was not serious. The big difficulty lay in getting the plane into the water again, for the river's level unfortunately had dropped while we were at work. Two men could not possibly move the plane; so there was nothing to do but cool our heels until the river should rise again.

About the middle of the third night on our jungle isle I was awakened by a hoarse whisper from Hinton:

"Steve, wake up."

"What's the matter?"

"Something's prowling around camp. Sounds like a great big animal."

Carrunch!

Walter was right! A ponderous, a loud, a threatening crunch!

Only a fitful light came from our camp



HE HANGS HIS MEAT OUT TO DRY LIKE LAUNDRY

When a bundle of *carne secca* (dried beef) gets wet in the Amazon it soon sours. This Indian, staggering under a load of foul-smelling meat, is taking it to a point of rock where he will spread it out to dry and partly deodorize in the sun. This meat appeared for supper on several occasions later and was always recognized by its special odor and flavor, no matter with what else it was incorporated.

fire, which we kept going all night to make the island seem less lonely.

Crunch! Crunch! Crunch!

"Sounds like an elephant," whispered Walter, and I agreed. By light of day both of us knew that elephants are not likely to be roaming about the Amazon Basin; but this was midnight, and big branches were breaking and trees were cracking on the other side of that fire!

We lay still for ages—listening. Then a strange swishing sound could be distinctly heard, as if some large creature



VISITED BY INDIANS AT THE ARACASA CAMP

The canvas fly served double duty for both Hinton and Stevens, and when it rained it was necessary to sling the two hammocks very close together, with the two occupants headed in opposite directions. The clearing was not natural, but was cut with hand ax and machete. These natives often appeared in camp without warning and noiselessly. One moment the camp would be empty, and the next, on looking around, it would be filled with a group of silent Indians.

were moving through the long grass. Surely no elephant would make a sound like that. It must be an alligator! I remarked as much to Hinton.

How far can an alligator reach with his jaws? The disquieting thought spurred me to action. I suggested that we get up and cinch our hammocks farther off the ground.

This we did, and, once on our feet, both courage and curiosity began to assert themselves. I dug out my flashlight and a revolver too small to be useful. Meanwhile a medley of crunching, snapping, and swishing sounds continued to break the stillness of the night. Neither of us was inclined to wait passively to be devoured by some unknown beast, so we decided to meet the monster.

Armed additionally with an ax and a machete, we wormed our way toward the noise. I turned the flashlight into the black jungle. We could see nothing, but the sounds grew closer.

All at once a terrific crash resounded

in the dark. Trees shivered, limbs gave way, and some large animal made off into the forest at full speed, bumping trees and breaking things right and left in its mad flight. For some time we could hear it tearing through the jungle.

Although we were still unenlightened as to the identity of our guest, it was at least comforting to know that he was of a retiring disposition, and after his departure we managed to get to sleep again.

By morning light we examined the scene of our night's adventure and, finding hoofprints much like those of a cow, we came to the conclusion that all the commotion had been caused by a tapir, that queer but harmless animal, with both swinish and bovine characteristics, the largest quadruped of the Amazon jungles, sometimes weighing as much as 500 pounds (see page 392).

INDIANS ARE ENTERTAINED

Two days after the tapir episode we entertained other visitors. Four Indians,



TWIN BEDS IN THE TROPICS

"Home, Sweet Home" in the Brazilian forest—two hammocks and one fly. The camera was tripped with a piece of thread (Stevens left, Hinton right).



PURSUED BY PIRANHA

Hinton and Stevens flew together practically all the time, but on a few occasions the plane was used to ferry a passenger down river. Then it was necessary for Stevens to start the motor, dive overboard, and swim ashore, as it was impossible to return to shore any other way, once the propeller was in motion. Dr. Rice made this picture of the swimmer scrambling up the muddy, vine-covered bank before some sharp-toothed fish should nip him in the ankle.



EACH MAN HIS OWN DENTIST ON THE UPPER URARICOURA

This native has filed his teeth to the sharpness of a piranha's (see text, page 377) in the belief that thereby he is preventing their decay.



A MAYONGONG YOUTH

The well-defined constriction on his upper arm shows that the binding began almost in his infancy (see, also, illustrations, pages 398 and 411).



A MAKU SQUAW AND HER HUSBAND; PARIMA RIVER

There is little in their costume to distinguish the men from the women in this tribe; they even affect the same style of hair "bob." The woman has decorated her shoulders with an old piece of cloth for the occasion of having her photograph taken.



A BELLE OF THE RIO PARIMA

This Maku Indian maiden has been diverted momentarily from her occupation of preparing farinim (see illustrations, pages 414 and 415).



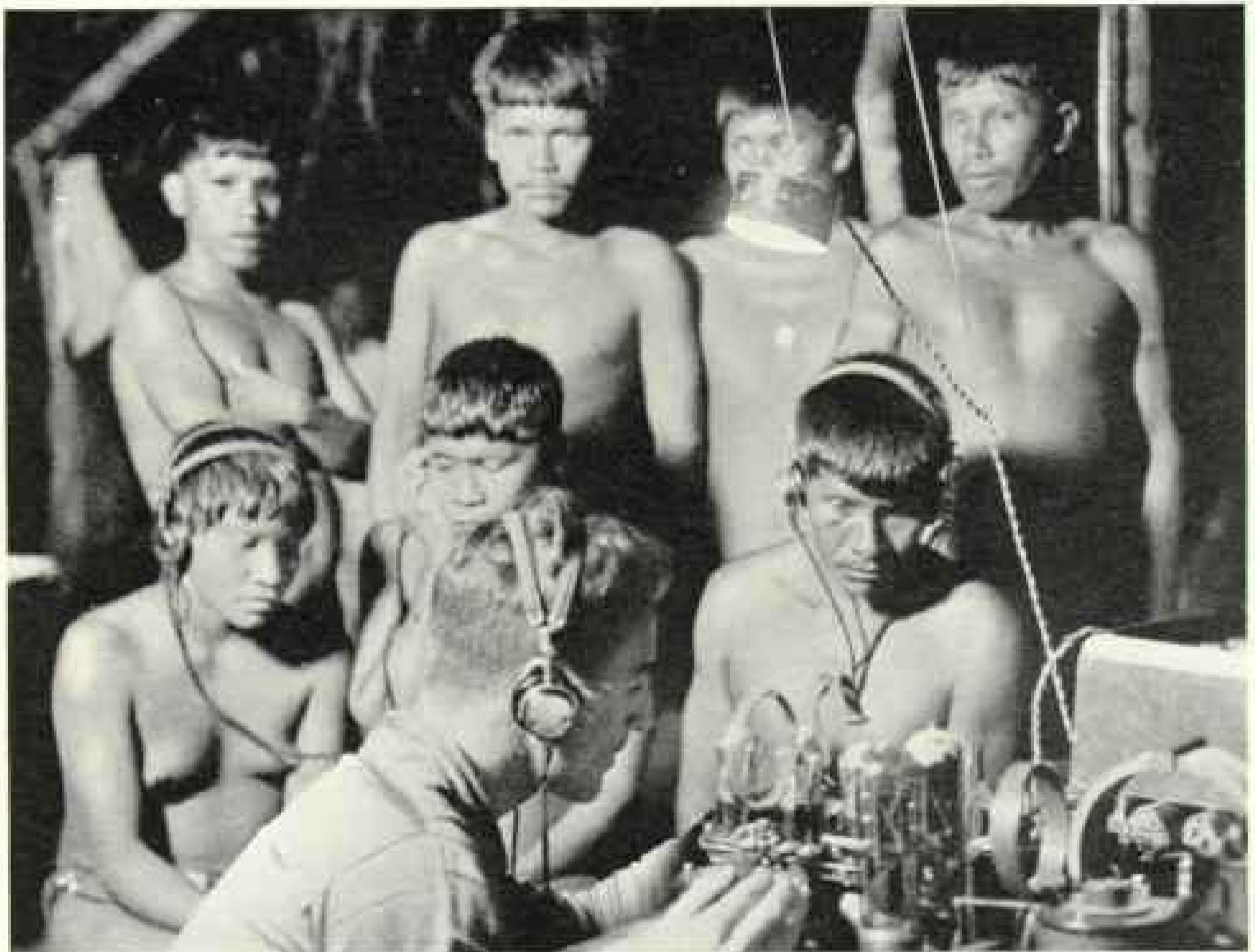
YOUNG MEDICINE MAN OF THE MAYONGONG TRIBE

His rawhide bag contains pebbles, roots, and a miscellaneous collection of rubbish with which he works his healing magic upon the credulous.



PRECARIOUS SLEEPING ACCOMMODATIONS: THE ONLY BED KNOWN TO THE UP-RIVER INDIANS

It is remarkable how the natives rest in such contrivances. As a matter of fact, they sleep very lightly, but put in quite long hours, for they go to bed at nightfall, as a rule, and often are to be found in their hammocks in the daytime, if in camp. They may be seen around a campfire in the evening smoking and drying fish; if not so engaged, they are likely to be in hammocks. Mosquito nets are unknown among the Indians; this accounts for some of the wicketfulness of native sleepers. If in a malacca, or community hut, the presence of smoke from cookfires tends to lessen the trouble from mosquitoes.



MAKU INDIANS OF THE RIO URARICOERA LISTENING TO A TALK ON EDUCATION
BY JUDGE GARY BROADCAST FROM PITTSBURGH

On setting off the flashlight the Indians suddenly departed, head sets and all, but fortunately the plugs pulled loose. From a distance of 25 feet they were coaxed back again. Jazz music meant nothing to them; neither did songs or recitations. They got more "kick" out of an ordinary mouth-organ, or harmonica, than out of the radio. Weight and bulk considered, a mouth-organ possesses greater trade possibilities than almost any other article except a burning-glass or a good knife (see text, page 412).

three men and a boy, were passing down the river in a dugout and, spying the wisp of smoke from our camp fire, stopped to investigate.

We were boiling fish for breakfast when they appeared, and here arose a question of etiquette: How was Civilization to introduce itself to Primitive Man?

The approach might be extremely important. Dr. Rice had been attacked a few years previously by a hostile tribe of Indians on the Orinoco slope, and 200 miles away to the southwest 68 members of an oil-prospecting party were massacred only two years ago.

Breaking bread was a peace offering long before the olive branch was thought of; so we pointed to the fish in the pot and indicated by signs that they were to help themselves. This they did with

evident satisfaction, thus sealing a pact of good will.

Our visitors were superior in appearance to the Indians we had met down river. In facial contour they resembled Mongolian types, and their straight black hair was cut in a "soup-bowl" bob.

We must have seemed veritable white giants to these natives, for the tops of the men's heads came parallel with our chins.

Each individual was scrupulously clean, and we observed that they bathed regularly. We found them to be keen mentally, sturdy, contented, helpful and kindly to each other, but each man thoroughly independent and self-sufficing. This was the first time, apparently, that they had had any contact with civilization. They had no iron whatever, their



OCCASIONALLY THE HYDROPLANE CAMERA WAS BROUGHT ASHORE TO PHOTOGRAPH DISTANT MOUNTAINS

The interested spectators are Mayongong Indians. Sometimes, after the author had taken photographs of natives, he developed and printed small negatives overnight in order to show his subjects their pictures the next morning.



TOASTING THE AERIAL CAMERA BEFORE THE DAY'S FLIGHT

The atmosphere of the Tropics contains so much moisture that water condenses upon a cool glass surface. It was necessary, therefore, to heat the camera gently before the fire in the early morning, so that when it was installed in the hydroplane the lens would not fog.



ANTS HAD SUPPED ON THIS SHIRT OF HUNTON'S (SEE TEXT,
PAGE 408)



THE TALLEST OF THE MAYONGONG INDIANS CAME HARDLY MORE
THAN SHOULDER-HIGH TO MEMBERS OF THE EXPEDITION



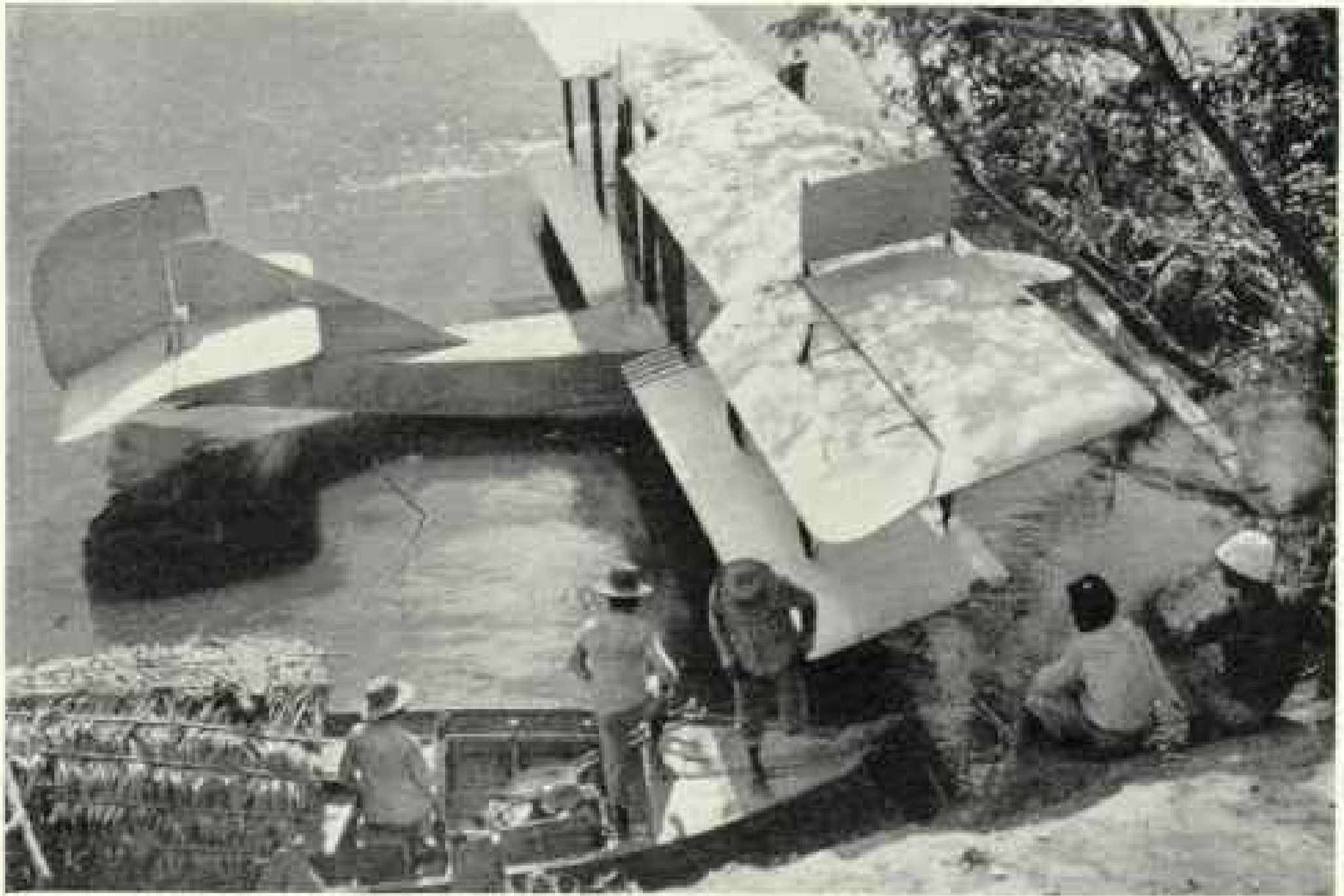
CONVERTING REED INTO BINDING TWINE

Two small blocks of wood divide the reed into four thin, pliable strips, which are used in erecting rough, temporary shelters in the forest. When cut green the strips are flexible and tough and take the place of valuable cord.

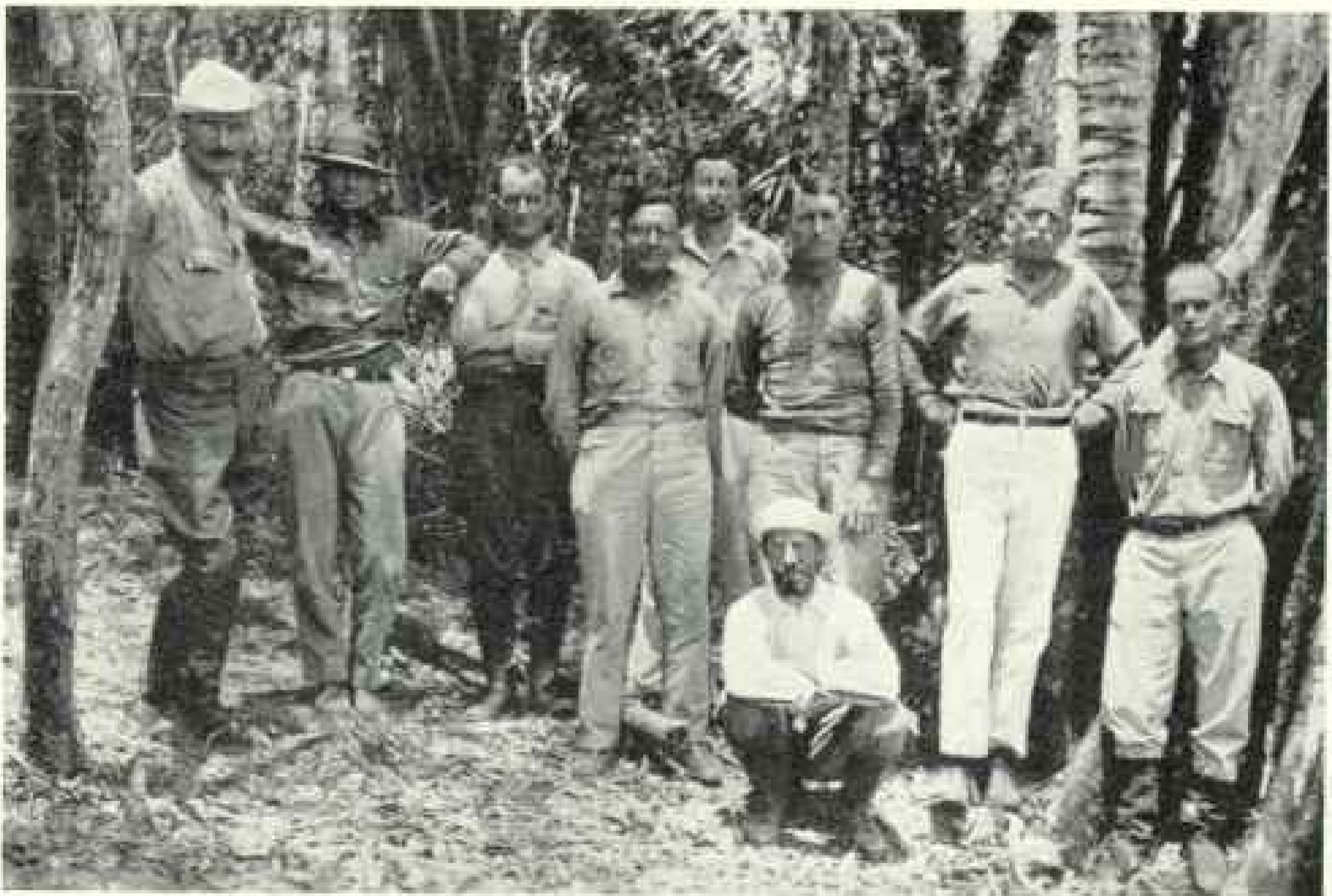


FLASHLIGHT OF A NIGHT'S LODGING IN THE AMAZON VALLEY

The bit of canvas spread over a ridge pole provides shelter from the rain for the occupant of the hammock, surrounded in mosquito netting. Above the shelter are the ends of vines which had to be lopped off to afford swinging space.



THE "ELEANOR III" TIED TO A BUSH IN THE SWIFT CURRENT OF THE URARICOERA. In the foreground is one of the canoes used by the expedition. The thatched awning amidship protects the cargo from rain and sun.



NINE OF THE WHITE MEMBERS OF THE RICE EXPEDITION, AT KULÉKULÉIMA, NEARLY 1,700 MILES FROM THE MOUTH OF THE AMAZON

Left to right: Stevens (observer); MacCaleb (radio telegraphist); Wildhusen (mechanic); Camara (interpreter); Arnold (astronomer); Hinton (pilot); Dr. Hamilton Rice (chief); Dr. Shattuck (physician); and stooping, Santos (motion-picture photographer). Forty Indians were employed in this region.



TALKING TO THE INDIANS THAT VISITED THE FLIERS AT KULEIKULEIMA ROCKS
One of the natives is slapping himself vigorously because of insects (piums).

boat and weapons being forest products, yet they saw at once the value of metal, for they did their best to obtain our machete by trade.

The hydroplane was on the other side of the island, screened from camp, but we had worn a slender trail to it, and, although hardly discernible by us, the Indians saw it soon enough. Evidently their curiosity concerning our method of arrival was aroused, for with one accord they arose and filed down the trail. They were not greatly surprised at the sight of the big plane; they seemed to think that the white giants might have almost anything.

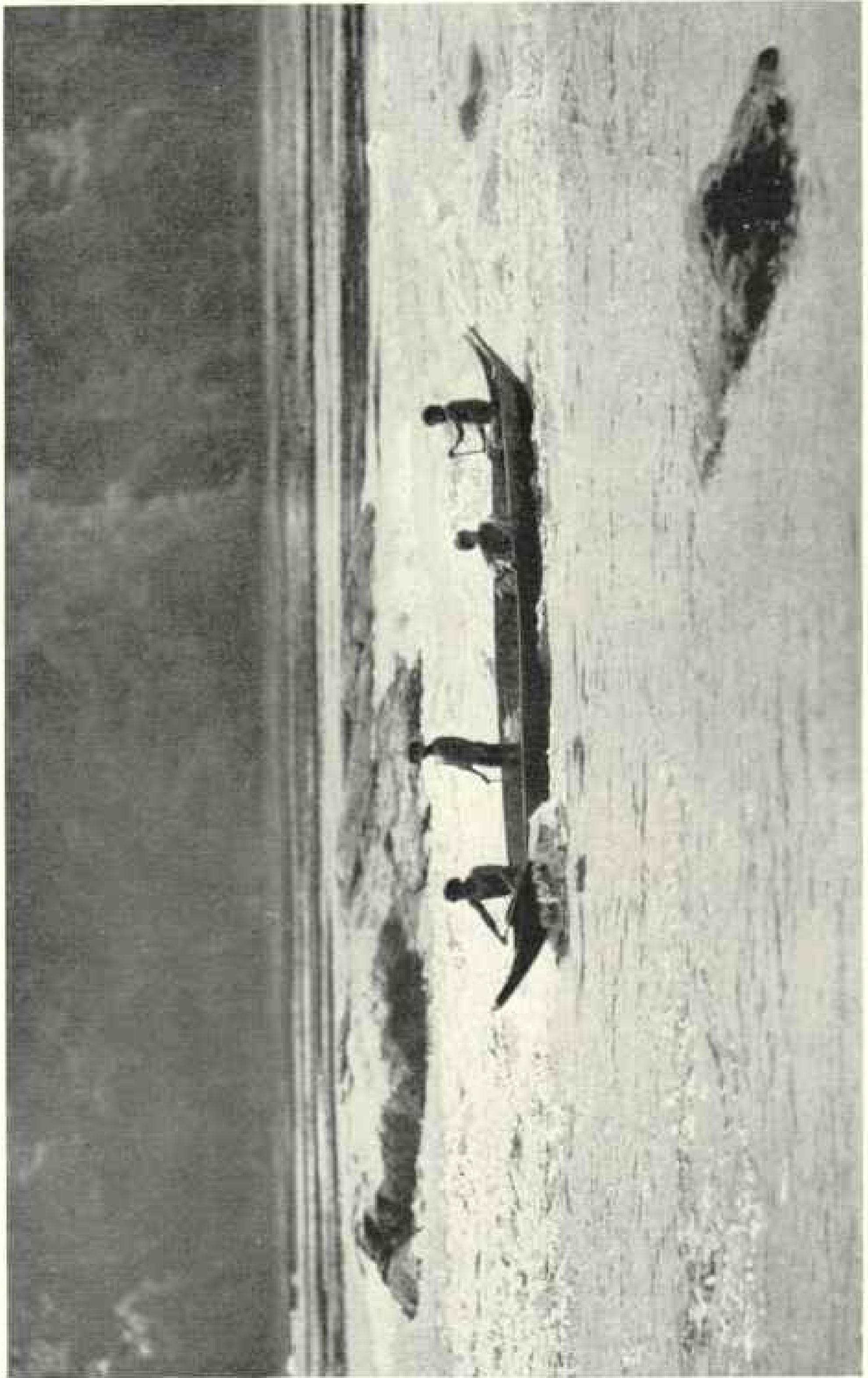
These Indians, Hinton and I noticed, were not bothered in the least by mosquitoes or gnats. Their fine brown skin, smooth and satiny, showed no evidence of insect attacks, although they wore nothing for protection. We developed a

theory that their failure to use either salt or sugar so changed their blood and perspiration that they were not attractive to insects.

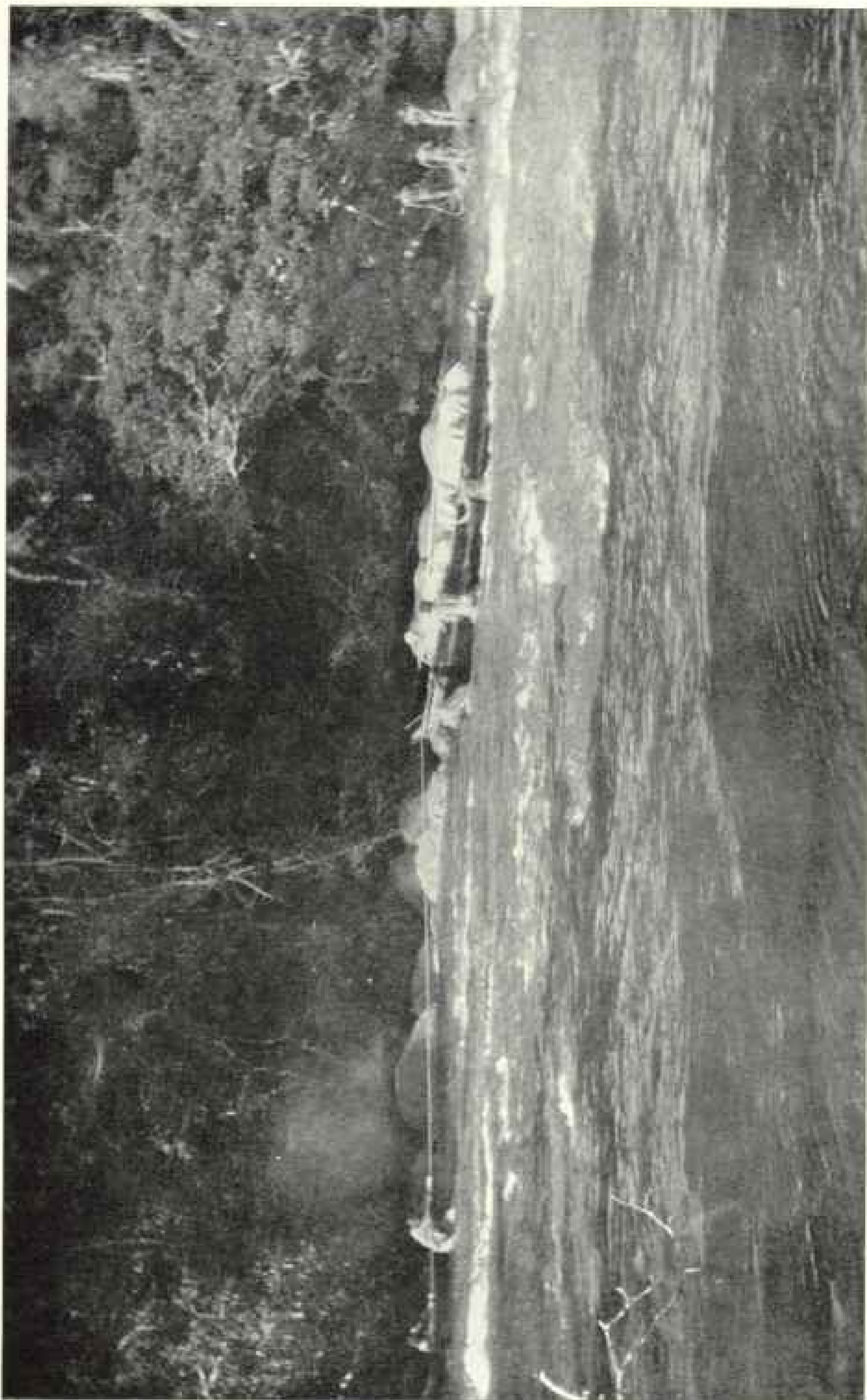
The Indians later on met our main party, but Hinton and I never saw them again. We mentioned to members of the expedition the peculiarity which had so impressed us, and we were informed that our savage friends, when last seen, were slapping mosquitoes with great energy. This seemed to us to bear out our supposition that when they began to eat white men's salt and sugar their insect troubles began.

FLYING INSECTS WORK IN DOUBLE SHIFTS

If unmolested, crawling insects, with few exceptions, will not sting or bite; flying insects, on the other hand, usually are out for blood and work in double shifts. During the day swarms of piums



MAKU INDIANS SHOOTING THE SHALLOW FALLS AT KULIKULIIMA (SEE TEXT, PAGE 388)



PULLING AND PUSHING A LADEN CANOE THROUGH RAPIDS IN THE RIO URARICOERA

The men alongside the canoe sometimes find footing and push, and at other times hang helplessly to the craft until their feet find rocks again. If the stout bowline ever breaks, the canoe is sure to turn broadside and upset.



HIS FIRST SHIRT

This Maku chief finds difficulty in fastening the white man's gift around his neck and calls on his squaw for assistance, much as a civilized husband sometimes calls on his wife for help in a similar difficulty.

(gnats) pester mankind; during the night swarms of mosquitoes take up the work where the pioms leave off. The pioms draw blood and the bite itches. One must not scratch these bites for fear of extending the area of irritation or, what is much worse, for fear of causing the dangerous tropical ulcer.

As dark approaches, the mosquitoes come out in great hordes. Unlike North American mosquitoes, they make very little noise while pursuing their vocation, but signal their arrival by puncturing the skin. There are so many of them and so many natives carry the malaria parasite in their blood that, sooner or later, one is almost sure to become infected.

A SCOURGE OF ANTS

One night Hinton hung his shirt up on a fish line. The next morning when he started to put the garment on it nearly fell to pieces in his hands, being mostly

holes (see illustration, page 402). Investigation showed that during the night a labor battalion of ants had gone up and down the line like a file of coolie coal-passers, cutting the shirt to pieces bit by bit.

Nor was this our only experience with ants. There are ants everywhere in the Amazon, and all kinds of ants—black ants, red ants, and white ants, great ants and tiny ants. They get into everything and eat almost anything. They boarded our plane by the hundreds and flew as stowaways, but fortunately the paint of the wings and hull was not to their taste.

Ants appear in one's food always, whether in settlements or in camp. Often one puts a spoonful of native sugar into his cup, skims off the ants from the surface of a little hot water poured in to dissolve the sugar, and then adds coffee. This method seldom removes all the ants,



MAYONGONG SQUAWS AND THEIR CHILDREN AT KULEIKULEIMA ROCKS



SHOOTING THE KULEIKULEIMA RAPIDS—A FEAT WHICH ALMOST ENDED IN TRAGEDY

The two Indians made this daring trip for the benefit of the expedition's motion-picture photographer. A few seconds after this photograph was made the canoe was caught in a whirlpool and both men were thrown into the seething water. It was only with great difficulty that they were rescued (see text, page 415).



MAYONGONG INDIAN DRAWING HIS BOW

Considerable muscular effort is required, as the bow is very stiff, because of the hard wood from which it is made.



INDIAN MERCHANTS BOUND DOWNSTREAM TO TRADE

but after the coffee is added they are not readily seen!

One of the most dreaded insects in the Amazon Valley is the large *tucandeira* ant, whose sting is excessively irritating. Some Indians use it to test the manhood of their boys. When a youth reaches a certain age he must put his arms into a hollow bamboo containing a colony of the insects, and if he endures the grueling test without flinching he is received into the tribe as a man—a quick and certain method of assaying courage.

THE RIVER RISES AT LAST

After three days of rain, on the tenth day of our exile on the island, the river rose and, much to our relief, floated the hydroplane again. We had pieced out our meager store of provisions by catching fish, but our salt was gone, and fish without salt is anything but a delicacy. The *Eleanor III* took off beautifully next morning and we shook loose the grip of the jungle. Twenty miles from Boa Esperança we sighted the rescue party, which had been sent to hunt for us, struggling through the rapids.

I left Boa Esperança in a canoe the next day to take a message to the rescue party to push on with supplies to Kuleikuleima. At the first rapids I was astonished to hear the sound of the hydroplane motor above the rush of the waters. There it was over us. I could not figure out why Hinton should be flying, since we had agreed that the plane was to wait until more gasoline had been brought forward.

Hinton swooped and a can was dropped out of the plane. I learned later that this contained a message informing me that he had Couzens on a short sight-seeing trip, but the can went over the rapids and the Indians and I spent a fruitless hour searching for it.

Hinton and Couzens had an exciting "pleasure" trip, due to failure of the pressure tank on the gasoline feed. For such emergencies a hand pump is located near



A YOUNG, WELL-BUILT WARRIOR OF THE MAYONGONG TRIBE

Why does he bind his arms so tightly? Why do the Chinese bind the feet of their girls? Just a mark of distinction, perhaps. This binding of the arms was quite as common as the perforation of the ears, both with women and men. In some cases the legs were bound similarly, below the knee.

the observer's seat, and Hinton put Couzens to work on it.

Ordinarily one probably could not push down on a pump with the left hand 12 strokes per minute for an hour and a half. That would be squaring the daily dozen. But Couzens did it. Indeed, he worked so valiantly that he kept the pressure a pound above the minimum requirement! He told us afterward that when he felt tired he just looked over the edge of the ship, and the sight of the jungle below had a most stimulating effect.



A LARGE SPECIMEN OF THE VORACIOUS FLESH-EATING PIRANHA

These fish, though not very large (seldom more than a foot long) are the most feared on the rivers of the Amazon Basin. In catching them the members of the expedition used copper wire between the line and hook. Their teeth would sever two strands of the size used for locking turnbuckles on an airplane. Three strands of wire, however, would hold them. These fish when pulled out of water make a loud grunting noise and close their jaws so powerfully on the flat sides of a knife blade as to crush their own teeth (see text, page 377).

The gasoline pump gave us our greatest trouble. One replacement did not cure the difficulty, and on two occasions I had to do some pumping myself.

RAIN PELTS LIKE HAIL

Flying in the rain was most disagreeable, especially since early in the game we removed our windshield to save weight and air resistance. With the plane flying at 70 miles an hour, even the gentlest of raindrops struck like hail, and our faces were often purple from the pelting. A storm always compelled us to fly low and through clouds. We never knew for certain whether we would find the river or just the endless sea of jungle on the other side of the shrouds of mist into which Hinton dived the *Eleanor III*.

While radio proved its value again and again during our journey, both its magic and that of the hydroplane seemed to be

lost on most of the Indians of the upper river basin.* Dr. Koch-Grünberg, who had been through this region with a previous expedition, had with him a portable phonograph and wax disks. He persuaded the natives to talk into the machine, and then had it repeat their words. After that exhibition, nothing could surprise them!

Whenever we took off in the plane, however, the Indians would retreat to the forest and a few faces would peer bravely between the folds of the river bank's green curtains. The noise of the motor seemed to affect them more than the sight of the plane, which they called *O Bicho Grande* (The Great Insect).

The radio interested the natives not at all. A number of times we put receivers over their ears when we were getting jazz music or speeches from Pittsburgh, but neither seemed to arouse any enthusiasm on their part (see illustration, page 400).

FLASHLIGHT POWDERS IMPRESS INDIANS

The flashlight picture made the greatest hit of all. At one camp on the Branco we made a flashlight photograph of one group of Indians while another group looked on. The party "shot" was startled into momentary flight, while the other Indians, who were looking on, laughed uproariously. At another place, however, we came near getting into difficulty by shooting a flash in a *malocca* (communal hut). The natives saw the smoke billowing out of the top of the hut and concluded that we had set fire to it. They gathered around us, gesticulating and jabbering, until we set off some more powder outside to show them that no harm had been done.

It was not difficult to get the natives to pose. Our problem was rather to get them to "unpose." Once they struck an attitude which the photographer desired, they held it indefinitely. No Hollywood director ever had more patient subjects. While we were preparing to photograph or were busy with some other duty, they had the habit of standing on one leg like storks, the unused limb being crooked to permit placing the sole of the foot against the supporting leg at the knee.

* Commander Donald B. MacMillan records a similar attitude on the part of Greenland Eskimos (see page 492 in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1925).

Many photographic problems were faced in the Tropics, not the least of which was the provision, or rather the lack of provision, for dark rooms. At one place the hollow trunk of a big tree served this purpose. The first precaution was to keep the film dry, and as everything mildews in the tropical jungle at the slightest provocation, films were packed in air-tight cans and kept out of the direct sunlight.

Temperature presented another vexing problem, for when developing fluids get above 75 degrees the picture is apt to slide off the film.

I usually developed films at the coolest hour of the 24, and very often this was 3 o'clock in the morning. By charging the so-called "fixer," or hypo, heavily with alum, the soft emulsion was hardened immediately; but we soon found that it was worse than useless to hang the films up before daybreak. In the first place, they would not dry in the moist atmosphere, and, secondly, the wet emulsion proved most palatable to certain nocturnal insects. By morning negatives would look as if some one had thrown rocks through them.

A NEAR-TRAGEDY IS STAGED FOR THE MOTION-PICTURE CAMERA

Hinton and I were at Boa Vista preparing to fly to Kuleikuleima Rocks, when a wireless message came from the advance party that the river had dropped and that our landing place had become a stretch of ugly rocks. A few days later a message came through that the water



FRUIT TO BE EXCHANGED FOR KNIVES, CLOTH, AND BEADS

The members of the Rice Expedition were glad to trade for supplies of farinha, bananas, etc., as to live on the country lessens the burden of transporting food through the jungles.

had risen again and the landing place was once more smooth and deep; so we took off and reached the Rocks safely (p. 368).

Silvino Santos, the Brazilian motion-picture photographer with our party, set up his camera on the Kuleikuleima boulders to photograph two Indians shooting the rapids. The water was very swift here, ending in a whirlpool, and as the Indians came down, Silvino waved them toward the rocks. They became confused and got into the worst water. Up shot the end of the dugout and out went the paddlers. They swept down into the whirlpool, struggling for their lives (see page 409).



GRATING MANDIOCA ROOT IN THE PREPARATION OF FARINHA

The bawn board is covered with pitch and studded with small pieces of flint or with hundreds of teeth of the piranha, making a grater. With a root in each hand, the squaw scrubs vigorously, much like a woman washing clothes, and in a surprisingly few seconds the mandioca becomes pulp. Farinha is the staple food of the Amazon Basin, for the wild Indians as well as for the Brazilians.



DRYING FARINHA ON A HOT SLAB OF ROCK

Farinha comes in the form of small, hard kernels, sometimes white, but usually yellowish in color; but for transportation it is better to make the mandioca pulp into cakes, which when dry are about half an inch thick and a foot or more in diameter. These cakes are stacked in lots weighing some seventy pounds, covered with green leaves, and bound with vines. It requires strong teeth to bite a piece from one of these cakes and to chew it afterward.

A reserve canoe manned by Portuguese-speaking Indians shot out from behind the rocks to the rescue.

"Wait, wait!" shouted Silvino; "I've got to put in another roll of film!"

Fortunately, the Indians ignored the demands of thrilling photography and struck out furiously toward the bobbing figures. The chief actors of the drama, though very powerful swimmers, were nearly exhausted when they were pulled out.

From Kuleikuleima Rocks we flew ahead of the exploring party, sketching the river and photographing those sections which were cut up too much for rapid sketching. By later checks with the ground party we found that the sketches made from the air by the aid of ruled paper and compass were fairly accurate. When corrections of declination of the compass had been made, their percentage of inaccuracy was satisfyingly low.

Our last base was at the junction of the Parima and the Aracasa, where the tributaries join to make the Uraricoera. To this point Charles Bull and his Indians, with great labor, had brought gasoline from Kuleikuleima. Dr. Koch-Grünberg ten years before had pushed on up the Aracasa branch, the lesser of the two tributaries.

WE FLY TO THE HEADWATERS OF THE PARIMA

Near the junction a deep canyon cradles had rapids of the Parima, which have ever been a barrier to white explorers (see page 375).

We were now getting into the mountains. The altitude of our farthest base was more than 1,000 feet above sea level (2,000 miles from the mouth of the Amazon)

On March 11, 1925, we made a four-hour flight to which we had been looking forward since our arrival in Manaus on July 6 the previous year. It fulfilled all our anticipations, for from the moment



FREEDING MANDIOCA OF ITS POISON

The large woven tubes filled with pulp are squeezed by the steady pull of a weighted pole or lever. The pulp is then washed with water and squeezed again, until it is free from its harmful ingredient. This squaw, in common with all other women of the camp at the junction of the Aracasa with the Uraricoera, was naked during the first days after the arrival of members of the expedition. Seeing that the strangers wore clothes, the natives gradually brought out the only wearing apparel they possessed. Note the development of this woman's upper arm.

we entered the Parima Canyon we were real pioneers (see pages 370 to 375).

The rushing waters swept under us viciously, the hills closed in, and the palm trees began to disappear, for the altitude changed the climate; but the jungle still stretched on all sides, muffling the hills and sometimes even the narrowing rapids in green. We discerned many falls in the river and put them on our sketches for the guidance of Dr. Rice's party.



PACK-A-BACKING THROUGH THE FOREST

When the members of the Rice Expedition found it necessary to make portages around swift water, much of the cargo of the canoes was transported in this manner.

The river drops 400 feet in 4 miles in one place. High waterfalls were discovered on the short tributaries coming off the mountain slopes. In the midst of the green we would see a thread of silver water, spun from a source lost in the forest, falling over a sheer cliff into an inkwell of blackness hundreds of feet below (see page 369).

On and on we went, to the headwaters of the Parima and beyond. We rose to the watershed of the range, where the serrated mountains divide the waters, sending some to the sea by way of the Orinoco and the rest down the Amazon. Here and there along the river banks, and occasionally deep in the forest, we saw the round maloccas of Indians. This was the first time we had ever seen Indian huts away from the watercourses; but this was warring country and it was probably necessary for the inhabitants to take extra precautions (see pp. 370-1-2).

Some of these maloccas appeared to be

occupied and others deserted. Perhaps the owners had been frightened away or killed, or perhaps natural death had visited some member of the communal family. Amazon Indians of this region have a superstition that when an important member of the tribe dies, the others must leave the malocca where the native expired. The tribe never uses the hut again. They clear a new place in the forest, erect a circlet of poles, weave basketry walls, and raise another thatched roof on center poles.

Over the Indian camp sites on the upper stretches of the river we released parachutes, to which were attached beads and trinkets of various kinds. These gifts were peace offerings to show the friendliness of Dr. Rice's party, which was to advance into this country later. None of the ground party was ever molested; so the parachutes may have served a useful purpose.

By this time our gasoline was nearly

half used up, so we turned downstream through our newly discovered country.

The situation had its ironic side. Here we were, the first white men who had ever penetrated into this corner of the Amazon Valley, discoverers on an old sphere that has been pretty well discovered, charted, and nailed down. Yet we couldn't set foot on our land nor swim in our river. Our eyes were privileged to see magnificent falls, but the swift product of our speedy age whisked us away from the cataracts after a moment's contemplation. From an elevation of 6,000 feet we greeted the inhabitants of this new country with parachutes!

The report we brought back and the maps and photographs of the river were invaluable to the ground party, but obviously the story of De Soto, La Salle, or any of the early explorers would provide not nearly such rich reading to-day if they had used airplanes.

At the head of the canyon was a good malocca, so we swooped to photograph it. This brought us into the superheated air of the valley, and when Hinton tried to rise he found that the radiator water boiled furiously. We were below the canyon rims, 600 feet above the bed of the gorge, whereas we preferred to be 3,000; but there was no way to get there.

The only possibility of coming out was to follow the canyon, taking all the swings of the narrow river, and this we did. With the walls of the gorge rising above us, Hinton banked and wheeled



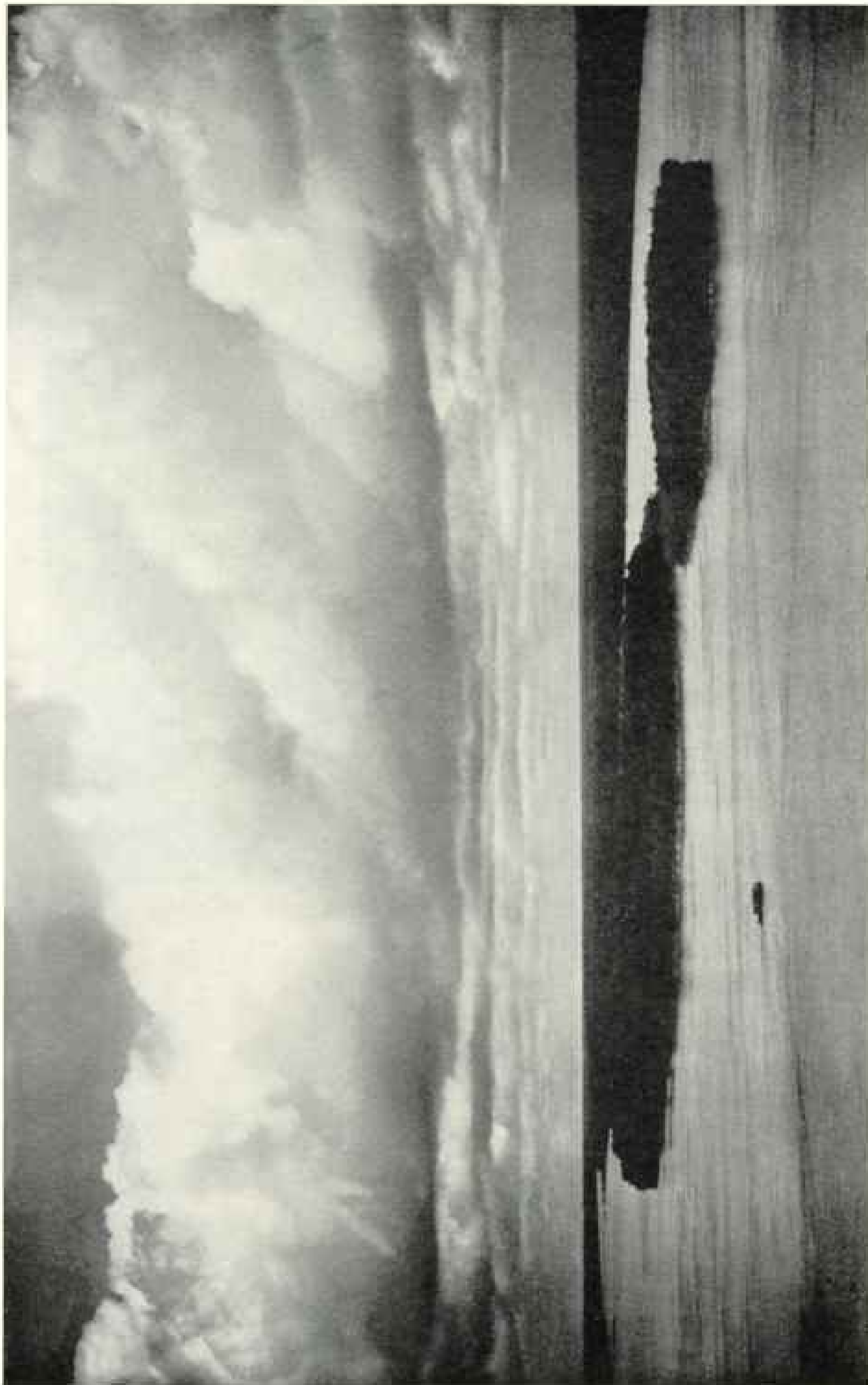
BRINGING IN AN ENORMOUS LOAD OF MANDIOCA ROOTS

Embarrassed by having her picture taken, this young squaw is fondling her youngster's hand to cover her confusion. The roots are quite large; they are scraped before being grated.

and hung to the little altitude we had. "S" turns and angles loomed before us, but finally the end of the canyon came and before us unfolded the welcome sight of a wide, smooth stretch of water.

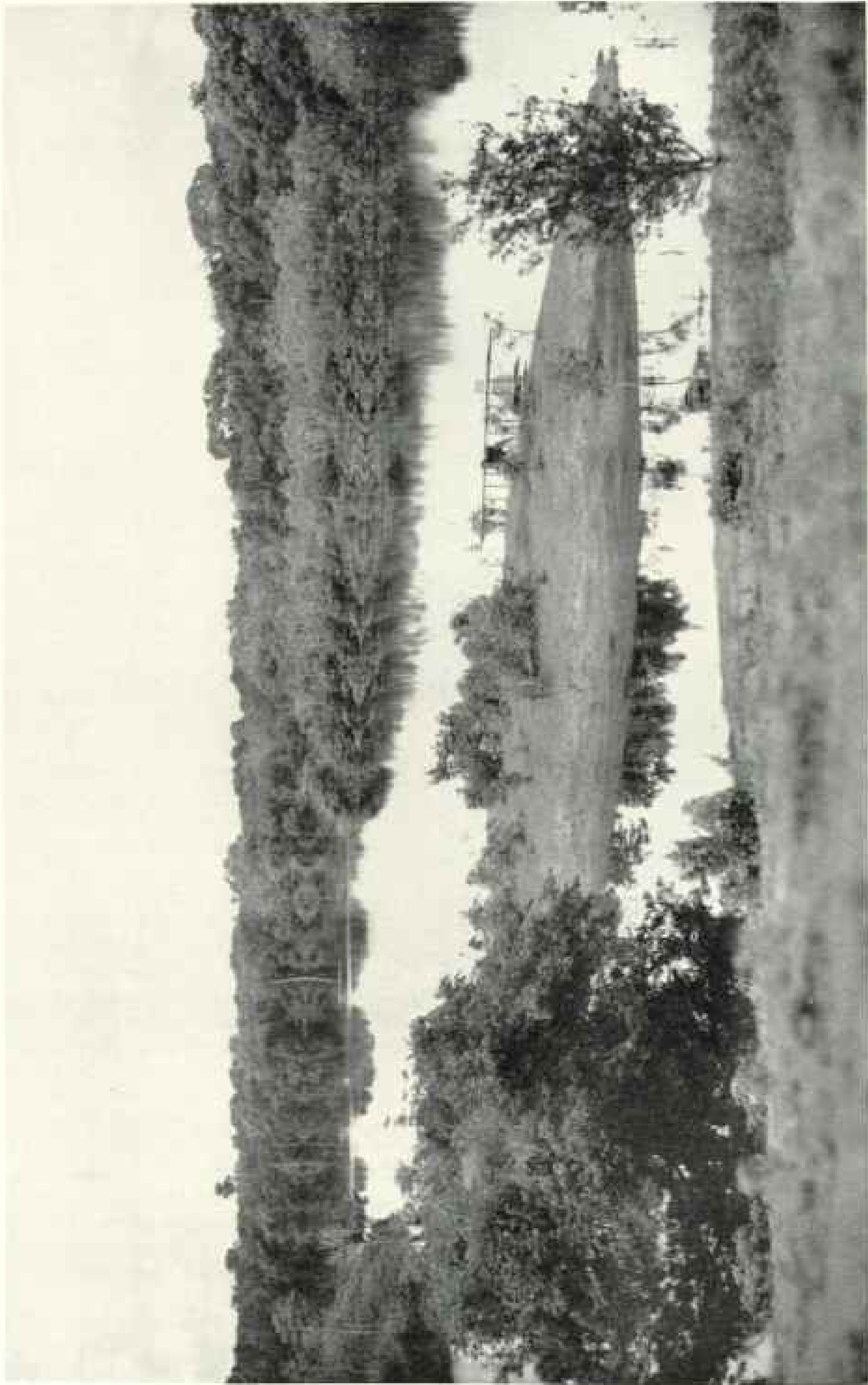
The *Eleanor III* glided down to the base, where Charles Bull and his Indians were waiting for us. We thrilled with satisfaction, for we had finally accomplished that which we had worked nine months and traveled thousands of miles to do.

I was to meet Charles Bull in California six months later and learn from him how useful our air sketches of this unknown country were. On these



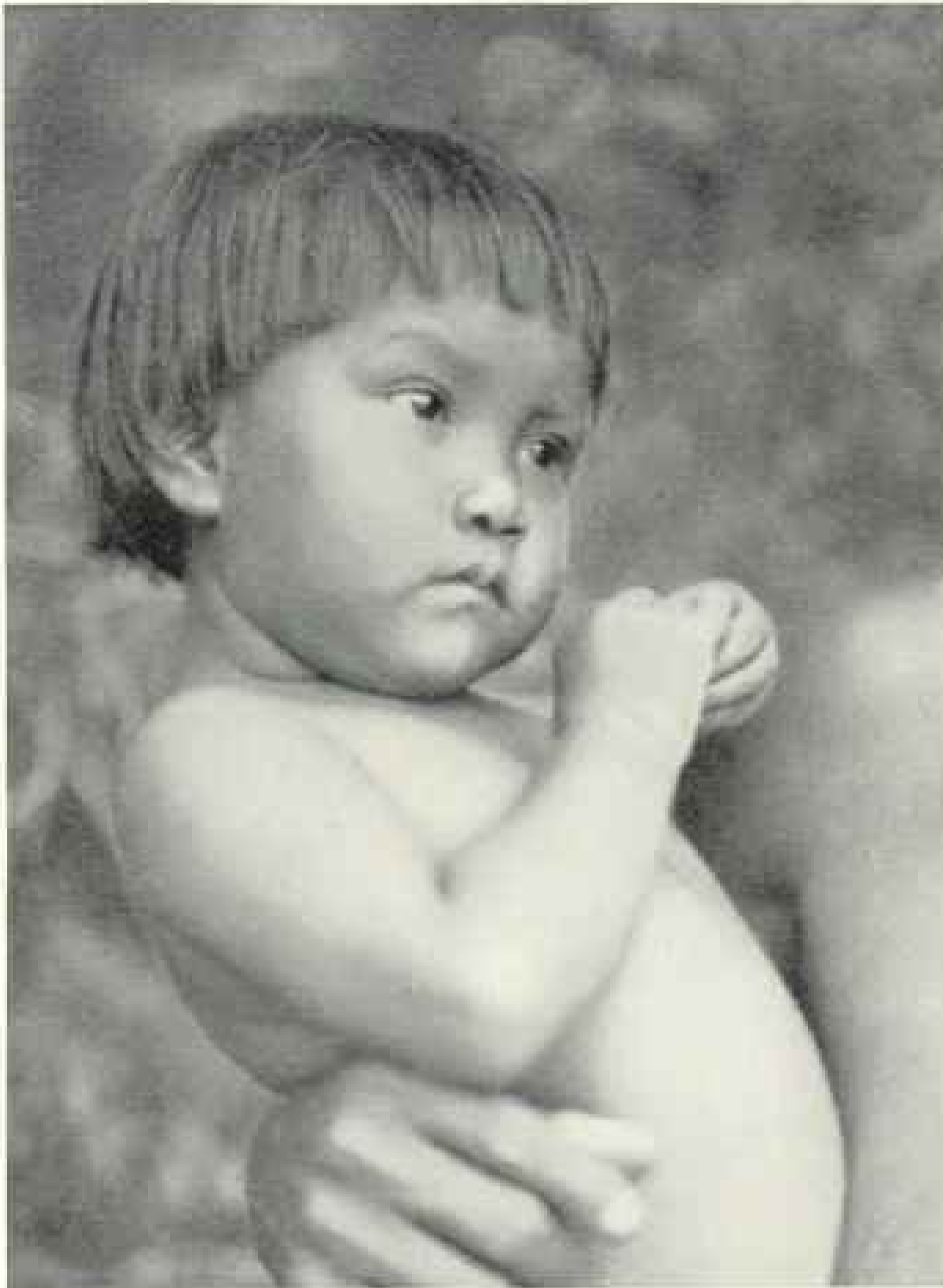
LATITUDE, 0 DEGREES, 00 MINUTES, 00 SECONDS

Looking down the Rio Branco above Cuarena. The Equator passes through the larger island. The launch is bound from Vista Alegre to Carvoeiro, down river, but is zigzagging, presumably to avoid sand bars. This photograph was made as the plane was flying back to Manaus, when the river was at low stage, late in March.



THE ARMEN SUCCESSFULLY SOLVE A CRITICAL PROBLEM IN ACCURACY OF AIR NAVIGATION

Figures as to latitude and longitude were all the fliers had to locate the gas supply left by the steamer of the expedition in this inlet, halfway between Carvoeiro and Maniós. Knowing the latitude and longitude of Carvoeiro, they computed the distance and flying time necessary; when this time was up, they did not see the cache. Flying for ten minutes more, they realized that they had overshot it, turned back upriver, and after ten minutes were rewarded by finding a small house and a hut up an inlet on the left, or north, bank.



A CHILD OF THE UPPER PARIMA

sketches the course of the Rio Parima was shown, with its bends, its waterfalls, stretches of rapids and islands; all tributary streams were shown, with their directions and the estimated percentage of flow added to the main stream. Indian clearings and huts, nearly always concealed from view from the river itself, but easily visible from the plane, were indicated.

THE RETURN TRIP IS SPEEDY

When the surveyors, a month and a half later, had pushed their canoes to the farthest attainable point and were halted by the narrowness of the river and high waterfalls, their only criticism was that our sketches were 8 degrees off in direc-

tion, due chiefly to airplane compass error caused by proximity of the engine.

Dr. Rice and his main party later pushed on up the Parima to its source. We left them at Kuleiku-leima Rocks and began the return flight to Manaos, which was made in four actual flying days, in sharp contrast to the two months it takes to go upriver by steamer, launch, and dugout.

Two welcomes awaited us at Manaos. The English and Americans of the town cheered us heartily, while the local police, officials of an entirely new city government, asked by what permission we landed there and whence we came. We were haled before the chief of police, then before the new governor, who, after due consideration, decreed that we might fly provided we notified the police first, a condition to which we

readily agreed, now that our 12,000-mile flight to the headwaters of the Parima was an accomplished fact.

We made one more flight after that, to get pictures of the mixing of the yellow waters of the Amazon with the black waters of the Negro (page 378). Opposite Manaos the Negro is about four miles wide, and a stiff wind across stream made the surface choppy; on landing the "spank" of the hull across the wave tops proved too much for the many patches we had made on the boat, and some of the canvas strips came loose.

We immediately had the plane pulled ashore—for the last time. Its days of usefulness were over and our Brazilian flights were at an end.

MARVELS OF MYCETOZOA

Exploration of a Long Island Swamp Reveals Some of the Secrets of the Slime Molds, Dwelling on the Borderland Between the Plant and Animal Kingdoms

BY WILLIAM CROWDER

With Illustrations in Color from Paintings by the Author

IT was still dark when I made my way into the marshy maze. But soon, through the multitudinous openings in the emerald gloom overhead, the sky appeared like liquid splashes of rose-tinged silver, while the waning August moon seemed so tenuous that a breath could dissolve it.

Within the humid retreat the ferns and flowers and dense tangle of wildwood began obscurely to take shape through the shroud of misty shadows. Then, swiftly revealing itself in the increasing light of dawn, was seen in sharper outline that confusing chaos which is as typical of the temperate as it is of the tropic swamp.

Now was resolved a marvelous spectacle. On every side a bewildering riot prevailed; living forms reared themselves among the débris of dead and dying. . . .

This primeval picture of exotic exuberance lay not in some remote and far-away region of our globe, but within a minute's walk from the station of Millneck, on the easily accessible north shore of Long Island, less than 40 miles from New York City.

A SEARCH FOR THE ODDER OF LIVING THINGS

Although a swamp is a paradise for plants, the sweet Elysium and land of honey for many animals, it is, in the opinion of the average man, a dark and dismal reach—wet, insalubrious, filled even with the miasmatic vapors of death. The region seems not to be the birthplace of vigorous, pulsating life, but a vast and soggy graveyard, a treacherous sink wherein death and disaster are supreme.

Nor is this impression without certain cause. A swamp may well be said to have its moods. It appears at its best only to

those in its confidence, revealing a quite charming aspect; to others it turns a sullen and forbidding countenance.

Here is maintained a constant ferment thrilling with life. Nowhere else, on land at least, does such prodigious fertility prevail. Even the sea, magnificent theater of life that it is, does not in certain aspects present a more extraordinary spectacle of the living drama.

It was not entirely from an overweening affection that I penetrated the reaches of my Long Island swamp while the rest of the world was asleep. My errand had been inspired by another and quite singular motive. I was on the way to watch the slime mold in its native haunts, and my objective was a certain old log, lying half-imbedded in the soft, soaked soil, which I knew to be harboring that oddest of living things.

Yet, absorbing as was my errand, I could not help drinking in the beauty of the surrounding scene in the gray light. Festooning the limbs and occasionally descending sheer to the earth, enormous vines hung suspended like giant swings or wrapped themselves like great garlands around the stately trees. On the trunks were expansive patches of greenish-gray lichens, oftentimes decorating their drab background of bark with fantastic figures.

THE WHISPER OF MYRIADS OF MOVING CREATURES

Nearly every low-lying plant that bordered the shore of a brook carried a curious burden of short, slender blue sprigs, delicate and diaphanous, disposed variously over their leaves as well as their stems. Some of these sprigs exhibited an odd contorting movement, bending into tiny loops. Insects! But it was only



Photograph from William Crewler

IN THE HAUNTS OF MYCETOZOA

Although slime molds are usually dormant throughout the winter, a mild day will bring some of them into activity; whereupon they may be observed traveling over the logs (see text, page 424).

when the plants were closely approached that the multifarious hosts made certain their identity; for then the individuals detached and lifted themselves in a murmurous, rustling flight, the entire company dispersing in a glistening haze—a dissolving azure frost-cloud of somnolescent damsel flies!

The log I was seeking had lain on the spot for perhaps a century or more. It was now decayed throughout. Still, little evidence of this condition was manifest from the surface; only at the crumbling of its one visible end and in places where the bark had long since fallen away were there traces of its disintegration.

From the base, which was of a diameter so great that it reached almost the height of my waist, to a point where the trunk tapered toward what had once been the tree top, the cypress was nearly concealed from view by accumulations of detritus and a swaying forest of ferns, some of whose fronds, still laden with dew, looked like silvery plumes.

In one section the bark was mostly gone, and the surface of the exposed smooth wood was punctured with numerous holes—the entrances to the galleries of wood-boring beetles and other insects.

What a teeming population this fragile tenement contained! Applying my ear to



Photograph from William Crowder

SEARCHING FOR SLIME MOLDS

These two collectors are watching mycetozoa making their way over a sheltered log. A pile of wood like this—old, weathered, and in a moist situation—is invariably the habitation of numerous species of slime molds.

the surface, I could hear a faint rustling within, a ghost whisper of myriads of tiny creatures—white ants scraping, enlarging, extending their corridors. Day and night, summer and winter, the tread and toil of the tireless workers continue; nor do their activities abate until the trunk is honey-combed and the frangible shell breaks apart from its own weight; whereupon the termites migrate to a more propitious shelter to continue their destructive labors.

WATCHING THE SLIME MOLDS GROW

Beyond these superficial details there was little in the appearance or the situation of the log to distinguish it from a hundred others lying about in the swamp.

But my business had to do only with that part of the log which was partially concealed by undergrowth and deadwood.

To clear away the plants and incidental débris was the work of a few seconds. Behold! Seldom ever before had such a gorgeous sight startled my unexpectant gaze.

Spreading out over the bark was a rich red coverlet, like the pile of a bright Persian rug, consisting of thousands of small, closely crowded, funguslike growths. They were the objects of my quest—myxomycetes or mycetozoa (see Color Plate XV).

A colony of these tiny organisms extended in an irregular patch over the top and sides of the trunk, covering an area nearly a yard in length and slightly less in breadth.

To such a soft, velvety coat a touch or two was irresistible; but on the merest contact of my finger a cloud of spores arose, settling upon the barer portion of

the bark as an impalpable film of reddish dust and leaving on my skin a tinge of ruby russet.

EACH UNIT RESEMBLED A MUSHROOM

I brought my powerful pocket lens to bear upon the dainty individuals. Each unit, although actually less than a quarter of an inch in height, resembled, in the focus of my strong glass, a miniature morel, a small mushroom, though more marvelous than any I have ever seen.

Of the total height, a third was taken up by a slender stalk which at its base was attached to the bark. Surmounting this stalk was a cuplike expansion, which in turn supported a large, dense, elongated cluster of tangled threads—the sporangium (spore case).

That was all. Simple in form, in detail unadorned; yet how impressive! In the case of some individuals the sporangium was immature, as was evidenced by the filmy, iridescent membrane inclosing them. In others this membrane had burst and was still hanging in shreds, disclosing the compacted mass of spores within the network—indescribable in tint, in translucent texture, and in graceful dignity of form.

For want of a better term, I have called their color *red*. It was one of those rare reds, such as is produced by Nature only in her most delightful moods, as in the rosy reflex of a winter's dawn or in the evening glow that in summer oftentimes transfigures the world as well as the face of the setting sun.

I doubt if any other natural object has a color precisely like these slime molds. It is a red that is almost purple, yet not purple; it is a nuance of red, intriguing, ineffable, that leaves one guessing whether he sees a vibration of color or is receiving only a hazy, illusive impression.

SLIME TRANSFORMS INTO SPORE-CASES

At one edge of the colony the slime molds were less crowded and, it seemed, less mature. In this place was visible a thin patch of glair, about the size of the palm of my hand, which glistened in the shadowy retreat like a filmy layer of silver-leaf (see page 443).

This patch of slime was significant. It was the last trace of a much larger portion that I had been watching for several

days. Even had its nature been unknown to me, I should readily have divined the reason for the diminution of its size because of an event that was now taking place before my eyes—the long-anticipated transformation of the slime into the colorful colony of pretty sporangia just described.

When, a few days earlier, I had been prowling through the swamp, chance brought me upon the log. At that time it was mostly bare over the area now occupied by the slime molds, except for an exceedingly delicate and almost invisible pellicle of a creamy texture which caught my eye.

THE MASS WAS MOVING

After studying the filmy mass I had become aware that it was moving. Spreading out fan-shaped, it advanced its borders almost as slowly as does the hour-hand of a clock. The rest remained stationary and was connected by a cordlike vein that led into a minute crack in the log.

As the advancing edge seemed to be the only part in motion and the area of the mass meanwhile was increasing, it was evident that the materials for this augmentation were coming from within the log by flowing through the vein.

I realized that a migration was taking place—that this curious mass of glair, which normally lives and grows in darkness in moisture-laden tissues of decaying wood, had arrived at the period of its existence when it must reach the outer air and light to reproduce and to enhance the favorable distribution of its spores.

During my visits on succeeding days, the only observable changes had been in the increasing area of the slime and in the shifting of its location. It had wandered, crossed and recrossed its path on the tree trunk, leaving a well-defined trail of organic refuse over its course. Yet slowly and continuously it had kept on the move, like some lost creature uncertain of its way, groping aimlessly about, apparently without other purpose than to follow the most fortuitous route. But in none of its excursions did it travel more than a yard along the length of the log.

Finally its traveling ceased and it began to separate into pellucid particles somewhat smaller than rice grains.

MARVELS OF THE MYCETOZOA

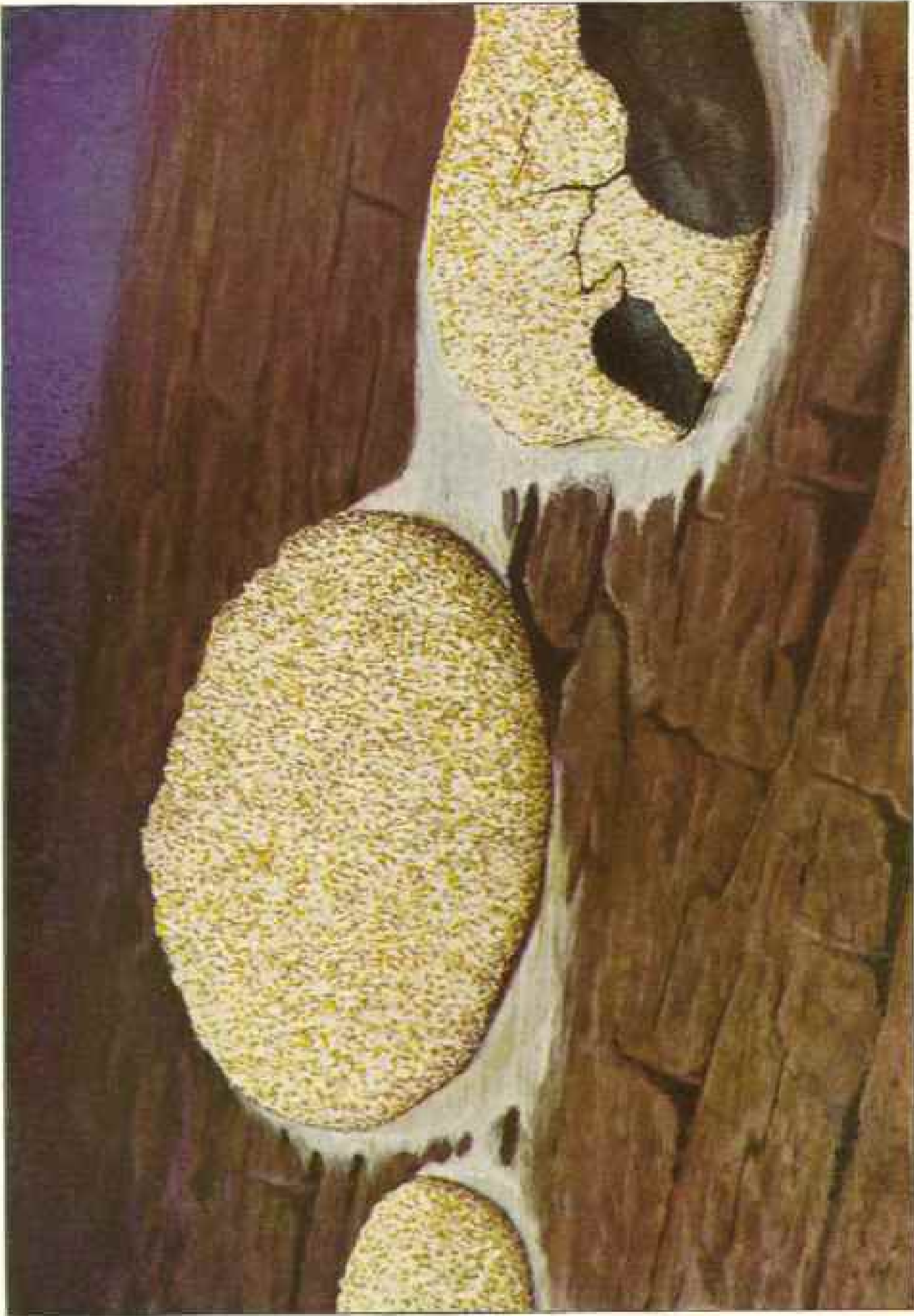


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Painting from life by William Crowder

A SPECIES OF SLIME MOLD FOUND THROUGHOUT THE WORLD

The delicate, funguslike organisms known as myxomycetes or mycetozoa are common in all the moist, wooded regions of the earth. Whether they are to be classed as plants or animals is a question upon which scientists are not yet agreed, although the organisms have been the objects of study for nearly 200 years. The above species is the *Leucocarpus fragilis*, magnified 30 diameters.



© National Geographic Society

Painting from life by William Cressler

THERE ARE MORE THAN 500 SPECIES OF SLIME MOLDS

With few exceptions, the sporangia (spore cases) of slime molds are seldom more than a quarter of an inch in height, but while their minuteness renders the individuals inexpressive, the habit of grouping into colonies oftentimes makes them an imposing spectacle. This species, *Fuligo septica*, enlarged $1\frac{1}{2}$ diameters, is world-wide in distribution.

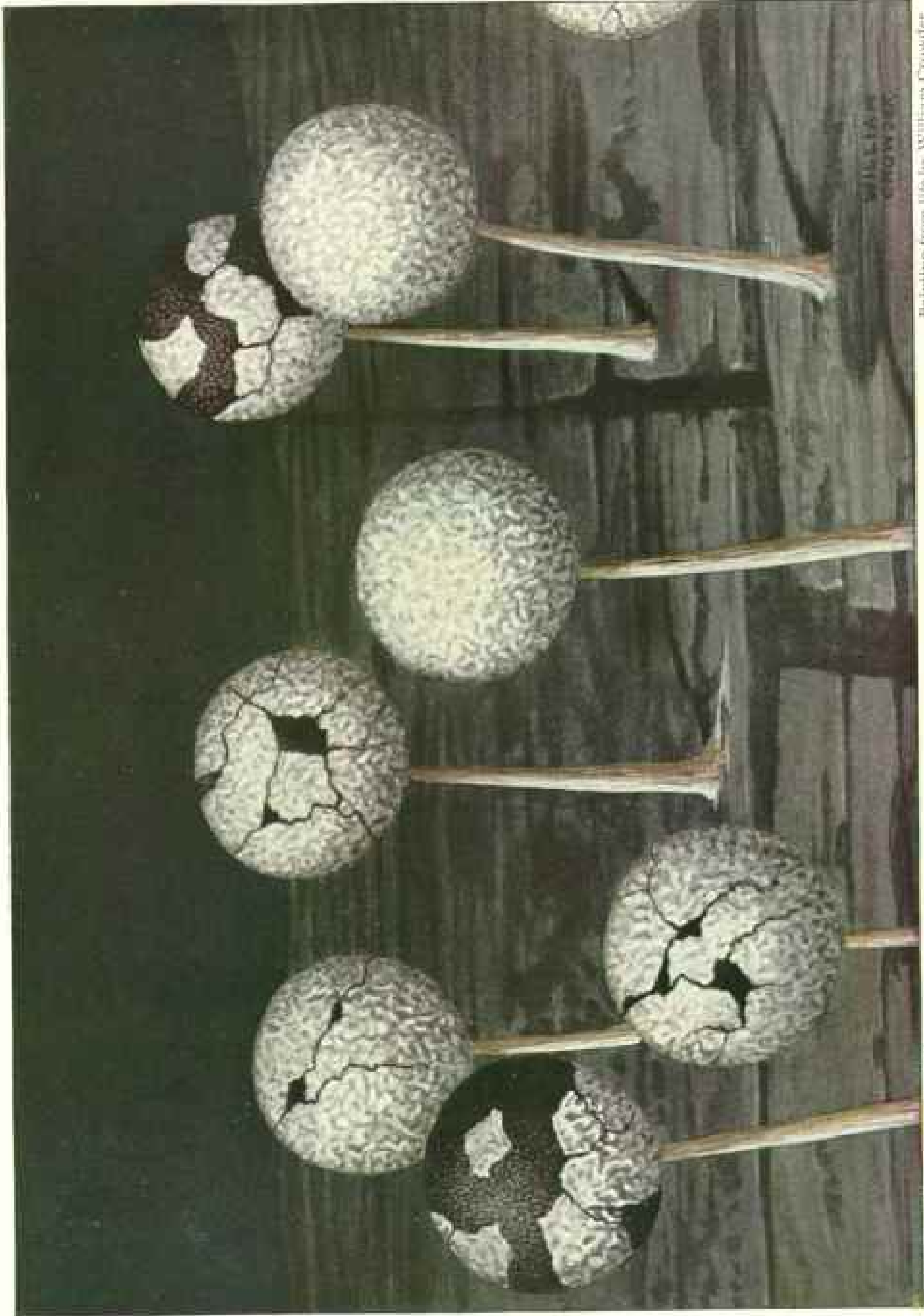


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SPORE CASES OF *BADIHAMIA PAPAVERACEA*, ENLARGED 40 DIAMETERS

Painting from life by William Crowder

The spore is to the slime mold what the seed is to the higher or flowering plants and the egg to the higher animals. Like the spores of mushrooms (see the National Geographic Magazine for May, 1920) and of ferns (see the National Geographic Magazine for May, 1925), the spores of slime molds are microscopic bodies which germinate after coming into contact with water. But unlike the spores of true plants, which develop directly into other plants, the spores of the slime molds produce first an organism, a small colorless speck of protozoans, which in a short time assumes an elongated pearlike form, carrying at its smaller end a thread or lash, which it whips around in the water somewhat in the manner of a traction propeller, thus carrying the microscopic organism into moisture-laden food products.



Painting from life by William Crowder

A MEMBER OF THE PHYSAECUM FAMILY

Individuals of this species (*globuliferum*) resemble tiny beads of porcelain or pearls strawn over dead leaves or wood. Enlarged 40 diameters. The sporangia of certain others of the same family are an intense black and nod at the end of hairlike stalks, reflecting from their glossy surface the blue of the sky; still others collect in groups and strike the eye with a startling shade of scarlet, staining the bark on which they appear like a splash of blood.

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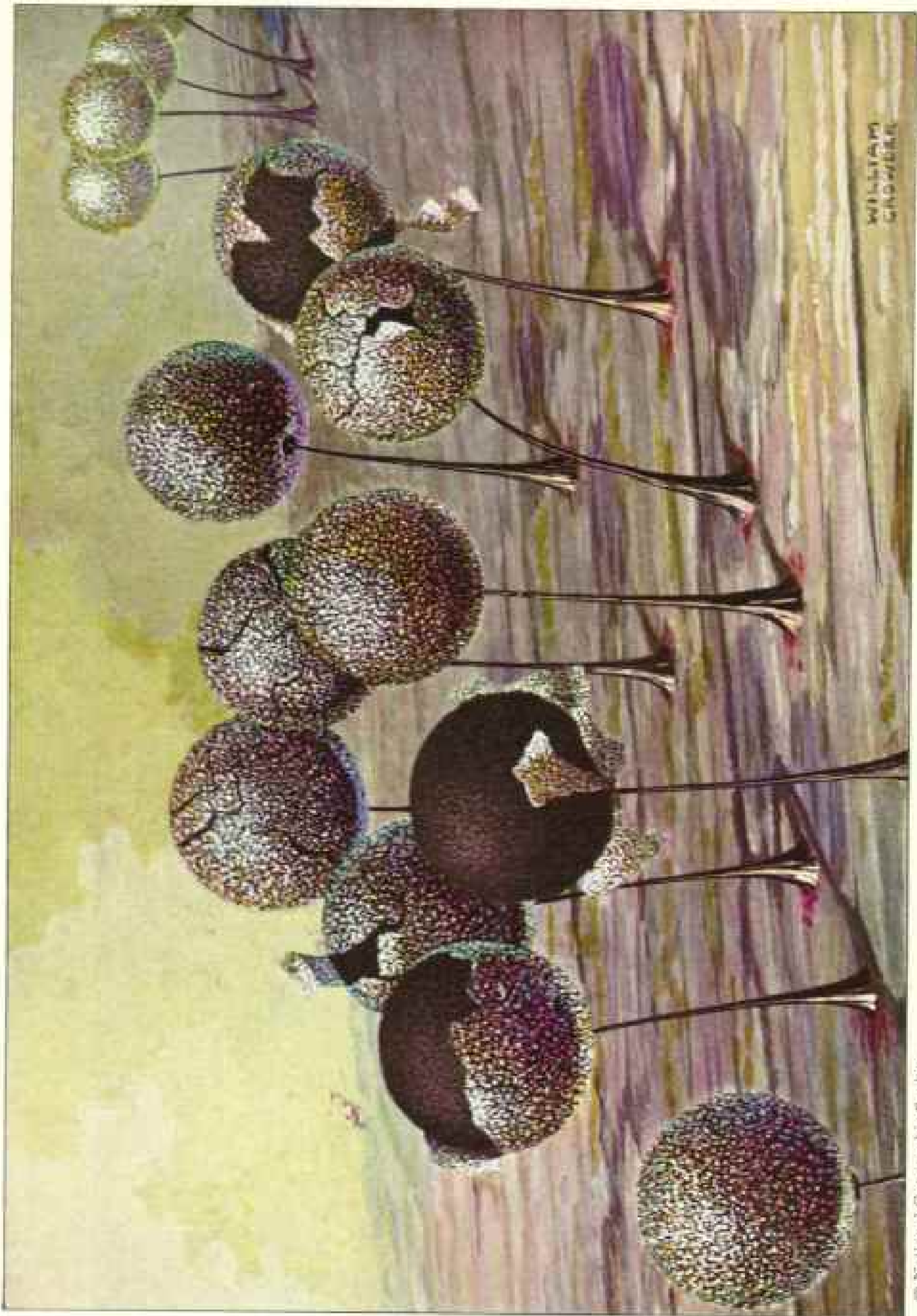


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TRICHA PERSIMILIS IS FOUND THROUGHOUT THE NORTHERN WORLD

Painting from life by William Crouder

There are two distinct phases in the life history of slime molds—the vegetative and the reproductive. The vegetative phase is known as the plasmodium of the species. The substance of the plasmodium resembles the white of an egg in consistency, is slippery to the touch, tasteless and odorless. This specimen is enlarged 40 diameters.

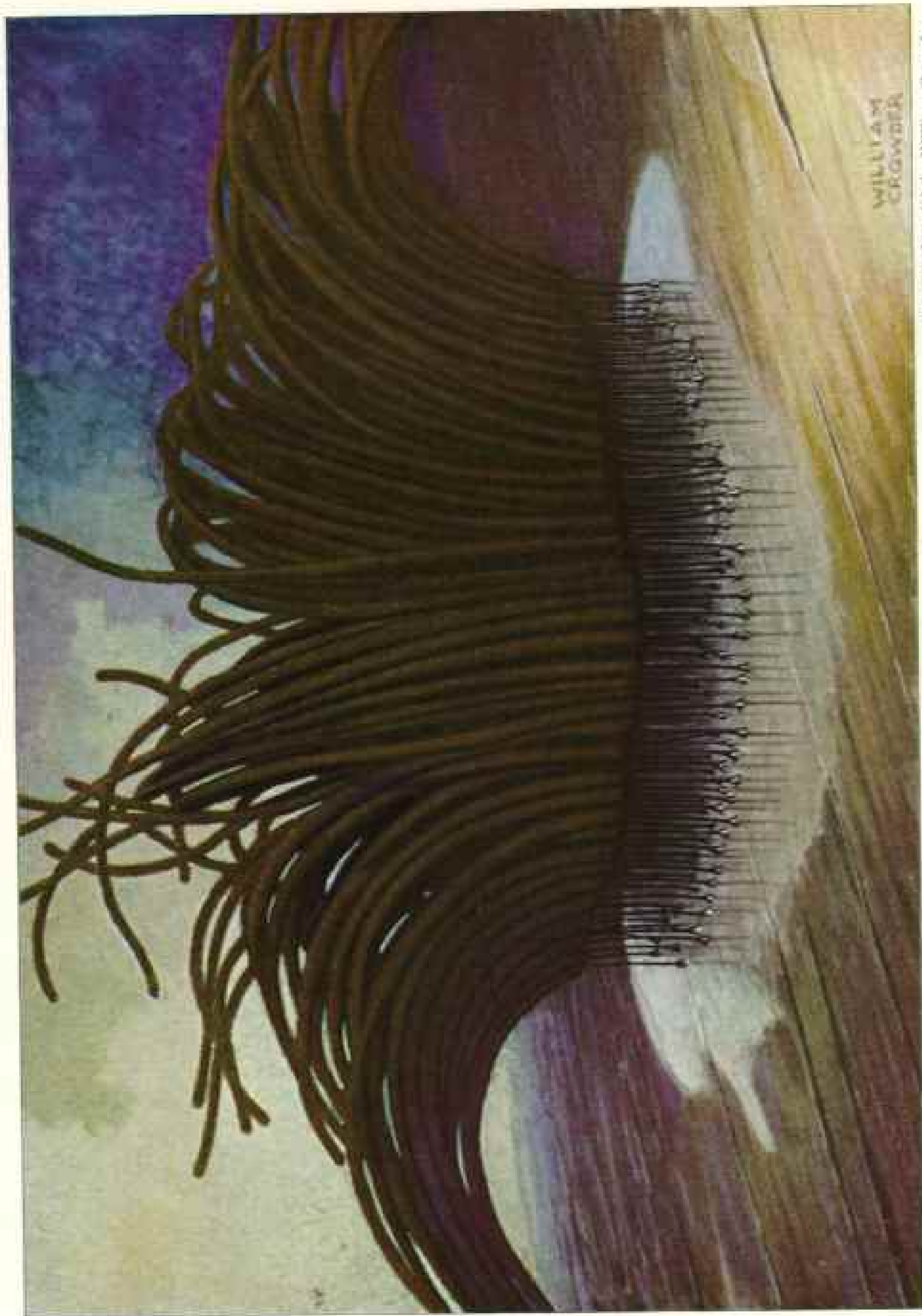


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Painting from life by William Crowther

LAMPRODERMA ARCYRIONEMA OCCURS IN LARGE COLONIES ON BARKLESS, DECAYING LOGS. ENLARGED 40 DIAMETERS

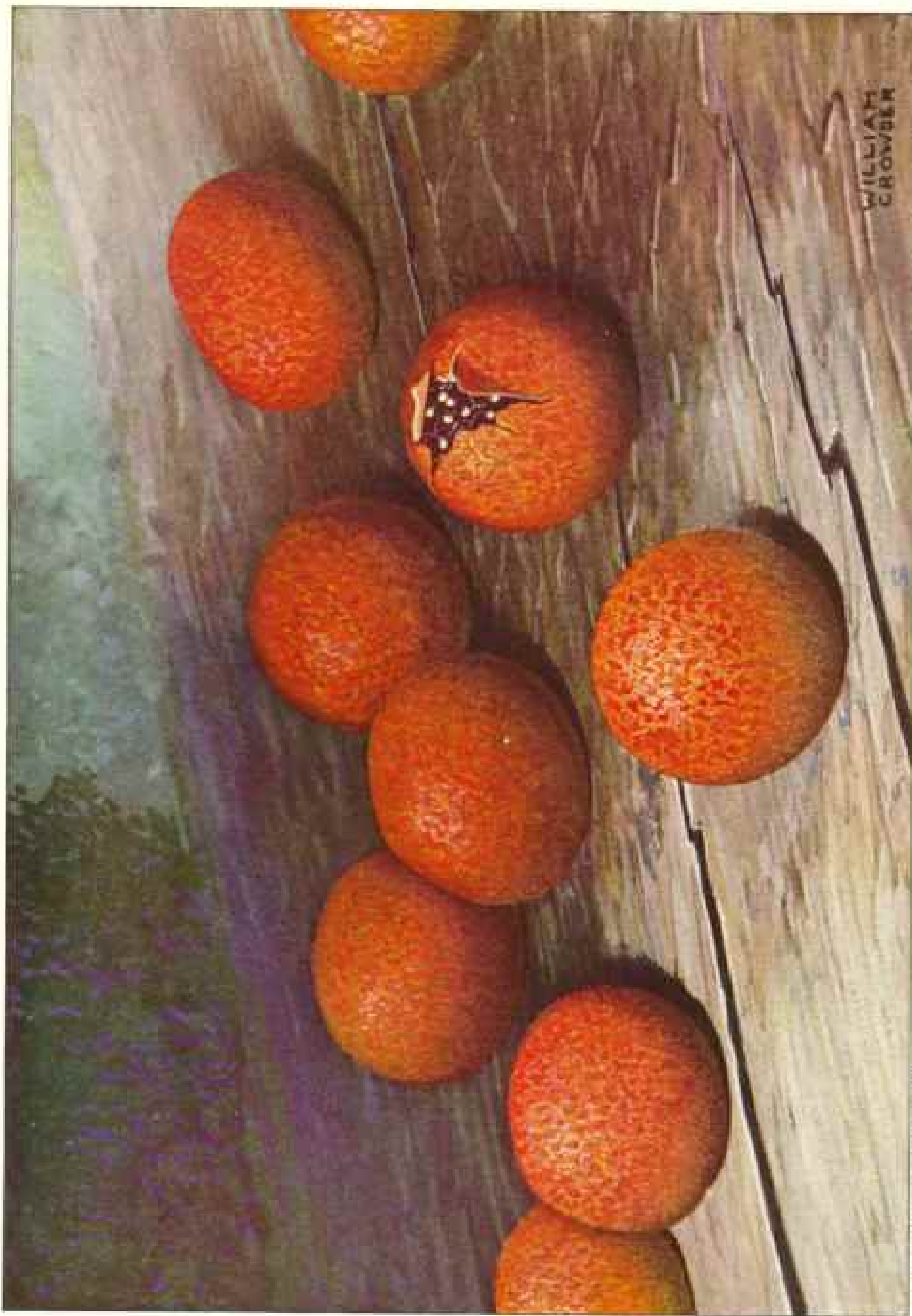
In their plasmodial state (see under Color Plate V) slime molds are found in damp situations, and in warm weather they spread over moist surfaces and creep through cracks and rotting bark.



Painting from life by William Crowder

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THE CHASTE ELEGANCE OF THIS SLIME MOLD'S PROPORTIONS COMMANDS ADMIRATION. *Stemonitis splendens* is one of the commonest of the mycetozoa. Its slender, dusky sporangia sometimes reach a height of an inch or more, and resemble miniature attenuated spikes of the reeds known as "cat-tails." A good magnifying glass is needed to resolve the finer details of the intricate network of *Stemonitis*. Its loose and gauzy labyrinth of plasmodium (see under Color Plate V) has a weird charm and unearthly beauty all its own. Enlarged 10 diameters.



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PHYSARUM LATERITIUM RESEMBLES CLOSELY THE FAMILIAR "PEPPERCORN"

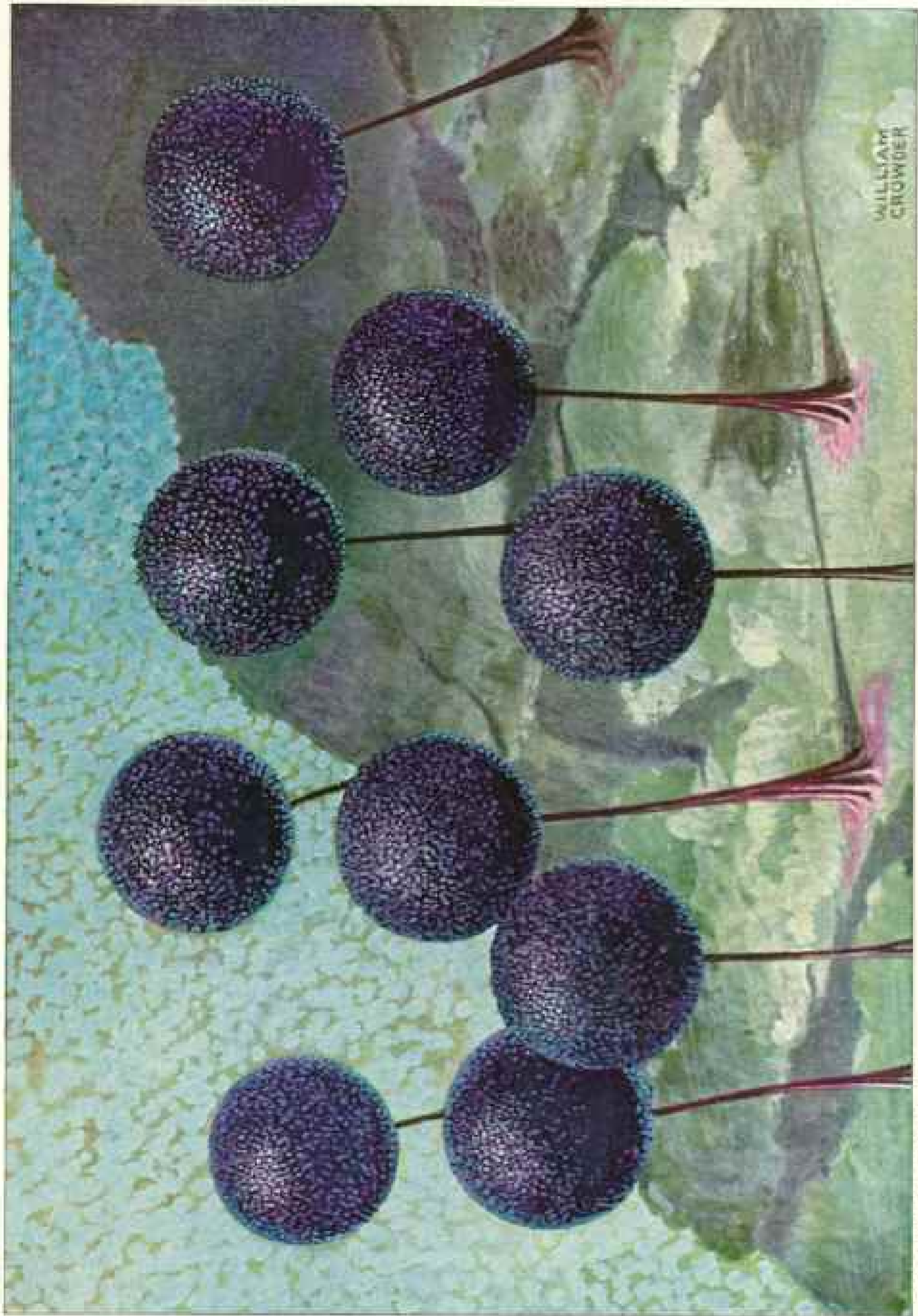
The plasmodium of slime molds (see under Color Plate V) shows strong "irritability," avoiding strong light and seeking moisture and food. It frequently surrounds soft organic substances and completely digests them. *Physarum lateritium* is a cosmopolitan species, being equally at home in New York, Pennsylvania, Colorado, Ceylon, Java and Brazil. The species is magnified 50 diameters in this painting.



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 PRINTING FROM LIFE BY WILLIAM CROWDER

THE IRIDESCENT BUDS OF *DIACHEMA LEUCOPHAEA* RIVAL THE TIPS OF A PEACOCK'S FEATHERS

This lovely species of myriophoria is not uncommon in the Eastern States, but is rare west of the Mississippi. It is easily identified by its white stem. Enlarged 75 diameters.

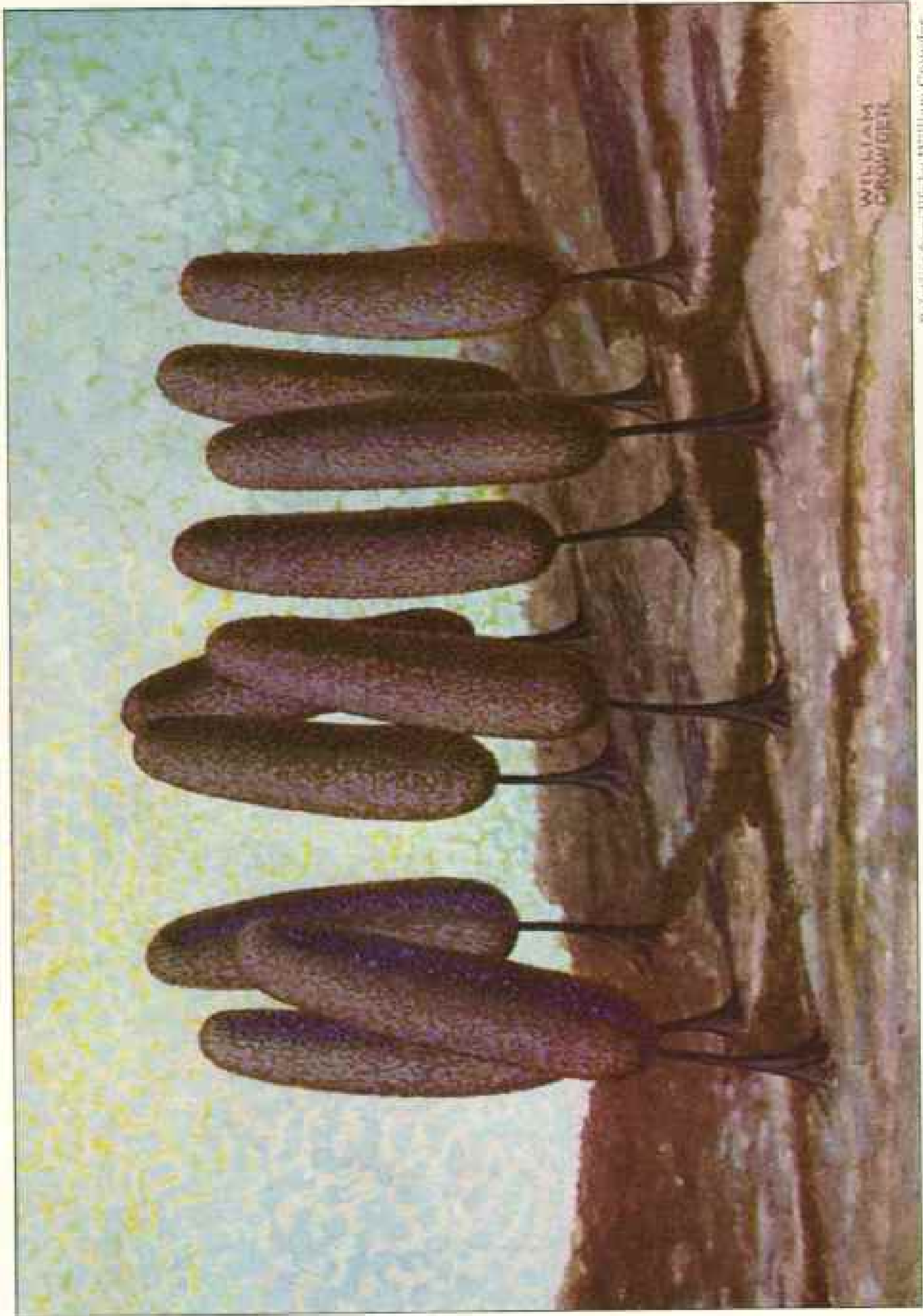


Painting from book by William Crowder

A GLITTERING SKIN IDENTIFIES LAMPRODERMA VIOLEACEUM

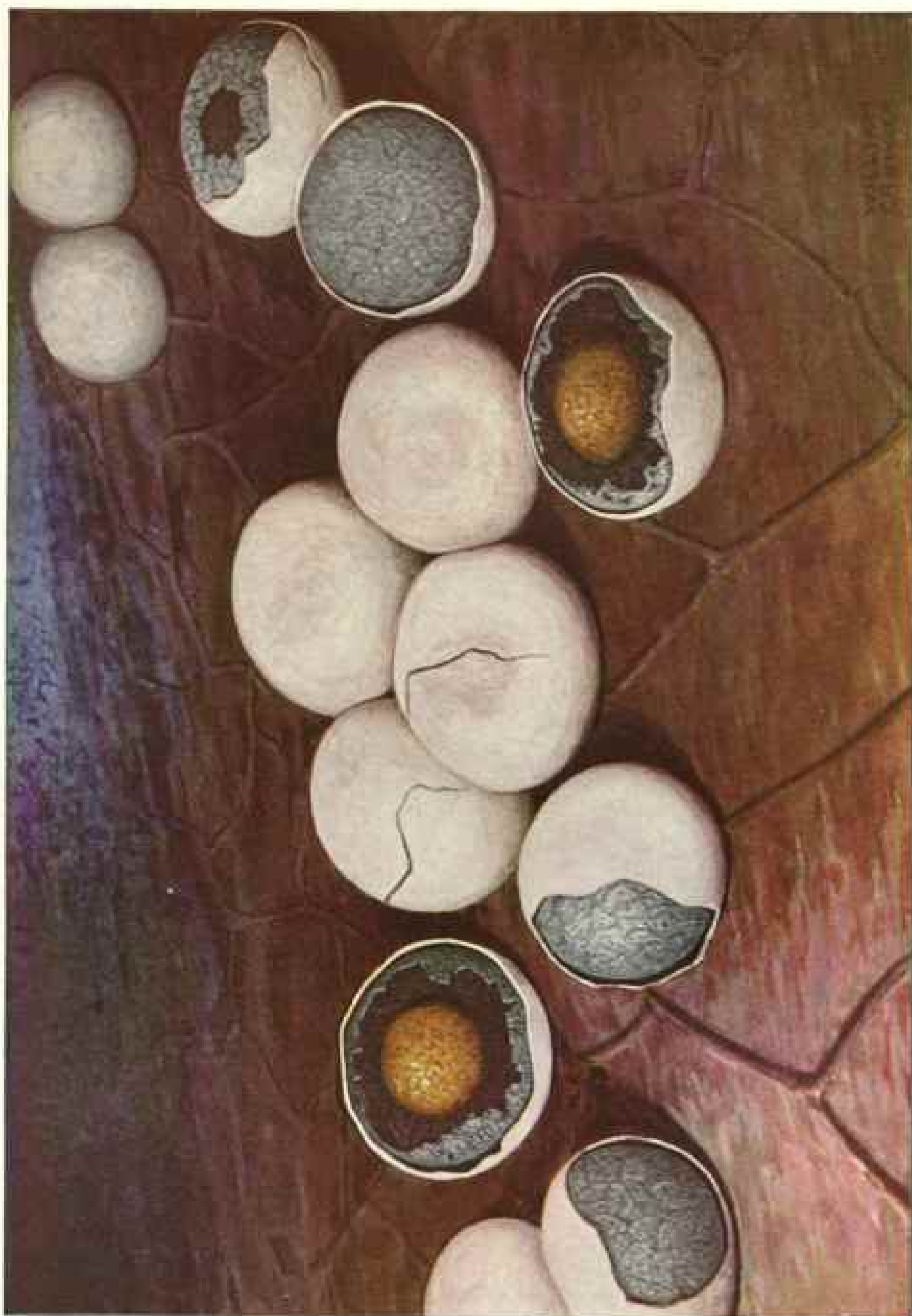
This species sparkles in the breeze like the waters of an agitated pool in strong sunlight. It is our commonest slime mold, and is to be found late in the fall on decaying sticks and logs far and wide. Enlarged 40 diameters.

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COMATRICHA PULCHELLA IS PROBABLY WIDELY DISTRIBUTED BUT IT IS RARELY COLLECTED
Painting from life by William Crowder

The sporangia of this species are very minute, being less than one-twentieth of an inch high. Magnified 30 diameters.



Painting from life by William Crowder

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BEAUTIFUL DIDYMA TESTACUM IS FOUND THROUGHOUT THE UNITED STATES

Most of the specimens of this slime mold in our Western States are found on dead oak leaves; in the East, they not infrequently gather on moss. When fresh this Didyma is easily recognized by its delicate pink color. Older specimens become white. Enlarged 40 diameters.



Painting from life by William Chamberlain

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WONDROUSLY WROUGHT DETAILS DISTINGUISH THESE GRANATE STRUCTURES

The spherical sporangia on slender stalks are like tiny baskets, the ribs and stays of which are represented by a latticelike wall of strange diometric design. The spores, a rich cinnamon brown oftentimes reddish in color, at first fill the little baskets to capacity, but eventually they make their escape through openings in the wall. At every slightest breath of air the baskets sway and jostle, strewing their burdens, pepper-box fashion, in all directions. This is *Dietydium cancellatum*, magnified 40 diameters

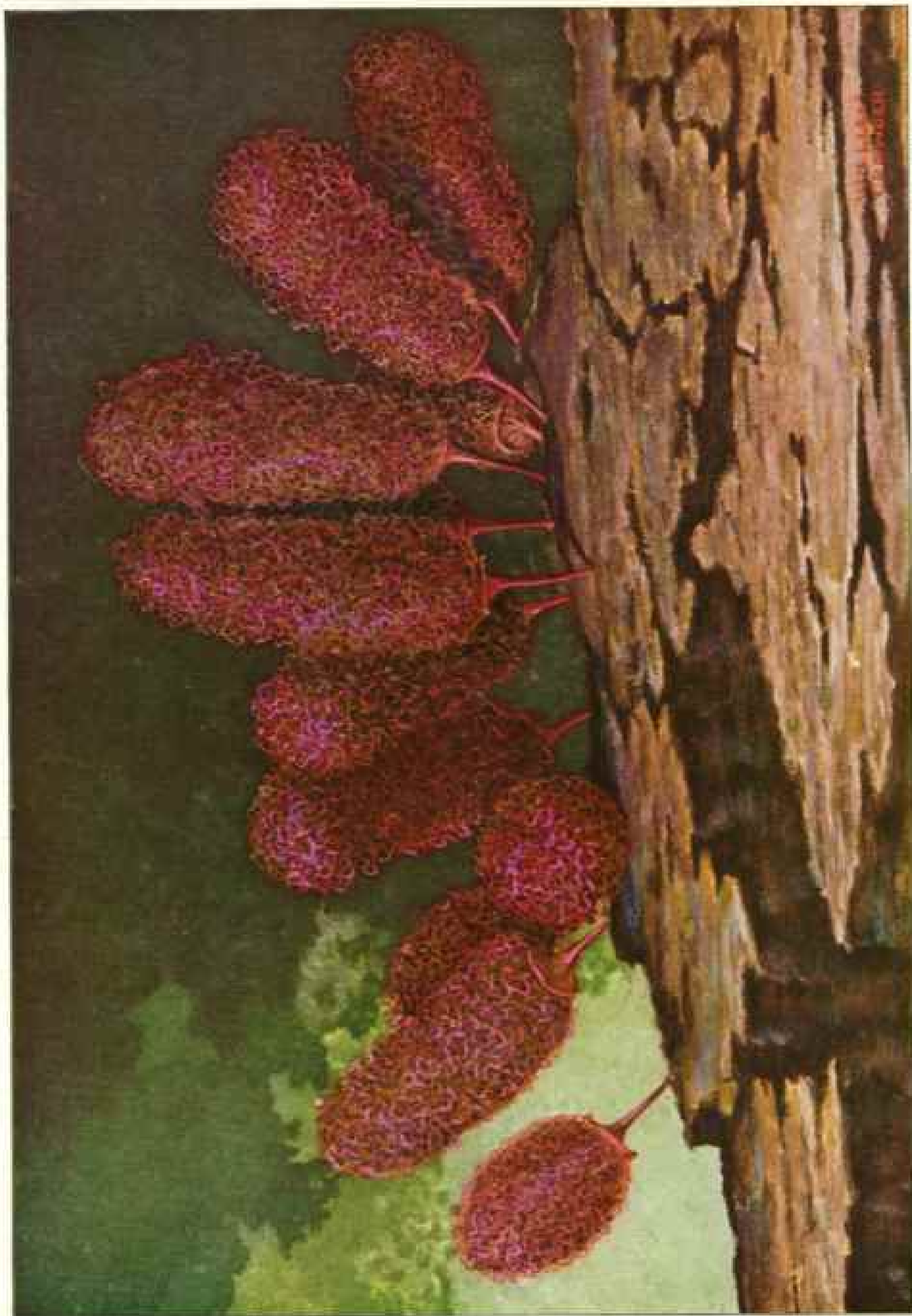


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ARCYRIA FERRUGINEA, ENLARGED 18 DIAMETERS

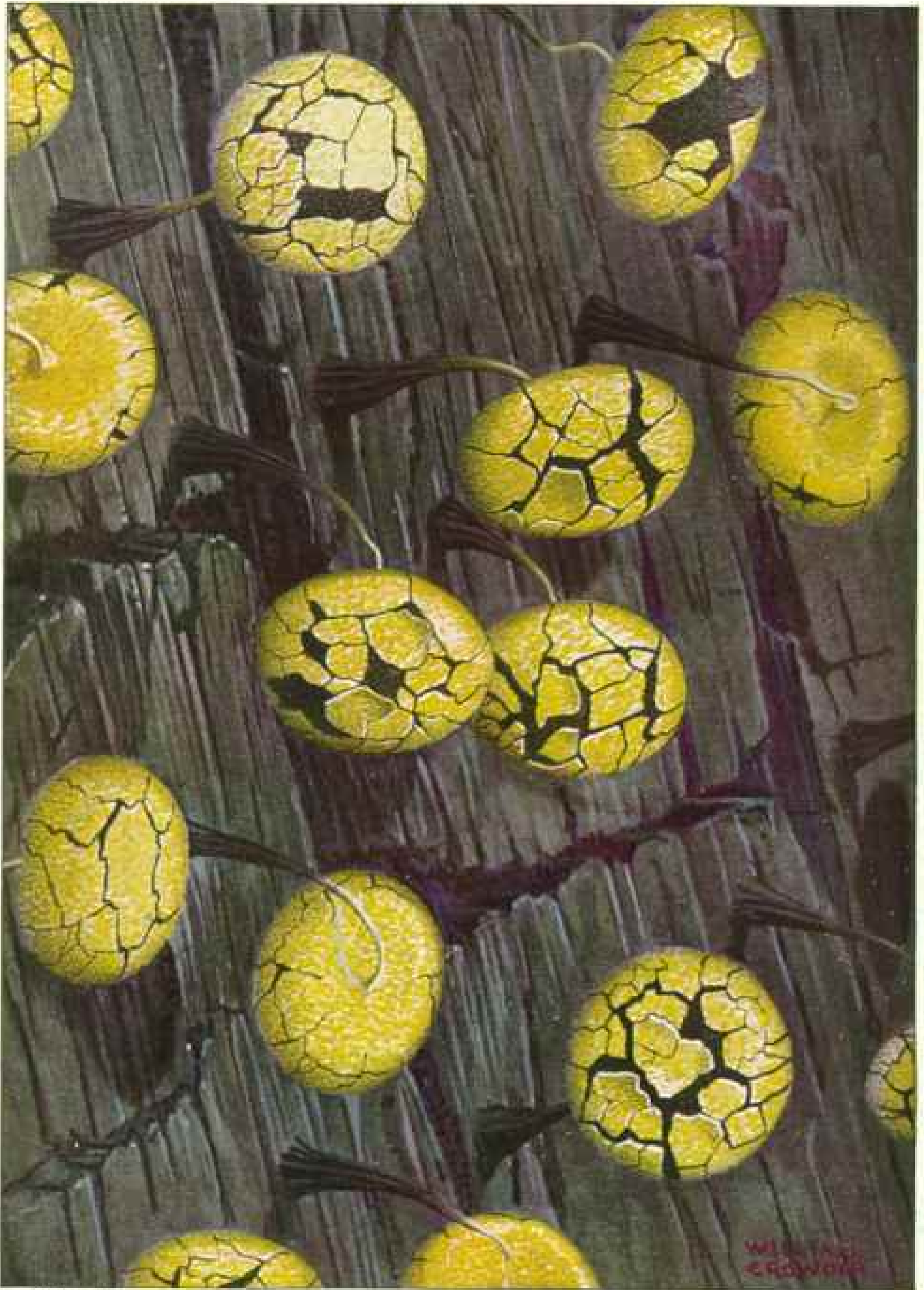
Painting from life by William Chamberlain

Groping, streaming, pulsating, the silvery protoplasm of the Arcyria family of slime molds shoots its ghostly threads from moisture-laden logs and wanders over the bark to its place of development into one of the loveliest of natural wonders in miniature.



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Painting from life by William Crowder
ARCVRIA DENUDATA IS THE COMMONEST SPECIES OF ITS GENUS (SEE ALSO COLOR PLATE XIV)

This ascarid mold is equally at home as far north as Alaska and as far south as Nicaragua. Enlarged 18 diameters.



© National Geographic Society

Painting from life by William Crowder.

SPECIMENS OF *PHYSARUM VIRIDE*. MAGNIFIED 30 DIAMETERS, SUGGEST EGGS
AND GOLF BALLS ABOUT TO PERL.

In the case of many of the slime molds the life history of the particular species has not been completely traced. They provide a subject which invites the attention of the student of zoology no less than that of the inquiring botanist.

This change came at dusk on the day preceding the dawn of our present inspection, and it came at an unseasonable hour, when I was not equipped with a light and when the fast-approaching night began to cloak in darkness the most interesting activities of this curious organism.

THE SILVERY LIQUID BREAKS UP INTO MINUTE PEARLS

My early return to the locality was not without its compensation, for an entire colony of sporangia had sprung up over night. But I arrived almost too late to witness the manner of the transformation; for, even as I looked, the silvery splash of liquid light that still remained on the log began to break up into a compressed group of minute pearls. The globules at first were creamy white, but gradually they assumed a cast of delicate pink, and with the change in hue came a slow, though definite, alteration in the form and size of each unit.

The tiny gems were strewn in shapeless clusters of a single layer, as if the contents of some fairy treasure casket had been spilled upon the bark. In several instances they were so closely crowded that the soft, yielding bodies arranged themselves in geometrical order, like the hexagonal cells of a honeycomb or the facet eyes of giant dragon flies.

Eventually a more fundamental change occurred. By degrees the developing sporangia increased in dimension along their vertical axes and began to resemble short cylinders standing on end, the topmost part of each being slightly enlarged.

As the columns rose, gathering their substance from the surrounding slime, the globules topping them became less marked, until they completely disappeared when each little sporangium had reached a height equal to three times its diameter.

THE INSECT WORLD GOES INTO ACTION AGAINST THE OBSERVER

Before this stage was reached, however, the sun was more than four hours old and the oppressive atmosphere of the swamp began to assert itself.

The rising temperature set the insect world in motion. Wasps and bees hovered uncomfortably close, respecting my per-

son only while I was puffing vigorously at my pipe. Occasionally the sting-bearers would crawl over my face and hands, and although they made no attempt to attack, their presence was distracting, lest I should forget and make an incautious movement.

The mosquitoes, the gnats and buzzing flies, on the contrary, considered my welfare not at all; whole tribes took telling toll of my lifeblood.

Round about, a more attractive crowd appeared. Gaudy butterflies settled lazily upon brilliant blossoms, uncoiled their siphons and thrust them deep into the hearts of flowers. A great moth, startled from its hiding place, flick-flacked its way here and there excitedly, the metallic blue of its wings flashing in the shade like a fragment of the sky.

Grazing the ground in its characteristic low flight, a somber ichneumon fly went hesitatingly by on powerful bronze-black wings, halting to explore some bit of ground or likely plant, in its search for prey.

Now my nostrils were assailed by the heavy odor of a near-by stinkhorn toadstool, which loosed its strangling stench on the humid air.

THE CLIMAX OF THE TRANSFORMATION SPECTACLE

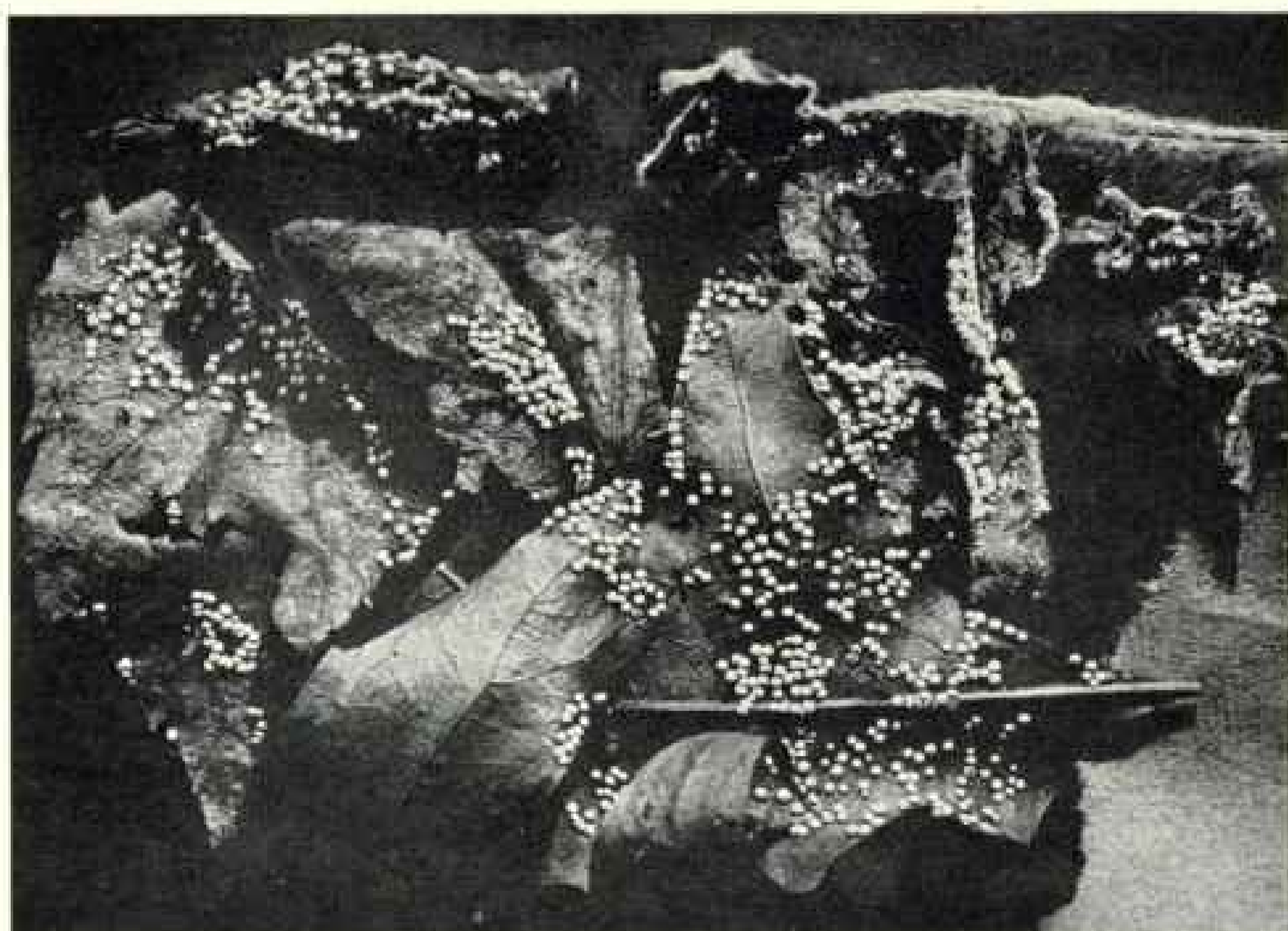
Despite these distracting factors, I continued to watch the growing columns of the slime molds. The nascent sporangia were now becoming diffused with a deeper tone of pink, particularly at their bases. For the first time, I noticed that the cylinders were no longer in actual contact with the wood; a hairbreadth space had intervened, and they were slowly being elevated into the air, as the stalks began to form.

These threadlike stalks, which were of a deep tone of garnet red, gradually reached a length of one-half the entire organism and expanded like cups at the top.

The flaccid group had by now lost its compressed, or honeycomb, appearance; each individual unit stood staunchly upright, independent, seemingly apart from its neighbors, yet in crowded contact with them. The surface now began to dry, and

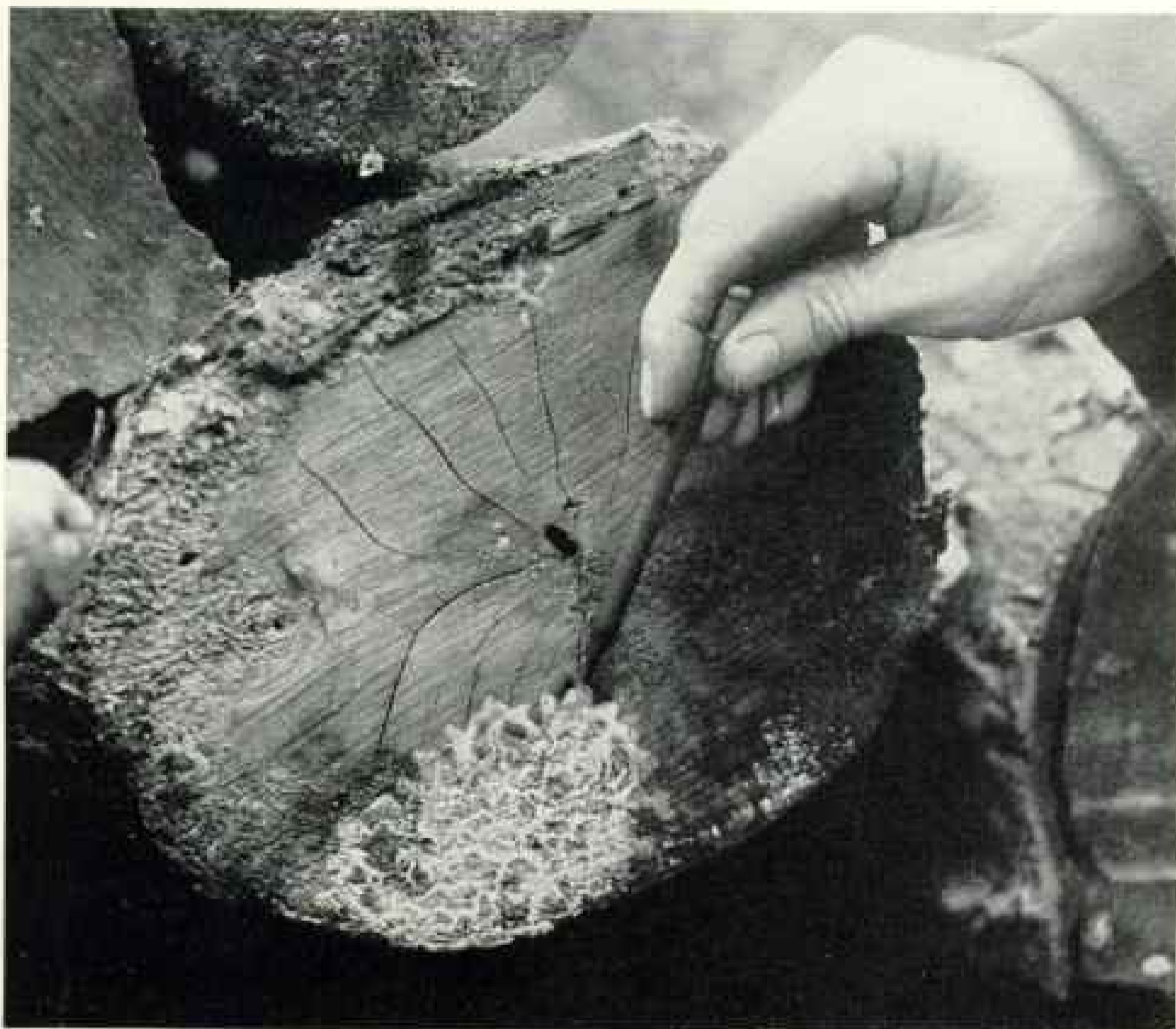


TRICHIA DECIPIENS (ACTUAL SIZE) IS AN INHABITANT OF WET LOGS.
Colonies of this species of slime mold often cover areas of a square yard or more.



Photographs by William Crowder

DIDYMA TESTACEUM, SLIGHTLY ENLARGED.
Compare with Color Plate XII of the same species.



Photograph by William Crowder

A SLIME MOLD TRAVELING

In this stage the plasmodium moves slowly about in search of food and moisture. Later it will develop into a beautiful object, similar to one of those shown in the Color Plates.

simultaneously the iridescent covering of filmy skin began to peel into shreds and tatters.

On the wings of the imperceptible movement of heavy swamp atmosphere, these fragments vanished, and—presto! there was revealed that wonder of wonders, a

gauzy tangle of spore-laden threads called the capillitium.

The sporangia were now fully formed. There was no further increase in the length or breadth of any part. The plasmodial slime was completely exhausted. The microcosmic spectacle was at an end!

Notice of change of address of your GEOGRAPHIC MAGAZINE should be received in the office 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 May number, the Society should be notified of your new address not later than April first.



Photograph from Dr. W. L. Schurz

EGRET PLUMES IN THEIR PROPER PLACE: AMAZON VALLEY

The exquisite egret (the snowy, or little, heron) has suffered so much persecution at the hands of plume hunters that it has been appropriately called the bird of tragedy. In former years great flocks of these snowy creatures covered the banks of Amazonian lakes like a sheet of dazzling white. The plumes are most beautiful in July.

THE AMAZON, FATHER OF WATERS

The Earth's Mightiest River Drains a Basin of More Than 2,700,000 Square Miles, from Which Came Originally the World's Finest Rubber

By W. L. SCHURZ, PH. D.

COMMERCIAL ATTACHÉ, AMERICAN EMBASSY, RIO DE JANEIRO

RECENTLY there returned to Pará a party of six Americans who had completed the most comprehensive survey of the Amazon Valley ever made by any expedition. For nearly ten months these representatives of the United States Department of Commerce, sent out to investigate the crude-rubber industry in its original home, had traveled more than 20,000 miles on 37 rivers of the Amazon fluvial system.

We had carried the American flag up the Amazon itself, through the Pongo de Manseriche, the western gateway of the great plain, where the river cuts its way athwart the last chain of the Andes, more than 2,500 miles from its mouth and less than 250 miles from the Pacific.

To the north we ascended the Rio Branco to the open *campos* country that reaches away to the borders of the Guianas, and to the south, in the Madeira basin, we reached Sena, three days up the Madre de Dios above Riberalta, Bolivia.

THREE GOVERNMENTS COÖPERATED

The Brazilian Government supplied a fine steamer, the *Andirá*, for the use of the commission during its stay in Brazil, and in Bolivia and Peru similar facilities and courtesies were extended by their respective governments. In Brazil we were accompanied by a special Brazilian Commission of four members, who had had much experience in the far interior: Dr. Avelino de Oliveira, geologist; Dr. J. G. Kuhlmann, botanist; Dr. Fernando Soledade, of the Federal Public Health Service, and Colonel Raymundo Monteiro, the leading Brazilian authority on rubber.

On rivers where these steamers could not navigate we traveled in launches, barges, or dugout canoes. We covered more than 400 miles on horse- and mule-back and one long stretch on foot.

The mightiest of the world's rivers

owes its name to a fanciful yarn told by Francisco de Orellana, the first white man who ever descended the turbid waters of the Rio Mar, as later generations of Brazilians have dubbed the stream that is more than a river.

A FANCIFUL YARN GAVE NAME TO WORLD'S MIGHTIEST RIVER

In 1541 Orellana was sent down the Napo by Gonzalo Pizarro in search of provisions for the forlorn expedition that had come over the mountains from Quito in search of El Dorado. Finding it easier to continue downstream than to return, and probably driven on by curiosity and avarice, he took to the "flowing road" that months later carried him out onto the Atlantic.

Among the adventures which Orellana related to his credulous contemporaries in Spain was one of an encounter with female warriors near the mouth of the river that is now called the Trombetas, or River of Trumpets. It was these long-haired savages—whether women or more probably men—who were responsible for the naming of what the Indians themselves, in the *lingua geral* of Brazil, called the *Paranáguasá*, or "The Great River."

Ever since the memorable voyage of Orellana the process of exploring and opening up the vast wilderness world of the Amazon basin has been going on, and much yet remains to be done.

Some years after the Pizarros had been wiped out in the civil wars of Peru, the terrible Lope de Aguirre led out of the Amazon and around up the Venezuelan coast the remnants of an expedition whose leadership he had assumed by the assassination of two successive chiefs of the party.

Adventurers in search of treasure cities in the jungle or devoted Catholic missionaries carried on the work from the Spanish side of the Andes.



Photograph from Dr. W. L. Schurz

NAVIGATING THE AMAZON ABOVE IQUITOS

Rafts are a much more common sight on Peruvian tributaries of the Amazon than in Brazil or Bolivia, the Peruvians being especially skilled in their construction. Frequently the rafts carry a thatched hut, in which the family lives during the slow journey downstream (see text, page 453). The source of the mighty river is only about 112 miles from Lima, Peru.

From the east Pedro de Teixeira led an expedition upriver that did much to secure Portugal's possession of the greater part of the valley, and intrepid "bandeirantes" from far-off São Paulo pushed northwest in long treks across Matto Grosso and into the basin of the Madeira.

TWO AMERICAN NAVAL OFFICERS WROTE A CLASSIC REPORT ON THE RIVER

The nineteenth century brought a more intelligent and scientific study of the Amazonia. The epic days of the Conquest were past, and, though the same hardy qualities were needed in the new race of explorers, theirs was a different task than that which the early Spaniards and Portuguese had faced.

Among the new generation were the great German, Humboldt; the Frenchman, Castelnau; the Englishmen, Bates and Wallace; Agassiz, the botanist, and the Americans, Orton and Heath. Two other Americans, Lieutenants Herndon and Gibbon, of the United States Navy, crossed the Andes from the Pacific in the fifties

and descended the Amazon, the one directly from Peru and the other from La Paz, by way of the Beni and the Madeira. Their report to Congress is one of the classic works on the Amazon country.

A still later group of specialists working over the Amazon basin includes the American ornithologist, Leo Miller; the Oliveiras, Brazilian geologists; Hartt, the American, also a geologist; Huber and Ducke, the Swiss botanists; Barboza Rodrigues, the Brazilian author of a monumental work on the palm tree; engineers like Colonel Church, of Madeira-Mamoré fame (see text, page 451); the brilliant Brazilian Euclides da Cunha; the Bolivian, Rivera, and the Frenchman, Paul Le Cointe, the foremost living authority on the Amazonia.

Among the explorers were two remarkable women—Mme. Coudreau, who spent years in exploring the rivers of the State of Pará, after her husband had died in the work for which he had been engaged by the government of that State, and Dr. Emilia Sneathage, a Swiss scientist, who



Photograph from Dr. W. L. Schurz

TRANSPORTING "BLACK GOLD"

The blocks of rubber are known as *caucho*, product of *Castilla elastica*, and the balls are of *Hevea brasiliensis* (see text, page 452). The discovery of rubber dates from the second voyage of Columbus, when the great navigator found the natives of Haiti playing with balls of an elastic substance.

crossed overland from the Xingú to the Tapajóz through a wilderness unknown even to the rubber workers of that region.

In the vast field of Matto Grosso, General Candido Rondon and his corps of aides have spent a generation in exploration and in the collection of scientific data, until to-day the immense territory that stretches from the Araguaya west across the upper reaches of the Xingú and the Tapajóz to the Madeira and the Guaporé is known to Brazilians as Rondonia. Americans will recall that it was Rondon, then colonel, who was joint leader with Colonel Roosevelt of the famous expedition that in 1913-14 descended the "River of Doubt" (now the Roosevelt).

RUBBER HUNTERS HAVE DONE THEIR SHARE OF EXPLORING

Much of the opening up of the Amazon Valley has been the work of the men who pushed farther and farther up the river and into the country in search for rubber. Some were like the Suarez brothers, who built up a veritable empire in Bolivia;

others were obscure rubber workers, whose journeys and discoveries in the jungle have never been recorded.

Among the most extraordinary of these anonymous explorers have been the Peruvian *caucheros*, or hunters of the rubber-yielding *Castilla elastica*, who have wandered all over the Amazon Valley in search of new stands of the tree. These they ruthlessly destroy and then push on in their jungle Odyssey to more virgin territory.

These restless nomads may be found all the way from the forests of the Ucayali and Javary east to the Xingú and down into the Guaporé country between Brazil and Bolivia. They mingle with the Brazilian rubber workers in the rude camaraderie of the great solitudes, but have generally waged a truceless war with the Indians, whose tribal lands they invaded in their tireless quest.

THE TRUE "FATHER OF WATERS"

Though not the longest of rivers, the Amazon is, by reason of its volume and



Photograph from Dr. W. L. Schurz.

"SWARMS OF ALLIGATORS OFTEN SHOW THEIR UGLY SNOOTS ABOVE THE SURFACE OF THE WATER"

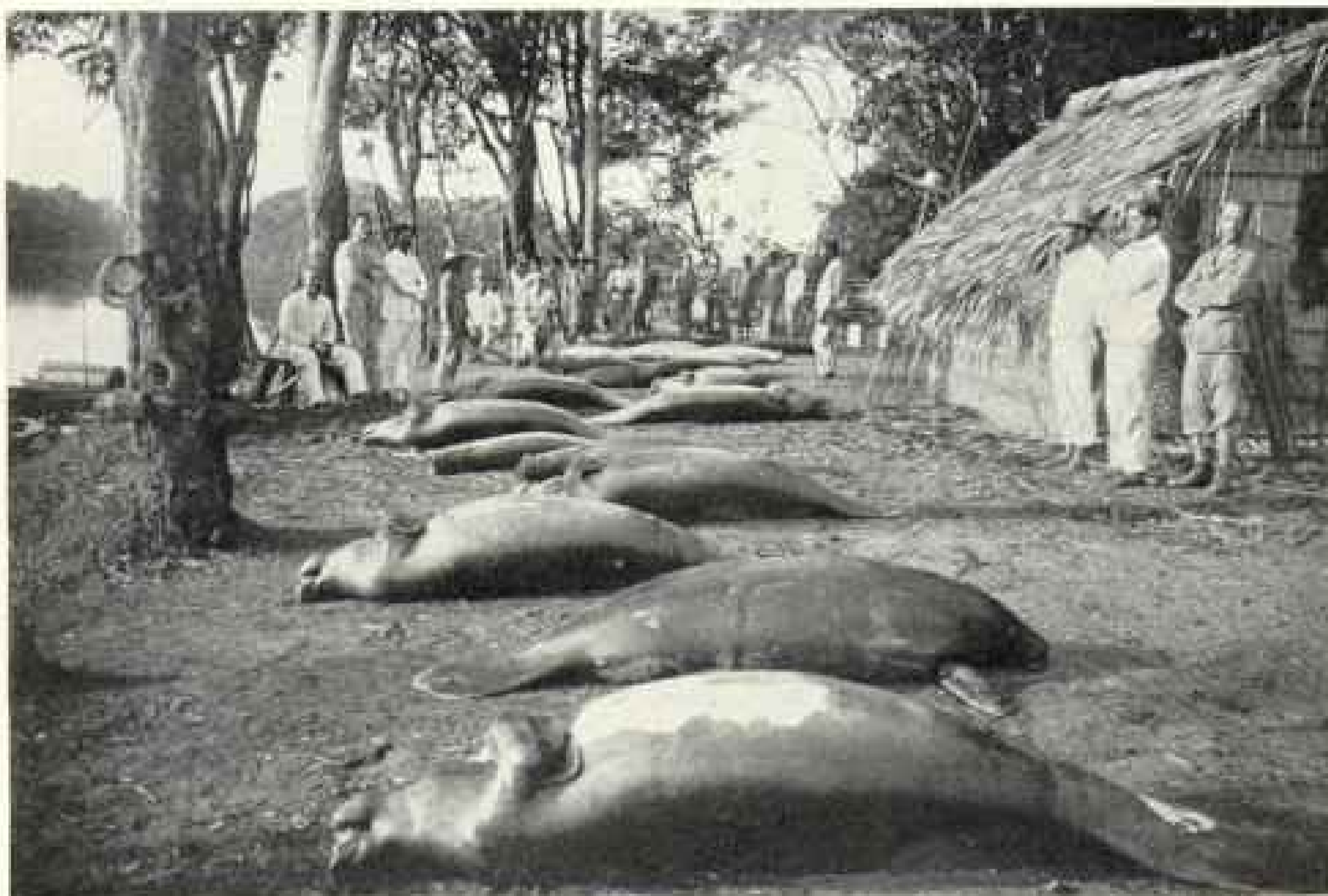
These reptiles are still numerous in Amazonia, despite the organized pursuit of hide hunters. At Manaus they are caught by floating within their reach a piece of hardwood, covered with raw meat, in which the alligator's teeth become imbedded when it snaps at the bait.

the magnitude of its fluvial system, the true "Father of Waters," the real "Rio Grande" of the world. It rises in a mountain lake high in the Peruvian Andes and flows north, through a deep gorge, for hundreds of miles. Then it turns east and heads through the last range of the Andes at the Pongo de Manseriche, to debouch therefrom directly onto the great Amazonian plain that reaches away across the continent to the Atlantic.

In the Pongo it is like a swirling mill-race, some 50 yards wide; 2,000 miles below, the banks of its main channel are, in places, scarcely visible from each other.

For nearly all its length the Brazilian Amazon flows through a number of channels that are connected by cross canals, or *furos*. Only at Obidos has it a single channel. At this point it is less than 2,000 yards wide and 350 feet deep, and in mid-stream runs with a current of six miles an hour.

No other stream has such great tributaries as has the Amazon. Some of them have vast fluvial systems of their own, like the Madeira, whose remotest headwaters are found in the far-away Bolivian department of Potosi; or the Negro, most mysterious of Amazonian rivers, which



Photograph from Dr. W. L. Schwarz

THE MANATEE AND ITS COUSINS GAVE RISE TO THE MERMAID STORY

This mammal, allied to the dugong and known variously as cowfish, peixe-boi, and manatee, has such keen sight, smell, and hearing that the Amazon natives must use all their skill in taking it with the harpoon or in nets set across the entrance to its feeding grounds. Its bluish-gray color makes it difficult to distinguish from brackish water or floating logs. The flesh tastes like pork and the fat yields an oil used by the Indians for massage in certain diseases.

comes down out of the wild country of southeastern Colombia and is connected with the Orinoco system by the strange Cassiquiare Canal; or the Purús, with its long branches, such as the Ituxy and the Acre. These are also the widest of rivers, the Tapajóz being eight miles from shore to shore at Boim and the Negro ten miles in the Boiósú Channel.

AMAZING VARIETY IN AMAZON TRIBUTARIES

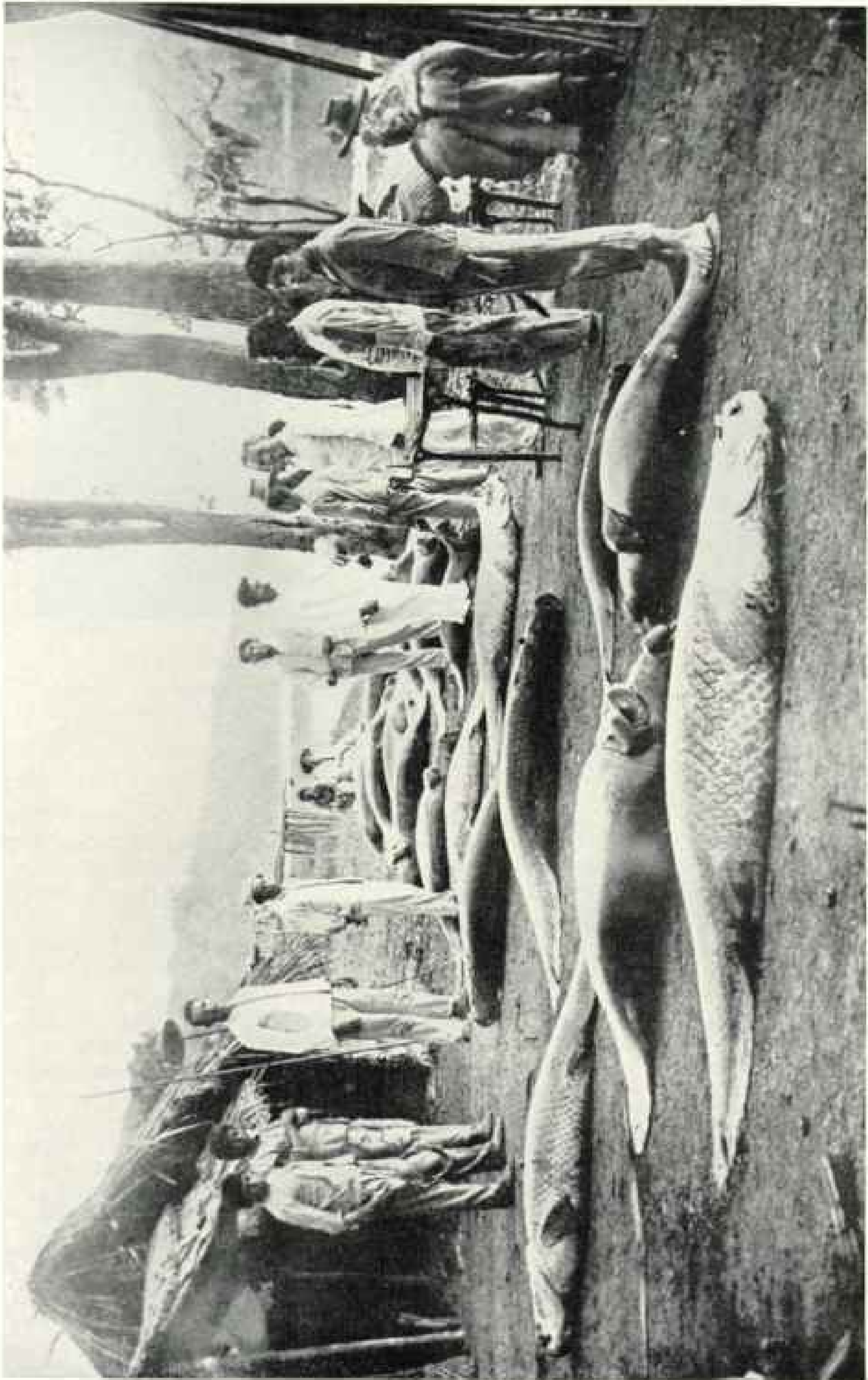
There is considerable variety among the rivers of the Amazon system. Some, like the Purús and the Juruá, meander across the alluvial plain in huge oxbows, across the neck of which the river may cut a new way in a single month of flood. Others flow in a fairly straight course, like the Branco.

Some are black-water rivers, like the swarthy Negro and the Jutahy; others are clear streams, like the fine Tapajóz, or the Branco, so named for its "white" water,

or the Guaporé. Most of them are yellowish streams, carrying vast quantities of alluvial sediment. Such are the Purús, the Juruá, the Ucayali, and the Amazon itself, which is always muddy.

Where the black Negro and the white Tapajóz enter the tawny Amazon, a sharp line divides their waters for miles before they finally mingle; also, some of the rivers have wide flood plains, and sometimes a veritable labyrinth of channels intersects these low-lying areas, as in the country between the Japurá and the Solimões. Sometimes they flow between high banks, as does the Tapajóz for most of its course, or as do the Jurity and the Parauary.

Most of the Amazonian rivers bear the names given to them by the Indian aborigines. Some are majestic-sounding, as befits the great streams so named, like the Xingú and the Purús and the Juruá; some are melodious names, like Araguaya, Aripuaná, Tahuamanu, Inambary, and



Wide World Photograph

A REAL FISH STORY FROM THE PURÚS RIVER

This is a day's catch of pirarucú, the largest of fresh-water fishes. It sometimes attains a length of more than six feet and a weight of 200 pounds (see, also, page 452). The two specimens with flippers are not fish, but manatees, fresh-water mammals (see, also, illustration, page 449).

Juruena; some are strange-sounding Indian names, Tupi, or Quichua, Gy-paraná (pronounced Zhee-paraná), or Jacundá, or Buyuyumana, "manu" being the Peruvian Indian word for river; some might have been left by an Arabian conqueror, as the names of the Bolivian rivers Beni, Madidi, and Abuná; still others bear the names of foreign explorers, like the Heath, Orton, Chandless, and Roosevelt.

Comparatively few have Portuguese or Spanish names, among the exceptions being the Amazonas or Amazon itself, the Madeira, the São Manoel, the Trombetas, the Negro, and the Madre de Dios, known to the Bolivian Indians as Manutata, or "Mother of Rivers."

FAMOUS MADEIRA-MAMORÉ RAPIDS HAVE COST MANY LIVES

Nearly all the rivers of the Amazon system are broken by rapids or waterfalls at a certain stage in their course.

The most famous, though not the highest, of these rapids are those which break the course of the Madeira and the Mamoré for more than 200 miles.

It is around these rapids that the famous Madeira-Mamoré Railroad was built to serve as an outlet for the rubber and other products of northeastern Bolivia. Previous to its construction rubber was brought down from Bolivia in large *batclones* (canoes). These shot the less dangerous rapids and were dragged painfully and slowly around the more perilous ones. The return trip was a matter of months and the losses of men from malaria, Indians, and capsizing in the rapids were enormous.

The first promoter of a scheme for a railway to circumvent the rapids was Col. George E. Church, an American army engineer, who obtained a concession to build a line in 1870. However, it was not until 1878 that a firm of Philadelphia contractors began work on the Madeira. The American and other workers suffered such frightful mortality from fevers that the undertaking had to be discontinued the year of its initiation.

RAILROAD BUILT WITH AID OF TONS OF QUININE

The final impulse for the completion of the work came with the Treaty of Petrop-

olis, in 1903, whereby Brazil bound herself to construct the line as compensation to Bolivia for the latter's cession of the Acre country.

The contract for construction was given to a syndicate represented by Mr. Percival Farquhar, and American engineers resumed operations in 1907. The road was completed to the Abuná in 1911 and opened to traffic in 1913 as far as Guajarimir, the present terminus of its 226 miles of line.

The principal problem in its construction was that of sanitation. Men died by the thousands of malaria, beriberi, yellow fever and other fevers; 400 out of 600 German laborers died, and Spaniards, Greeks, Barbadians, and other elements that were brought in suffered as heavily.

When the line reached the fatal camp of the Jacý-Paraná it seemed for a time as if the whole enterprise would have to be abandoned, as it had been in 1878. However, heroic measures saved the great job from failure. Quinine was brought in at the rate of over two tons a year and served with the meals in all the camps. Buildings were screened, as at Panama, and in addition to the main hospital at Candelaria efficient camp hospitals and hospital trains were put into service.

ONE OF THE COSTLIEST ROADS EVER BUILT

Doctors made the daily rounds of the construction gangs in track automobiles, treating all who were ill and tagging the more serious cases for transfer to Candelaria. During the four years 1908-11 the total entries at Candelaria totaled 30,430 patients.

There have been few conquests of American sanitary and civil engineering to compare with the completion of this railroad, isolated in the heart of the South American Continent. It was finished too late to be more than a financial liability, for the great rubber boom had collapsed and traffic from the Beni country declined in volume and value with the falling price of rubber. More than \$30,000,000 had been expended on the line, one of the most costly railroads ever built.

A small band of British represents the company that administers the road for the Brazilian Government. Theirs is a discouraging task, but done efficiently. One



Wide World Photograph

SPEARING THE FISH MONARCH OF AMAZON WATERS

The skillful native harpoons the piraricú from the prow of his boat when an agitation of the water denotes that the fish is approaching the surface. During high water it is also caught by a line attached to a tree on the bank or to a perch in the middle of lake or river.

train a week makes the run through the jungle between Porto Velho and Guajaramirim, stopping overnight at the village of Abuná, where the traveler finds the best hotel between Pará and the Andes.

Guajaramirim is a small frontier town, whence one jumps off into the wilderness of the Guaporé or takes the little stern-wheeler that goes south toward the heart of the Bolivian Oriente.

Here we saw blocks of caucho rubber from the Guaporé, and a carload of lean dogs for the lonely workers in the *seringaes*, and wild-eyed cattle from the Mojos plains of the Mamoré, with horns so wide they had, according to one native, to be loaded sideways into the cars.

At Porto Velho the Candelaria Hospital still stands as a haven for the sick and injured for hundreds of miles up and down the railroad and the rivers. The clean, well screened buildings lie among pleasant grounds overlooking the Madeira, and around them are flower and vegetable gardens.

In all that vast basin of the Madeira no one is so esteemed as Dr. William Emrich, the veteran American physician of con-

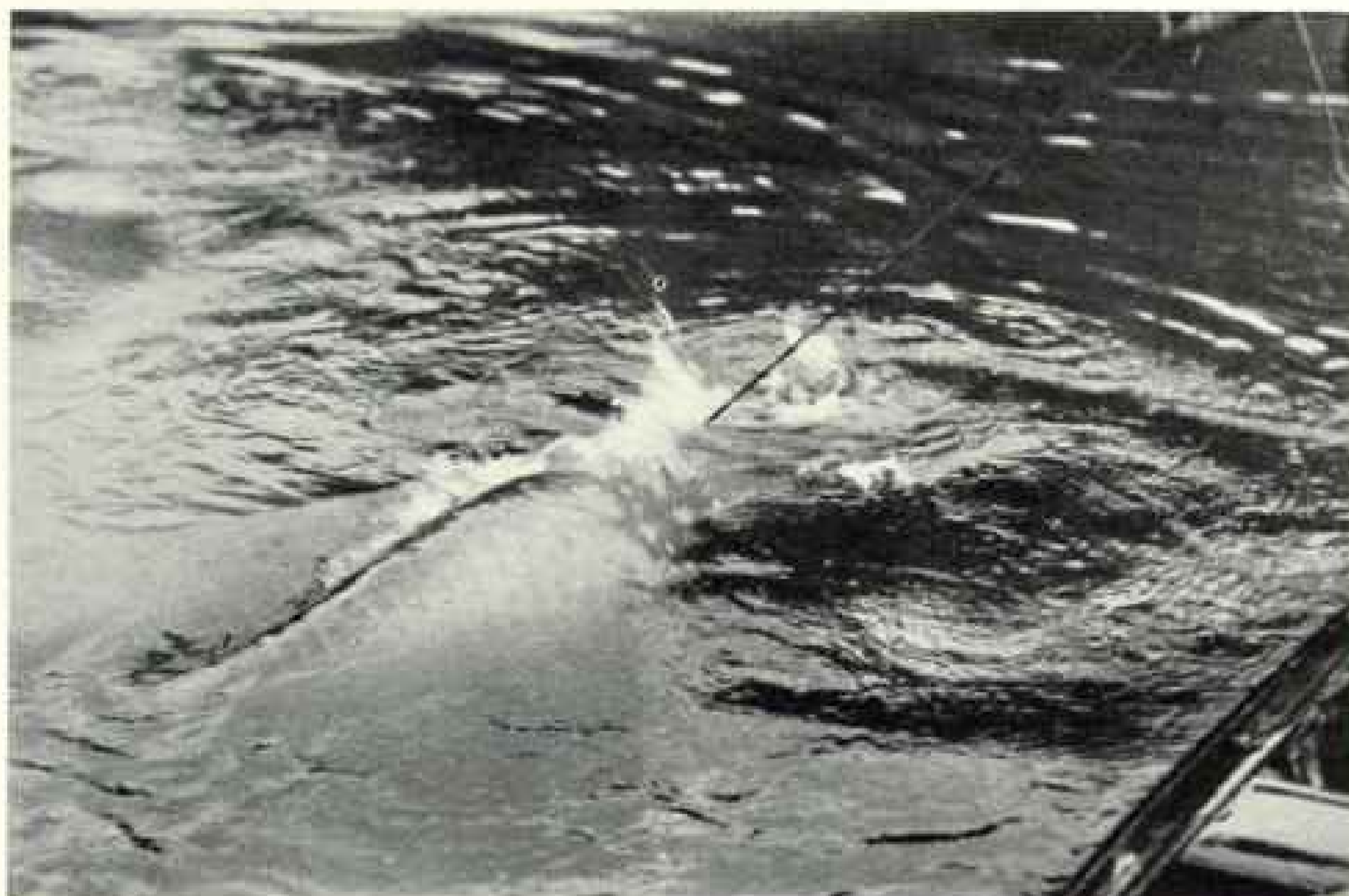
struction days, who is in charge of the Candelaria Hospital.

LARGE FLEETS OF STEAMERS, CANOES, AND RAFTS PLY AMAZON RIVERS

A large fleet of steamers plies up and down all the large affluents of the Amazon. It is possible to travel with comfort from Pará as far as Yurimaguas, on the Huallaga, in Peru, hundreds of miles above Iquitos, and up all the great tributaries to the limit of navigation, fixed by rapids or bars (see map, page 354).

During the rainy season, when the rivers rise from 30 to 50 feet, it is possible to go much higher, unless there is a permanent barrier, as at Santo Antonio, on the Madeira. Ocean-going steamers from Europe and the United States regularly ascend the Amazon to Manáos (see page 355), nearly 900 miles from Pará, and the same vessels could go up to Iquitos, more than 2,000 miles from the mouth.

Above Iquitos there are 500 miles of navigation for steamers drawing nine feet of water—that is, to within a few miles of the Andes. A line of steamers is actually in operation between Iquitos and Cal-



Wide World Photograph

THE END OF THE GIANT'S STRUGGLE (SEE, ALSO, PAGE 450)

Exhausted, the speared pirarucú (see opposite page) allows itself to be pulled alongside the canoe to meet death from a machete. Its cured and salted flesh forms a staple food for the river dwellers; its dried tongue makes an excellent file, and its broad red-margined scales are used as sandpaper for polishing native weapons and gourds.

lao, the port of Lima, on the Pacific, by way of the Panama Canal, making a journey of more than 6,500 statute miles by water to connect two points, only 630 airline miles apart overland!

The common type of steamer used on the Amazonian rivers is popularly called a *gaiola*, or bird cage, because of the open superstructure, adapted to the tropical climate. On the rivers of the Acre and on the Rio Negro shallow-draft stern-wheelers of our Mississippi River type are employed.

A wide variety of other craft is seen. The Peruvians are especially skilled in making canoes, some of their dugouts holding 15 or more persons. They are also famous builders of rafts, which are a much more common sight on the Peruvian rivers than in Brazil or Bolivia. Frequently these rafts carry a thatched hut, in which the family lives during the slow journey downriver, and they may also carry cattle and pigs and a flock of chickens (p. 446).

Two years ago a huge raft came down the Purús from Peru with 17 families

aboard, housed in as many cabins, and with a large supply of live stock and poultry.

Rubber is also frequently transported by making a raft of the balls, on which a low platform is built for those who pole it downstream.

THE AMAZON BASIN IS MORE UPLAND THAN MORASS

In spite of the cataclysmic floods that annually sweep over the valley, to pour out through the wide mouths on both sides of Marajó, the Amazon Valley is not a gigantic morass, where man must be half-amphibious to survive. Probably not more than 5 per cent of the more than 2,700,000 square miles of the Amazonia are below the normal flood level of the rivers. The great mass is upland country.

One who travels on any of the rivers is surprised by the high bluffs that border them for long distances.

Isolated hills and mountains are also prominent phases of the Amazonian landscape. A day above Pará one sights to



Photograph from Dr. W. L. Schure

A SWARMING TURTLE PEN ON THE RIO BRANCO (SEE, ALSO, PAGES 362 AND 383)

Despite the wholesale destruction of their eggs, turtles still abound on some of the rivers in Amazonia, and "their pursuit constitutes one of the most important industries in certain districts" (see text, page 450). After being shot in the neck with an arrow to which a cord is attached, they are herded into pens to await shipment to Manaus or Pará. From the flesh is prepared a number of tasty dishes; the eggs furnish turtle oil and turtle butter.

the north a broken chain of mountains that continues a long way to the west. At Monte Alegre it crops out at the river's edge in a remarkable hill, from which one may see the Amazon Valley in epitome.

To the south, beyond a maze of connecting *paraná's* that run among lush meadows, where cattle graze for most of the year, rolls the wide yellow flood of the Amazon's main channel. To the north of this hill there stretches a country of open grass lands against a background of mountains that shut off the horizon. On the lowlands to the east and west is the tropical jungle.

Far away to the northwest, in the campos, or open country of the Rio Branco, mountains loom up in every direction, to culminate on the Guiana border, in the Mountains of the Moon on the east and high Roraima on the north.

After weeks or months on the monotonous jungle-lined rivers, we always greeted these campos lands with a feeling

of release from some oppressive confinement. We breathed deeply and our spirits rose as if we had come out into a freer and fresher world. In fact, we have no more pleasant memories of the Amazonia than of galloping across the open country of the Rio Branco and of the lower Amazon, with the cool wind blowing in our faces and mountains looming up on the horizon.

THE AMAZON JUNGLE OFTEN CAUSES PANIC

The Amazonian forest is not the tangled and impenetrable jungle that is usually imagined. The heavy growth of vines and trees that generally lines the banks of the rivers is probably responsible for this impression, but back of this matted curtain of vegetation the forest soon becomes fairly open, and one can usually walk through it without even the need of a machete to cut a way.

Progress is difficult only when the jungle

falls into low ground, where bamboo or *to-bocal* forms a thorny maze, or when there is a heavy growth of palm trees.

The flooded forests are always forbidding and sinister, as the upland forest never is. Yet it is easy for the unpracticed woodsman to become lost in either, once he strays far from the trails. He is then liable to be seized with a panicky apprehension, especially as the jungle is poor in food, except for the good marksman who is well supplied with ammunition.

Edible plants are scarce, and during the dry season the only source of water for a long distance may be in the *cipós*, or huge boalike lianas that hang from the trees. Even then one must have a machete to cut the thick vine.

We heard many tales of denizens of the valley who had been lost in the inhospitable bush and had been saved by wandering rubber workers when on the point of starvation or exhaustion.

ONE AMAZON PLANT YIELDS HIGHLY INFLAMMABLE SAP

The outstanding tree of the upland jungle is the *castanheira*, or Brazil-nut tree, which towers high above the general level of the forest. Sometimes these giants are found with a circumference of nearly forty feet.

Scattered through this jungle are hundreds of species of trees that range in hardness from the light balsa wood to the



Photograph from Dr. W. L. Schurz

LOADING TURTLES AT PORTO VELHO

The head of steam navigation on the Madeira is also a terminus and administration headquarters for the Madeira-Mamoré Railroad, probably the most remarkable forest railway in the world (see text, page 451). Almost every sleeper along its 226 miles represents a human life. Porto Velho itself is a clean European village, well planned and lighted.

heavy, deep-red *aitá*, one of the hardest of all woods. Among them are such curious trees as the *assacú*, feared by the natives for the powerful astringent poison in its sap.

The Amazonian flora contains many remarkable poisons, some of whose virtues are known only to the Indians. Among these toxins are the terrible *mata-calado*, or "silent death," which is reputed to leave no trace in the system; the *capaço*, about whose powers fantastic tales are told in the Acre country, and the famous



Photograph from Dr. W. L. Schwarz

EXTRACTING BRAZIL NUTS FROM THE PODS

The pod sometimes weighs more than two pounds and contains from 12 to 22 nuts. After these are extracted with a machete, they are washed and sorted for shipment, the United States taking the bulk of the crop (see text, page 455).

curare, a poison brew used for tipping arrows.

Among other interesting plants are the one known to the Peruvians as *chuchusco*, whose sap is generally reputed

among the natives to have the properties of "the fountain of youth"; the *parauary*, whose efficacy as a cure for wounds we demonstrated on several occasions; and a species of laurel, common on the Rio

Negro, which when bored into at a certain season of the year yields a considerable quantity of clear, inflammable liquid that should find a use in industry.

THE THERMOMETER MAY VARY
54 DEGREES IN 15
HOURS

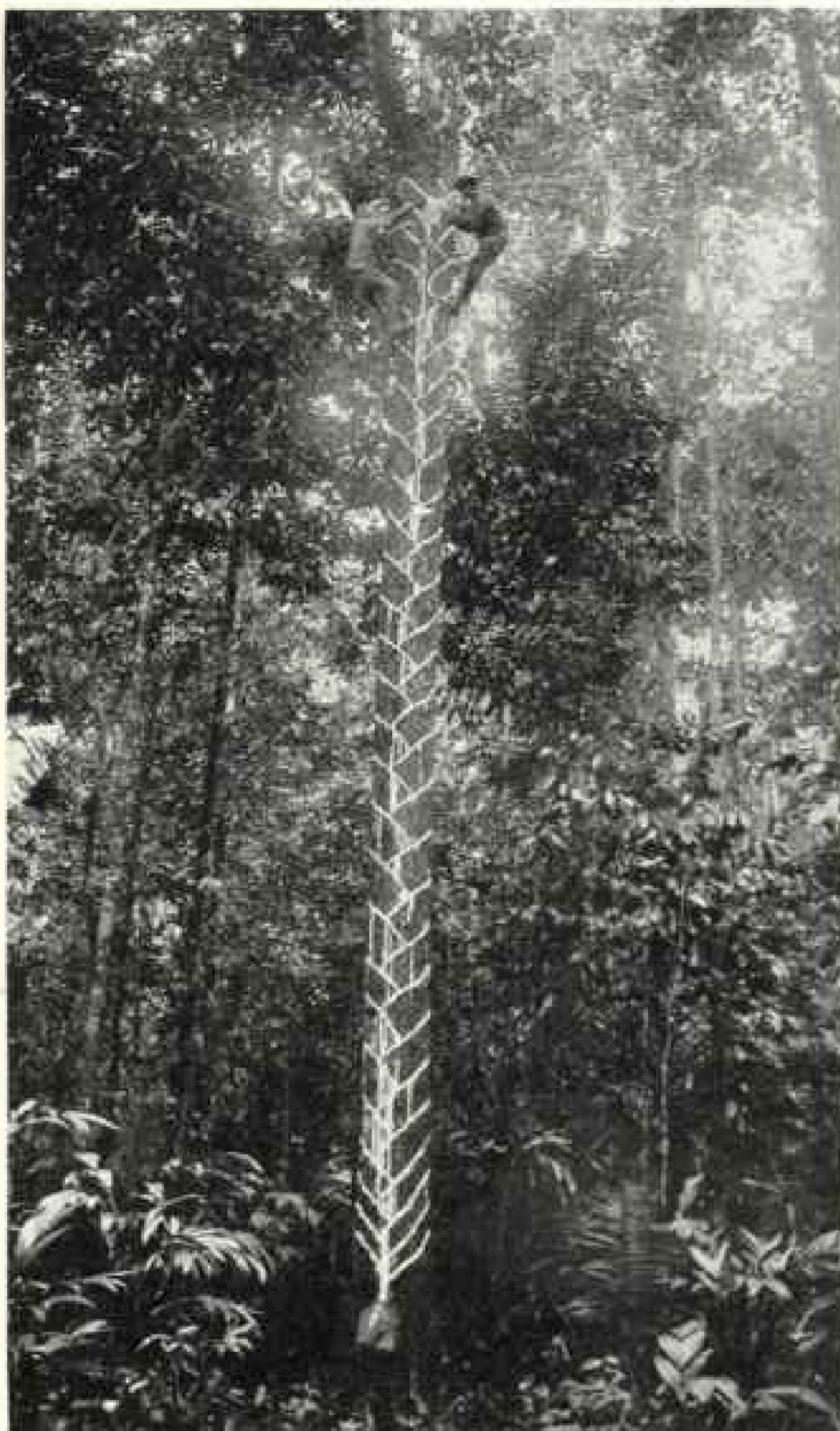
The climate of the Amazonia is not one of unmitigated heat, as is popularly believed. During the middle of the day it is generally very hot, and at such times the jungle is a veritable Turkish bath. However, the nights are nearly always cool enough to demand a blanket for comfort, and in the so-called winter season there is frequently a succession of cool days, when the mornings are uncomfortably chilly.

The daily range of temperature may be very wide, and I recall one day on the Madeira when a thermometer on the open foredeck of the *Audira* registered 130° at 3 p. m., and at 6 the next morning read 76°.

A cool wind that blows from the snows of the far-away Andes brings the well-known *friagem*, that sends the thermometer down into the forties and sets the natives to shivering.

Nor does it rain incessantly, even during the rainy season, though the total rainfall averages about twice that of New York. There is, in fact, a real dry season, which is at its height in June and July, when rain may not fall for a month or more.

We found the long Bolivian ponchos, made of ordinary cotton cloth covered



Photograph from Dr. W. L. Schurz

TAPPING A BALATA TREE FOR GUTTA-PERCHA

The stiff, heavy gum produced by the massaranduba, a slim forest giant known locally as the bully tree, is one reason for the existence of Boa Vista, the chief cattle-shipping point on the Rio Branco, tributary of the Negro (see, also, text, page 383). Gutta-percha has many uses in commerce, one of the most important being in the manufacture of balata belting.

with a thin layer of fresh rubber latex, an excellent protection against the downpours, though very hot.

Except in certain ill-favored localities, where man's negligence or a highly unfavorable environment makes it so, it is



Photograph by Dr. William Curtis Farabee

SLEEPING IN TIERS: AMAZON VALLEY

The hammocks of the whole family, among the Waiwai Indians living along the headwaters of the Trombetas, are tied to the same two house posts, one above the other. The mother sleeps nearest the ground, with the father and children above. The dog is kept on a platform at the head of the hammocks, so that the jiggers may not get into his toes.

not an unhealthful climate. White men spend their lives there in excellent health, though one may pay dearly for disregard of certain elementary rules of hygiene. Hookworm is widespread among the great mass of barefooted natives, and malaria in more or less malignant form is rampant in some districts, but over wide areas does not exist at all.

The gospel of quinine and the mosquito net has been spread widely by the devoted agents of the Brazilian Public Health Service and by the Catholic missionaries, who act as their aides in much of the Upper Amazon country.

Yellow fever and beriberi, which once took a heavy toll, have disappeared, the latter with the healthier diet that has come with a greater dependence on a fresh supply of locally grown food.

Leprosy is too common, but the Brazilian state governments are making a strong effort to segregate and treat the unfortunates afflicted with it.

A "SINGING DOG" BROUGHT TO WASHINGTON, D. C.

There is much less *wild life* in the Amazon forest than would be expected. Every rubber worker in Brazil carries a .44 Winchester carbine on the daily round of his trees and shoots any animal that he sees. Then, at night, he will set his gun as a trap, or "armadillo," behind some log on his customary trail, over which prowling animals may jump.

Consequently, as one Brazilian put it, the wild game has been "liquidated" over wide areas of the valley or driven into the more remote interiors, sometimes by the heavy floods or by hunger. Most of it is a timorous, shrinking fauna. Even the jaguar, the largest of the carnivora, is seldom aggressive, though a related black species has a bad reputation, and the other felines are dangerous only to the smaller creatures of the jungle.

There are still monkeys in profusion, and at dusk or dawn the forest often reverberates with the truly terrifying roar of the "guaribas," or howlers, or the early morning silence is broken by the staccato chatter of the noisy prego monkeys. Monkeys are a highly esteemed article of food among the Peruvian woodsmen and are everywhere hunted

relentlessly in the vicinity of plantations because of their predatory habits.

Deer are very common in some parts, but the tapir (see page 392) and anteater are going the way of other large game.

One of the rarest of Amazonian animals is the wild dog. I brought back one of these strange canines that was found in the Beni Valley, in Bolivia, and presented it to the National Zoölogical Park at Washington. The dog is amphibious, enjoying nothing more than to stand on his head in a pail of water. Instead of a bark, he makes a noise midway between a squeal and a chirp, which fact earned him much publicity as the "singing dog."

THE SAVAGE PIRANHA DEVOUR AN ALLIGATOR

The rivers and lakes teem with life, in fact, the Amazonia is a fisherman's paradise. I have never seen so many fish as at some places on the Solimões, notably at the site appropriately called Piracema, "pira" signifying "fish."

The giant pirarucu, dried and salted in sheets, is the most valuable fish of the Amazonian waters. The mammalian peixe-boi, or cowfish, the manatee or dugong of other countries, is also widely hunted (see pages 449 and 450).

The savage, though small, saw-toothed piranha swarms in some of the rivers, ready to prey on anything, from fish to man, that exposes the slightest abrasion on the surface of the body (see, also, page 412).

Paul Le Cointe, the eminent director of the Commercial Museum at Pará, told me of how he had once seen a school of piranha devour an alligator. The alligator was pounced on by a jaguar, which turned it over and began eating into the tenderer parts exposed beneath. The injured animal had then crawled back into the river, where the piranhas set on it and, entering the cavity made by the jaguar, soon finished the helpless brute.

Where these fish are present it is even dangerous to trail one's fingers in the water over the side of a boat, not to speak of bathing in the stream.

Fresh-water porpoises, or botos, are seen frolicking far up the great rivers, where their semihuman antics have given rise to a local legend to account for doubt-

ful paternity among the caboclo mermaids of those shores (see text, page 461).

Swarms of alligators often show their ugly snouts above the surface of the water (see page 448) or bask on the muddy shores, though they never enter certain rivers. Turtles abound on some of the rivers, in spite of the wholesale destruction of their eggs, and their pursuit constitutes one of the most important industries in certain districts, as on the lower Rio Branco. The hunters shoot them in the neck with arrows, to which a large cord is attached. They are then herded in pens by the hundred, to be sent down to Manaus or Pará (see pages 382-383, 454-455).

Electric eels grow to a large size, one which I killed in Peru having measured seven feet in length and nearly six inches in thickness. These eels are capable of giving a severe electrical shock, and one of our party facetiously suggested their propagation as storage batteries.

The Amazonia jungle is rich in bird life, and many species are remarkable for the beauty of their plumage or their song.

Parrots and macaws, the polycolorred araras of Brazil and huacamayos of Peru, are very common, and there are few more beautiful sights in the jungle than these birds in flight.

A disagreeable feature of the Amazonian towns is the presence of flocks of funereal buzzards, usually perched on the most conspicuous buildings in the place or strolling about the streets with impunity.

A PLAGUE OF INSECT LIFE

The Amazon Valley, unfortunately, is as rich in insect life as it is poor in large fauna. These include mosquitoes of the *culex*, *anopheles*, and *stegomyia* varieties (see, also, text, pages 377 and 405).

Even more pestiferous than the mosquitoes in some parts of the valley are the ants. One who inadvertently brushes against a tree may suddenly find his whole body the field of operation of scores of the dreaded *formigas de fogo* (fire ants), that leave him spotted with burning welts. While riding along a jungle road or canoeing under overhanging trees, one may expose himself to the same vicious attacks. A canoe which is

boarded by these insect buccaneers is a most uncomfortable craft.

The savage taxi, or *tangarana*, ants grow to be more than an inch long, and a pinch from their powerful mandibles is a painful experience (see, also, page 408). The sauba, or leaf-cutting ant, is the principal enemy of agriculture in the Amazon Valley and has been known to cause the abandonment of certain localities by their inhabitants.

Among other insect pests are the chiggerlike mucedim, the bloodsucking pium and its larger brother, the borrachudo, and the annoying motuca fly. Tarantulas scamper about old buildings, and I remember pulling a large one from my boot in Bolivia.

Yet all these insects are not found everywhere and one is frequently exempt from all forms of insect life. On the other side, there is a profusion of butterflies, and one of the pleasantest recollections of rides through the jungle is of great blue morphos butterflies zigzagging down the trail ahead of me, the sun occasionally flashing from their brilliant cerulean wings.

One of the most curious insects found by our party was a well-armed and paradoxical Peruvian creature called the Traffic Bug, which carried a red light in its head and a green light in its tail.

There are few more widespread misconceptions of the Amazon Valley than that it is the chosen haunt of serpents of all kinds. Thus, a common picture in the old school geographies showed a boa constrictor seizing a horse and rider at once, and popular fancy has perpetuated this belief in the ubiquitous and deadly Amazonian snake. During our entire stay I saw by actual count six snakes. One may easily find them in the canebrakes and swamps or in old, abandoned houses, but by avoiding these one may travel far without encountering a snake.

The best-known snakes of the valley are the jararaca and the surucucú, both of which are poisonous. The rather innocuous boa constrictor, or giboia, is encountered now and then, and, domesticated, is sometimes kept in houses for the purposes of ridding them of rats and bats. The much more objectionable anaconda, or sicutijú, grows to a great

length and is the source of many myths among the natives, whose imagination enhances its size and prowess to terrifying proportions.

MANY INDIAN TRIBES IN TROPICAL AMA- ZONIA

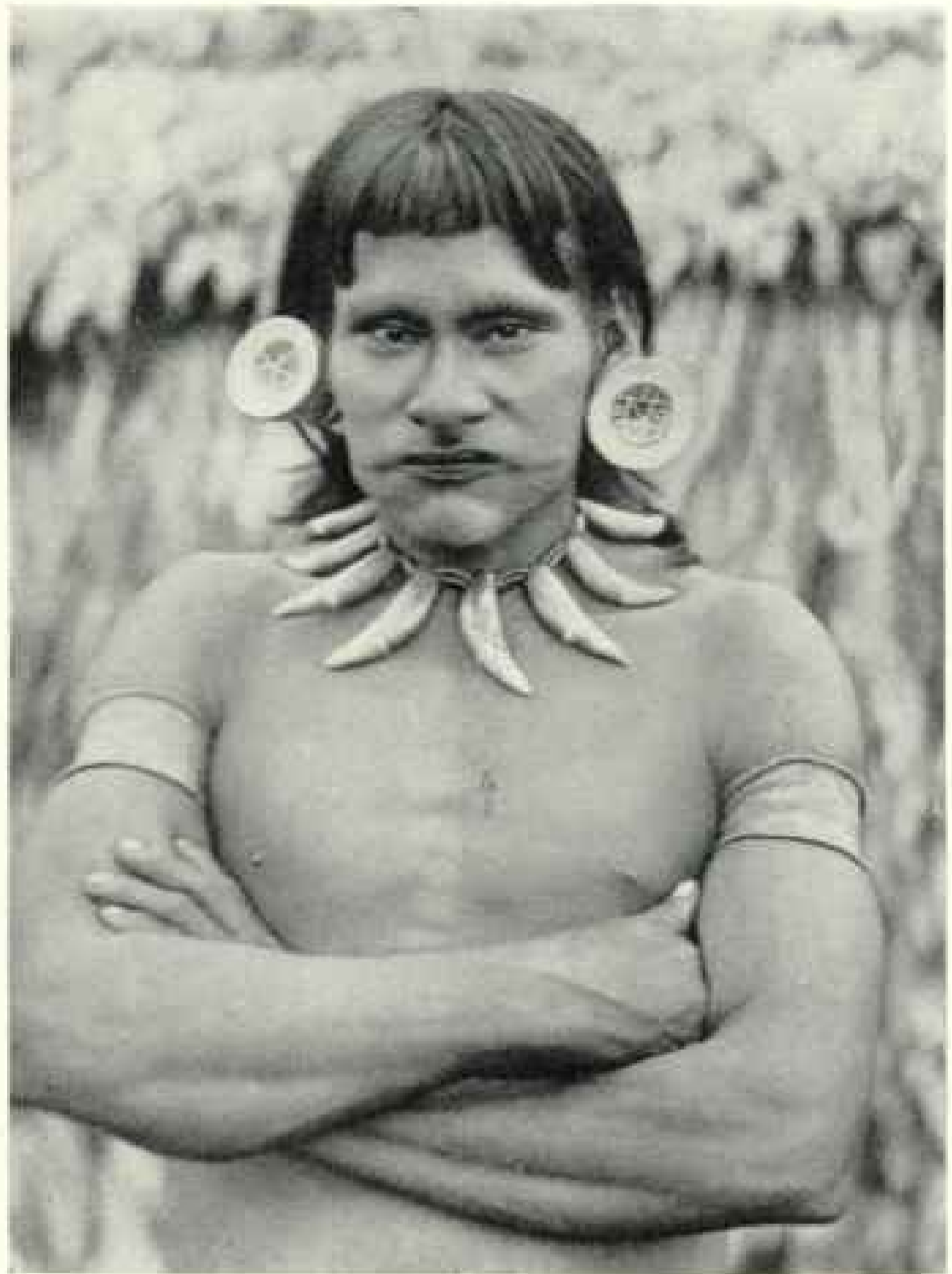
In all the tropical part of the Amazon basin there probably are between 1,500,000 and 1,600,000 inhabitants. Of these some 1,300,000 live in Brazil and the remainder in the five Spanish-speaking countries, but largely in Bolivia and Peru. The basic race is Indian.

There are still small groups of savage Indians in the jungle fastnesses on the Bolivian side of the Abunã, but they seldom appear along the river. Many tribes often reputed to be "bravos" or "barbaros" are innocent of any hostile intent so long as they are left alone by the whites.

The great mass of the population of the Amazonia is a mixed people, product in Brazil of the crossing of white with Indian and Negro, and in the Spanish countries of white with Indian. In Brazil these people are loosely referred to as *Caboclos* and in Bolivia and Peru as *Cholas*.

AMAZONIA, THE HOME OF THE RUBBER TREE

Above all else, the Amazon Valley suggests to the outside world RUBBER. For a long time it was the principal source of the world's supply, until the vast plantations of the East came into production



Photograph from Dr. W. L. Schurz

A HUITOTO INDIAN OF THE PUTUMAYO COUNTRY

Huitoto means "mosquito," and the tribe is so called because of the thin, misshapen limbs and fat bodies of its members. The practice of binding the upper arms, of wearing necklaces made from the teeth of jungle animals, and of adorning the ear lobes with short lengths of cane is common to several tribes of Amazonia. The Indians of this great rubber region were formerly exploited by unscrupulous agents, and consequently view every white man as a potential enemy.

and left to the wild rubber of the Amazonia a very minor place in the world market.

The Amazon Valley was the original home of the *Hevea brasiliensis*, the tree that produces the superior rubber known as "Fine, Hard Pará" or "Up River Fine." Its original habitat was in the higher country about the upper reaches of the southern tributaries of the Amazon. Thus, there is a wide belt of country that extends west from the basin of the Tocan-



Photograph from Dr. W. L. Schwarz

LOADING COTTON AT YURIMAGUAS, PERU, FOR THE ATLANTIC SEABOARD

Since the collapse of wild rubber, formerly the chief product of the Amazon Basin district of Peru, cotton planting is assuming some importance. Founded in 1709 by a Spanish missionary, the flourishing town of Yurimaguas takes its name from an Indian tribe which fled from its home in the Amazon Basin to escape slave hunters. The women of the tribe are believed by some authorities to have been the Amazons encountered by Orellana when he descended the river which bears their name (see text, page 445).

tins across the upper courses of all the great north-flowing rivers to the Ucayali, in Peru, where the tree is really native.

Wherever it exists along the lower rivers, as it does as far as the islands of the delta, it has grown from seeds carried down by the current of the rivers.

There are several other varieties of trees that produce "weak" or "weak fine" rubber, but the "brasiliensis" is the only source of the "fine" rubber that established a world standard in the industry.

In 1876 Henry Wickham, now Sir Henry, took seeds from near Boim, on the lower Tapajóz, to London, where they were planted in the Kew Gardens. The seedlings that grew therefrom were transplanted in the Orient and formed the nucleus of the vast plantations of Ceylon, Malaya, and the Dutch East Indies.

There the business was established on a scientific basis impossible in the native

rubber industry of Amazonia, and with a potential production that assured its early domination of the world market.*

There are many small plantations in the Amazonia, especially along the lower Tapajóz, in the Maués lowlands, and on the Madeira, some of the trees dating from the sixties of the last century, but they are insignificant in comparison with the plantations of the Orient. However, the Amazonians are hopeful of the establishment of plantations on a scale akin to those of the East, and that would save the traditional industry from total eclipse.

RUBBER'S CHECKERED CAREER

Rubber in the Amazon Valley has had a checkered history. Shortly before the ascendancy of plantation rubber became

* See "Singapore, Crossroads of the East," by Frederick Simpich, in the NATIONAL GEOGRAPHIC MAGAZINE for March, 1926.

an accomplished fact, the industry reached its zenith in a burst of unprecedented prosperity. Prices of crude rubber rose for one dizzy moment to eleven shillings (\$2.75) a pound, and there were many in the Amazonia who believed that this level of prices had come to stay.

Those were bonanza times for Pará and Manaós (see page 355) and Iquitos and for every little settlement whose life depended on the price of the "black gold."

Men accumulated more money in a few months in the far interior than they had ever dreamed would come their way, and then swarmed down to Manaós or Pará to spend it in a few days of hectic pleasures, until empty pockets sent them up-river again, to the old, hard round in the jungle or at the trading post.

Champagne and the roulette wheel and automobiles hired by the day had swiftly accounted for the surplus they had brought from the distant seringal. Those more ambitious than the rest traveled to Paris for a few days on the boulevards before the inevitable journey back to the solitude and hardships of the forest.

Most of the great proprietors and traders indulged on a more elaborate scale. As a consequence, but few solid fortunes were built up from the millions that poured into the Amazon during that time.

The name given to an island in the mouth of the Juruá—Iha da Consciência, or island where men bound for the rubber country put ashore their conscience—bears witness to the ruthlessness with which some of the ephemeral wealth of that time was made.

After the peak of the boom, prices fell with terrifying rapidity, and those who had not liquidated their high-priced stocks in time were faced with ruin.

This was the beginning of the great crisis, from which dates the present depression of the Amazon Valley. Families, only a little while before in affluence, were impoverished and few business houses survived the shock.

An exodus of thousands of rubber workers followed from the upper rivers. Torsos of great unfinished buildings in Manaós testify to the completeness of the disaster that reduced the resources of the State and of its inhabitants.

The Federal Government of Brazil made efforts to save the rubber industry from

utter ruin, but its program was too grandiose for realization. Moreover, the increasing entrance of plantation rubber into the market at that period only aggravated the effects of the crisis.

The Amazonia, especially the Brazilian and Bolivian parts of the valley, have continued to produce rubber in considerable quantities. Temporary rises in the price of crude rubber have given a fitful encouragement to those who had been disheartened by the blow struck at native rubber by the plantation product, but the wiser believe that only the adoption of the plantation system can enable the Amazon country to compete again on anything like equal terms with its formidable rival of the mid-East.

A REGION OF MYTH AND MYSTERY

In spite of nearly four centuries of exploration, large areas of the Amazonia still await the coming of the first white men. The courses of all the important rivers are well known, but there is much *terra incognita* between some of them, as between the Negro and the Japurá, or between the Santiago and the Pastaza, in the region under dispute between Ecuador and Peru; also a wide belt of territory extending across the northern part of the State of Pará yet remains to be explored.

Many myths and misconceptions regarding the region persist. To most people it is still a sort of antediluvian swamp, where man is perpetually ravaged with fevers and exposed to lurking serpents and carnivora, not to speak of blood-thirsty savages. Even to Brazilians of the south and to Bolivians and Peruvians of the mountain country it is a forbidding and mysterious land.

To Euclides da Cunha it was an unfinished world into which man had come too soon. Another Brazilian writer, under the spell of da Cunha, has recently entitled a book on the Amazonia "Terra Immatura," and the morbid imagination of Alberto Rangel saw in it an *inferno verde* (green hell).

The Amazonia is neither a hell nor an earthly paradise. By far the greater part of it is entirely habitable by white men, though there are sections where nearly every circumstance of the environment militates against human existence.

WHERE THE SARD HOLDS SWAY

With Illustrations from Natural-Color Photographs by Colonel Luigi Pellerano

IN MOST other parts of Europe fine old costumes of other days have entirely disappeared, but in Sardinia, if one visits the right places at the right time, beautiful souvenirs are still to be found of times when the pageantry of the Middle Ages expressed itself even in the everyday dress of the common people.

There are almost as many variations of costume on this Mediterranean island as there are villages, for each little community has some feature of its own. In one locality a certain combination of colors may be used exclusively, while in another the cut of the apron or the arrangement of the headdress may be the distinguishing characteristic.

These differences in village styles were once to be found all over Europe and may be traced to the remoteness and comparative isolation of places in medieval times. On the Continent they have been ironed away by contact, but in Sardinia efficient and easy means of transport are of more recent development, and some of its mountain solitudes have not yet felt the full force of this standardizing influence.

A SOBER-MINDED PEOPLE FOND OF COLORS

Although the Sards are essentially a sober-minded people and not particularly addicted to display in other respects, their costumes are riots of blue, scarlet, orange, green, and all the shades that go between. These are often elaborately embellished with embroidery, gold lace and brocade, and gold and silver buttons. Many of the finer ones have been handed down from generation to generation and possess, in addition to their not inconsiderable intrinsic value, the sentimental significance of heirlooms.

While varying so widely in color and style, there are certain features common to nearly all the island costumes. The apparel of the Sardinian woman consists of a heavy skirt of silk or wool, a white waist, a colored bodice or corset, an apron, and a sort of kerchief to cover the head.

The skirt is sometimes of a sober hue, but may be of scarlet, blue, orange, or purple (see Color Plate III). Over it is worn the apron, which is nearly always

of a brilliant color and varies greatly in size and shape with the locality.

The women of Aritzo, who wear one of the richest and most original costumes on the island, affect a tongue-shaped apron of scarlet, faced and banded in bright blue. Other villagers wear long, dark aprons much embroidered in bright colors (see Color Plate VII), while still others wear fan-shaped ones with a ruby-red center and a wide white border garnished with figures of blue and gold.

The white waist is worn beneath the bodice, and the kerchief, perhaps white, but generally of bright hue, covers the head and sometimes the shoulders, and is brought together under the chin with a fancy pin (see Color Plates III and VII).

The exact origin of this kerchief or head-cape is unknown, but it dates far back into antiquity, as the head of a statuette of the Goddess Vesta in the Etruscan Museum at Gori, Italy, is draped in much the same style as that popular with the women of Sardinia to-day.

So impressive are the costumes of some of the peasants that the occasion of their leaving church on Sundays and fête days has been likened to a scene at the court of some prince of the Arabian Nights. The flaming reds, blues, and purples are frequently decorated with gold lace and brocade, and as the worshipers descend the church steps with their silver and mother-of-pearl rosaries in their hands, the richness of their costumes, the beauty of their faces, and the background of odd balconied houses all combine to produce a truly medieval atmosphere. Last among the women come the widows, dressed usually all in black.

THE WIDOW'S MOURNING USUALLY LASTS FOR LIFE

The widow's dress is not the same throughout the island. While in most places she must wear the black habit of mourning all her life and endure an existence as somber as the color of her garments, in some villages only a kerchief of black is worn, and she may continue to gratify her love for bright colors in the rest of her costume (see Color Plate V).



©

Autochrome by Luigi Pellegrini

CAMPIDANO COURTSHIP

Among the villages of the great Sardinian plain (*Campidano*), which stretches for fifty miles from citadel-crowned Cagliari to Oristano, these brilliant and costly peasant costumes are seldom seen nowadays. The beautifully fabricated grillwork over the well is a relic of the age when Spain dominated this island hub of the western Mediterranean (see "The Island of Sardinia and Its People" in the *National Geographic Magazine* for January, 1923).



60

Autofotografie by Luigi Peddini

GREEN GIVES THE COLOR NOVIE TO OLENA'S GALA COSTUMES

Only on feast days and Sundays do the men of Oliena wear this gay attire. Many of the Sardinian women have a serenity of expression which would have delighted old masters seeking models for Madonnas.





©

Anticostume by Luigi Pellegrino

VARIETY IN COSTUMES REFLECTS THE DIVERSE INFLUENCES WHICH HAVE FLAVORED SARDINIAN LIFE

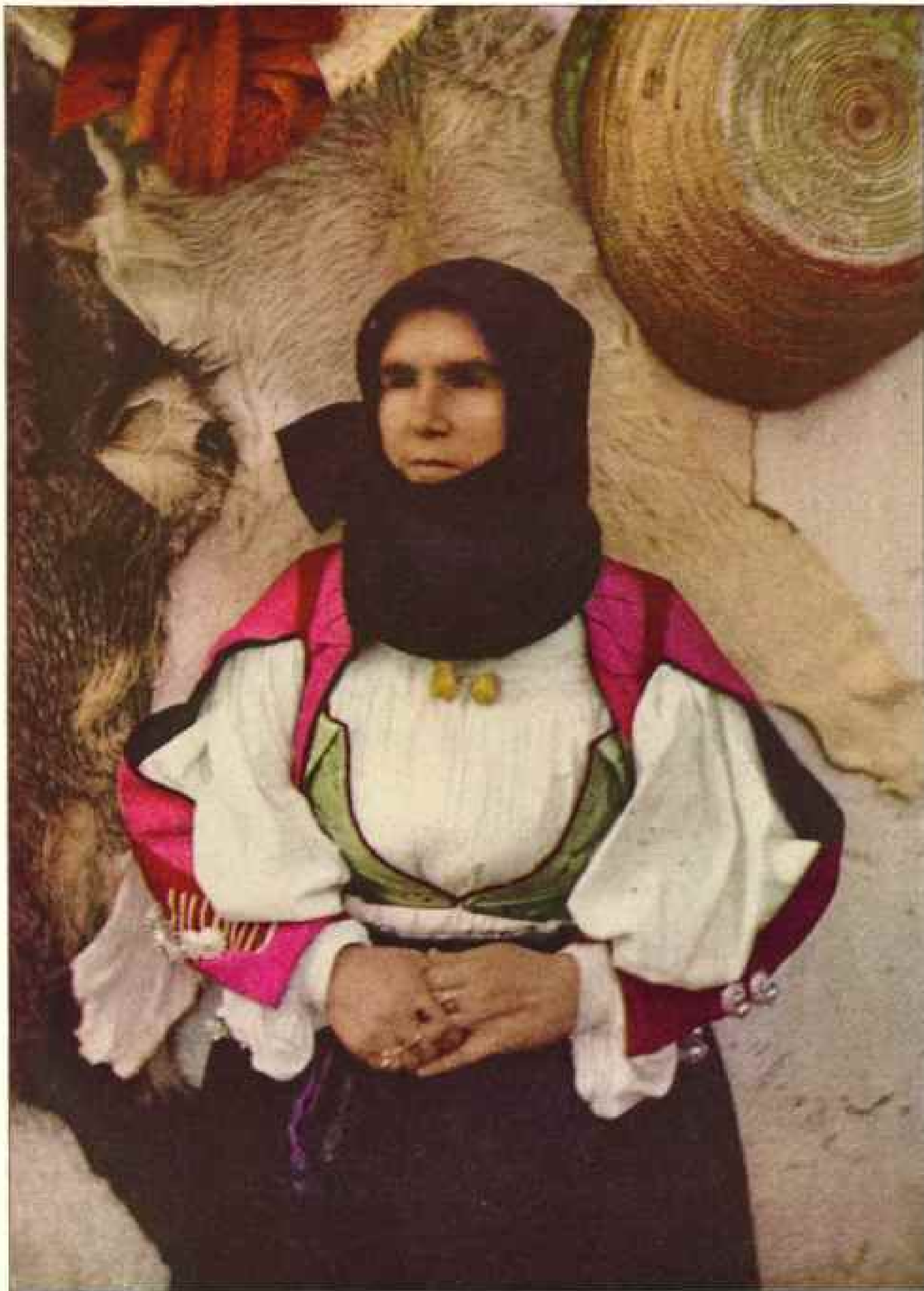
The mother and daughter, at the left, wear the relatively somber garb of the southern mining region, while the brilliant plaited skirt and elaborate embroidery worn by the young woman at the right proclaim her as a resident of Osilo, a northern village which boasts the most beautiful costumes in Sardinia.



Autostudio by Luigi Pellegrino

A PAIR SASSARESE

She dwells among the gray-leaved olive groves and vast vineyards of the northern province of Sassari, and speaks a Tuscan dialect, recalling the fact that in the Middle Ages her city was a Pisan colony.



©

Autochrome by Luigi Pellegrini

THE WIDOW SWATHES HER FACE IN BLACK

The Nuoro peasant does not permit her bereavement to rob her costume of color and ornament, however. The double button at the neck is a feature which is common to many districts of the island (see also Color Plates II and VII).



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Autochrome by Luigi Polverini

A SERVANT SALUTES TWO GENTLEMEN OF OLLENA

Wealthy farmers, when traveling along mountain trails, still carry their guns, though the banditry of the open road has become a mere tradition. The man on foot carries his lunch in the end of his *beretta*, or long cap.

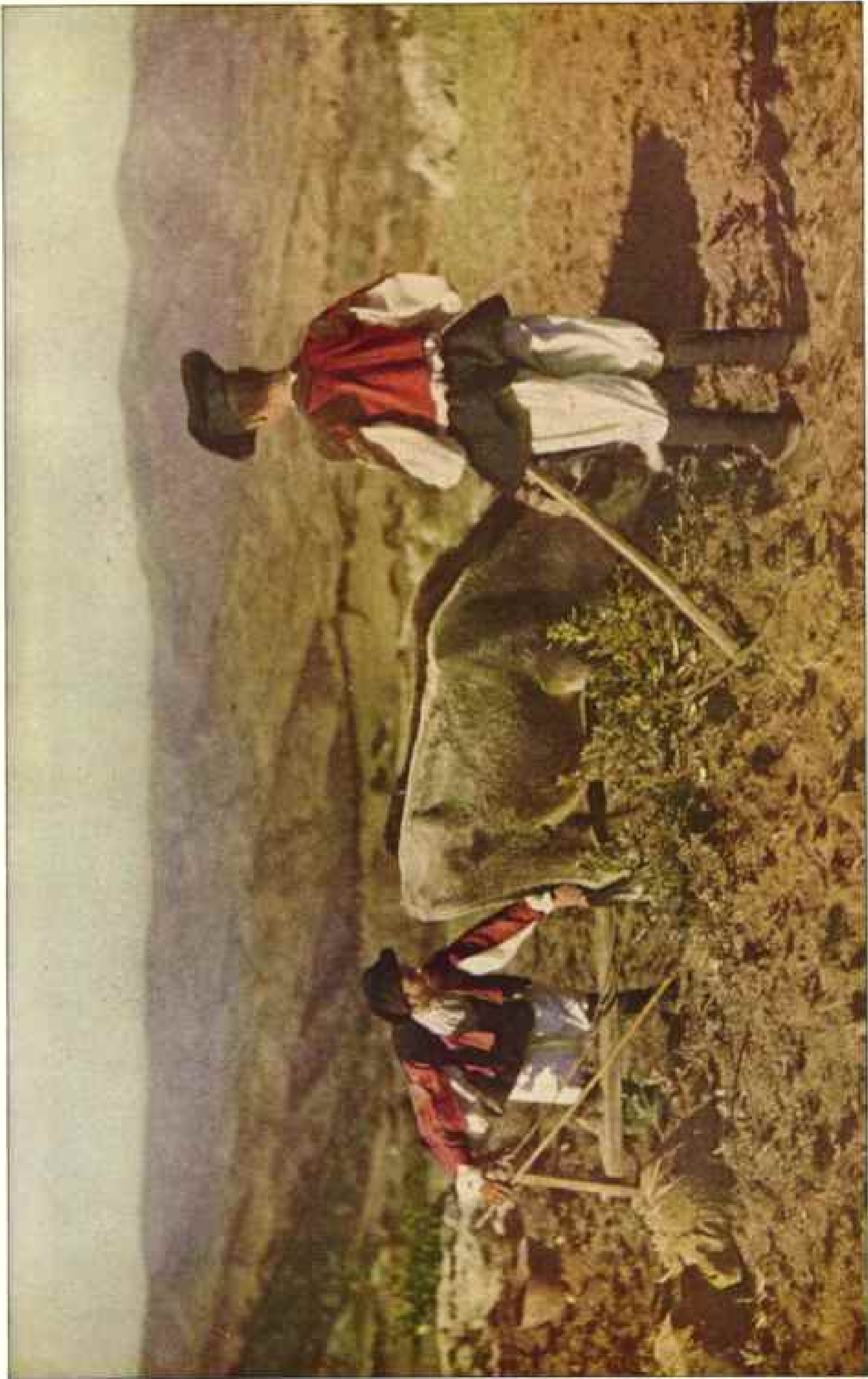


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Autograph by Luigi Pellizzari

SHE DWELLS IN THE HIGHLANDS OF NUORO

In this section of the island, known as the Switzerland of Sardinia, the women have retained old fashions unaltered, but in most other districts the peasant costumes which have been handed down for generations as family heirlooms are rapidly disappearing.



Autoschroma by Jozsef Pollmann

BARTORI'S SPLENDOR DISTINGUISHES THE HUNGARIAN OF THE INTERIOR

These mountain farmers consider such bright-colored, everyday woollen garments as fit only for the fields; on Sunday they don their best and go calling on their neighbors. This type of handmade wooden plow is used only in the mountain districts, where the turf is of little depth.

Red or scarlet is ordinarily the color of youth and, with bright blue, is utilized in nearly every variation of costume. There are other colors that have special significance when worn in certain ways, as, for instance, in Desulo a purple border appearing on an apron signifies that the wearer has lost her parents. In some communities if a woman is widowed she must forever forswear the use of scarlet, even though she marry again.

The men of Sardinia also have an interesting heritage of costumes which, while they differ with locality like the women's, show fewer marked variations. Generally speaking, a man wears knee-length or longer, bell-shaped, baggy trousers of white and either leggings of coarse serge or high spats.

Over a white shirt is worn a gayly colored vest, sometimes closed to the neck, sometimes a cutaway, and over this a small doublet.

Around the masculine waist is often wound a Turkish sash, which in ancient times was used to carry a dagger, but now conceals nothing more deadly than a pipe.

The Sard confines his hair beneath a little black skullcap, over which he wears a regular Sardinian cap—a narrow cloth bag, closely resembling the old American stocking-cap—which, in addition to being a head covering, serves as a lunch bag and valise in the daytime and as a pillow at night (see Color Plates I, VI, and VIII).

Many villagers also wear the *ragas*, a peculiar sort of short overskirt not unlike a Scotch kilt (Plate II), or a pair of short, balloonlike top trousers that extend only to the middle of the thigh (Plate VIII).

The shepherds of such villages as Fonni (from the Phœnician word *phianna*, meaning "elevated view") wear the *mastruca*, a sleeveless fleecy sheepskin jacket. Gun, pipe, and handoleer are carried as inseparable companions.

The Sard is a brave, hardy, liberty-loving people, whose history has been one long and continuous struggle for existence against alien peoples that have so repeatedly assailed their shores. This bitter experience has served to accentuate and develop their native qualities, and the Sardinian soldiers who fought for Italy in the World War well demonstrated their courage and the ability of their race to endure hardships and privations.

Although these people have maintained their individuality in the face of great oppression, they could not but feel the influence and bear some of the impress of the many races that have occupied their island in the last 25 centuries. Italian, Spanish, and Saracenic influences are all to be found in their costumes.

Probably as early as 500 B. C. there is record of the presence of Phœnician settlers in Sardinia, and Carthage maintained her sovereignty over the island until 238 B. C., when the proud mistress of North Africa had to bow to the superior power of Rome and her insular possession was declared a Roman province.

THE SARDS NEVER SUBMITTED TO THE CÆSARS

But Rome never quite succeeded in subjugating the Sards, for the mountain dwellers of the Barbagia at that early date gave evidence of the same spirit of independence which has ever since been one of their cardinal characteristics. An unending guerrilla warfare was waged against the legions of the Cæsars. Many of the natives were slaughtered and many more were enslaved and sent to Rome, but never were they wholly subdued. Indeed, so refractory were they in servitude that their Roman masters were glad to be rid of them, and the expression "Sards for sale" became a byword.

Following the dispossession of the Romans, the island was overrun in turn by Vandals, Saracens, Pisans, Genoese, and later by the armies of Aragon, Austria, and Savoy, until finally, during the latter part of the last century, the land became an integral part of the united kingdom of Italy.

Development of natural resources will bring to the Sards material prosperity, but it will at the same time mark the beginning of the end of that picturesque remoteness that has been theirs.

The beautiful costumes that have distinguished the island are here reproduced as a valuable historic record through the medium of natural-color plates, made with rare artistic perception by Col. Luigi Pellerano. They cannot much longer resist the advance of modern styles, but will soon join their counterparts in other lands as colorful memories of the past, to be seen only in museums.



Photograph by C. W. Wright

THE WAY IN WHICH SARDINIAN WOOLENS ARE WOVEN

The women of the Mediterranean island are industrious and painstaking. Their flocks supply the necessary wool for the yarn from which are woven many of the costumes shown in Color Plates I to VIII.

RECENT BEQUESTS BY MEMBERS OF THE NATIONAL GEOGRAPHIC SOCIETY

WHILE the National Geographic Society depends entirely upon the small annual membership fees of more than a million members, its activities for the increase and diffusion of geographic knowledge appeal so strongly to many individuals that bequests are not infrequently made to further these objects.

Among the most recent of such bequests is that of Mr. George True Nealley, a resident of New York City and for 17 years a member of The Society, who bequeathed one-fourth of his estate, or more than \$20,000, to the National Geographic Society; one-half of the estate, or \$40,000, was left to Harvard University, and the remaining one-fourth to the National

Academy of Sciences. The Board of Trustees of The Society has set aside the bequest as a separate fund, the interest on which is to be used for purchasing books for The Society's geographic library, and each volume so purchased is to be marked as a memorial to Mr. Nealley.

Miss Abbie M. White, of Grafton, Massachusetts, who was a member of the National Geographic Society for 20 years, recently died, at the age of 70, and bequeathed "to the National Geographic Society of Washington, D. C., in memory of Edward S. Bowen, late of Pawtucket, in the State of Rhode Island, the sum of \$15,000, to be used for the purposes of said Society."

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

TO carry out the purposes for which it was founded thirty-eight years ago, the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over \$50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their

discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted \$25,000, and in addition \$75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings and whose customs, ceremonies, and name have been engulfed in an oblivion.

THE Society also is maintaining expeditions in the unknown area adjacent to the San Juan River in southeastern Utah, and in Yunnan, Kweichow, and Kansu, China—all regions virgin to scientific study.

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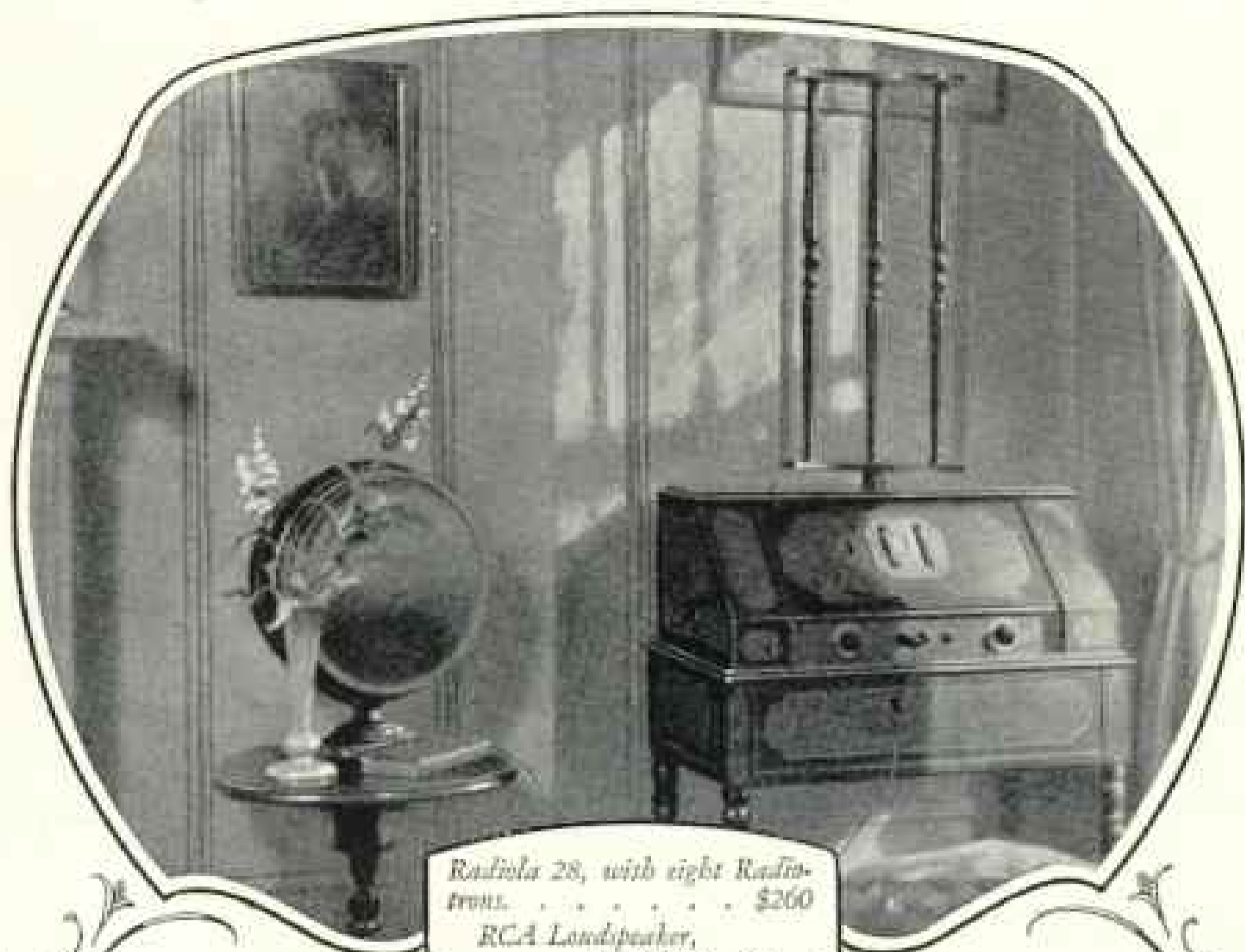
NEW 90 DEGREE

CADILLAC



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Cadillac—Division of General Motors Corporation



Radiola 28, with eight Radiotrons. \$260
RCA Loudspeaker, Model 100, \$35

Eight tubes —but a single control



Like an eight-cylinder car, the eight tube Super-Heterodyne gains ease of operation with power. The new Radiola 28 has five tuning circuits, each adding finer selectivity. It has eight tubes, each adding greater sensitivity. And the last tube, the new power Radiotron, adds volume—with clarity! But all the delicate mechanism is sealed away. And a single control tunes in the programs—station after station.

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and tone quality have been a two years' wonder.

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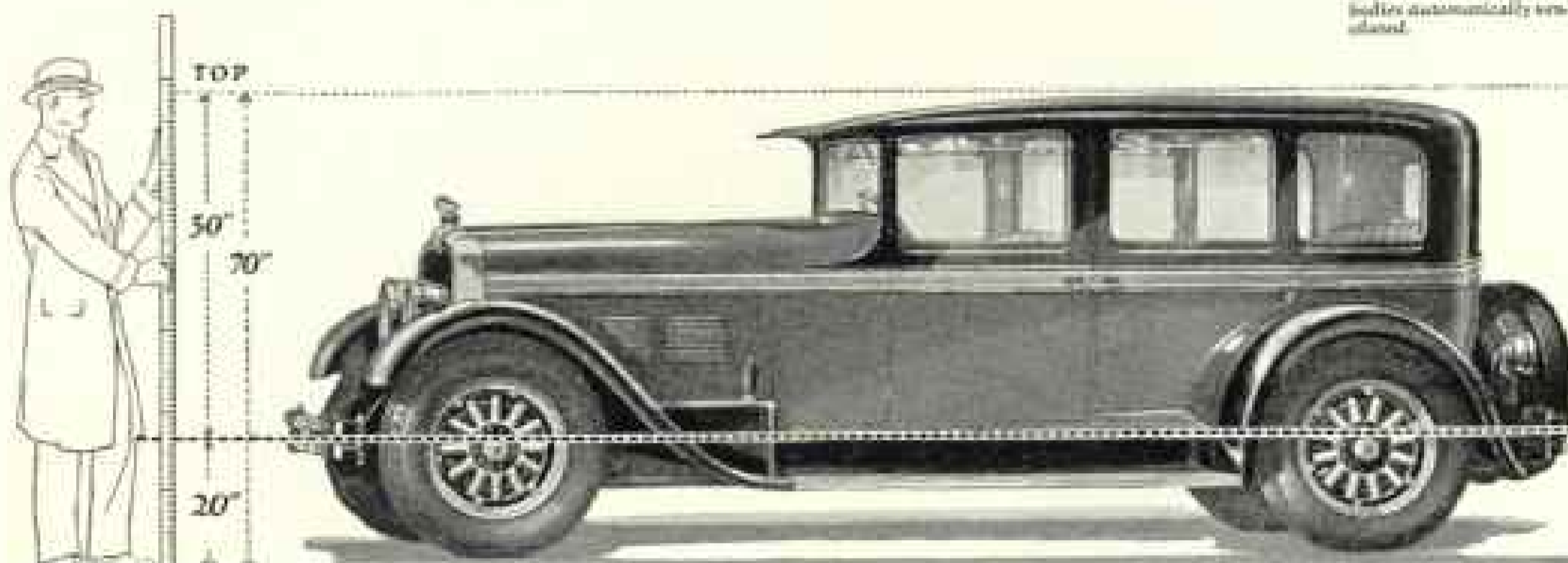
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—permitting lowered body; it improves with use

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—inherently equalized; quick-acting and positive

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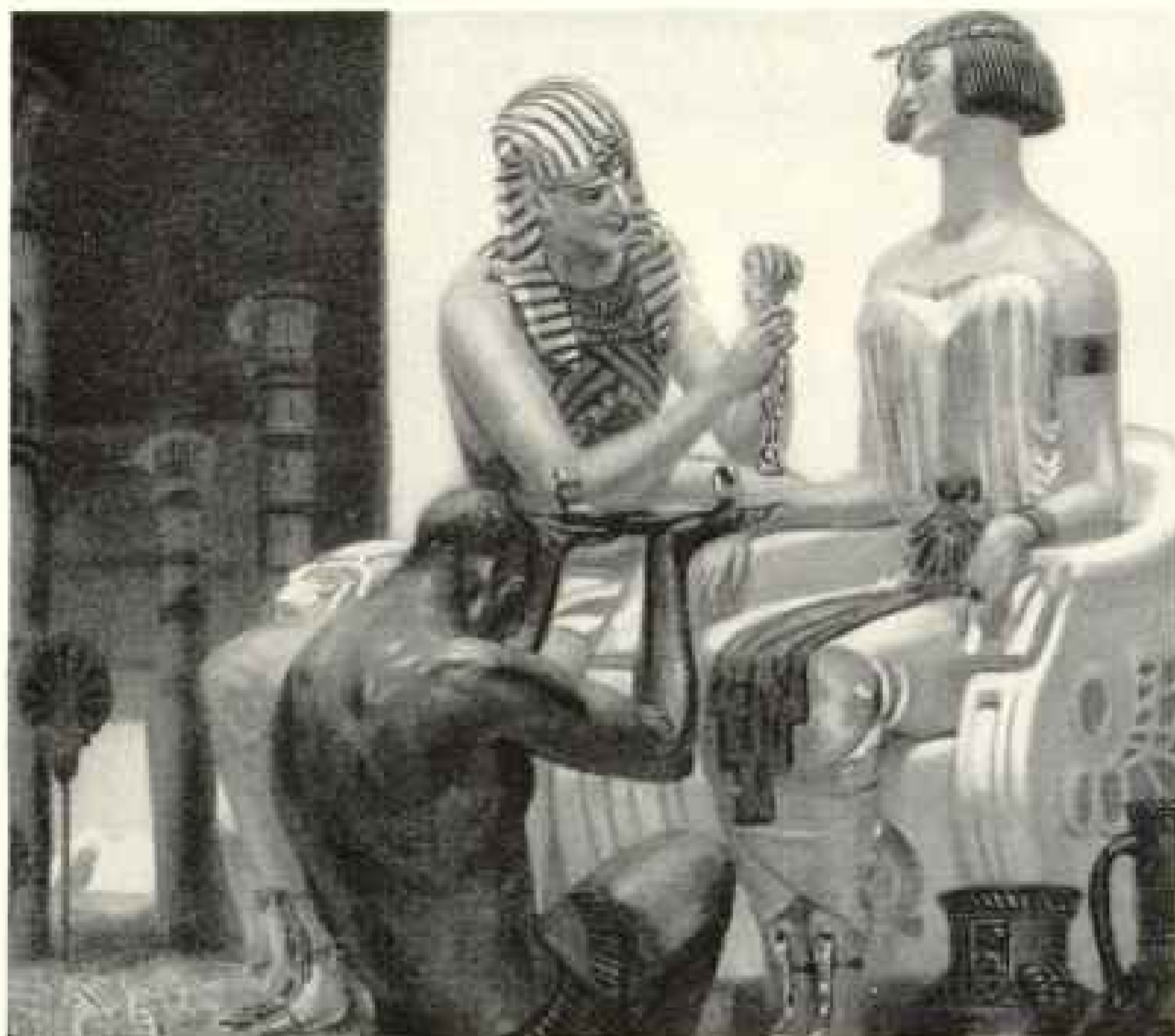
Words alone, or even pictures, cannot convey an adequate conception of the new and different engineering principles embodied in The NEW STUTZ. You must actually see the car and drive it yourself.

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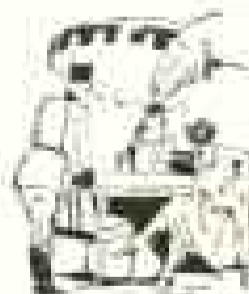


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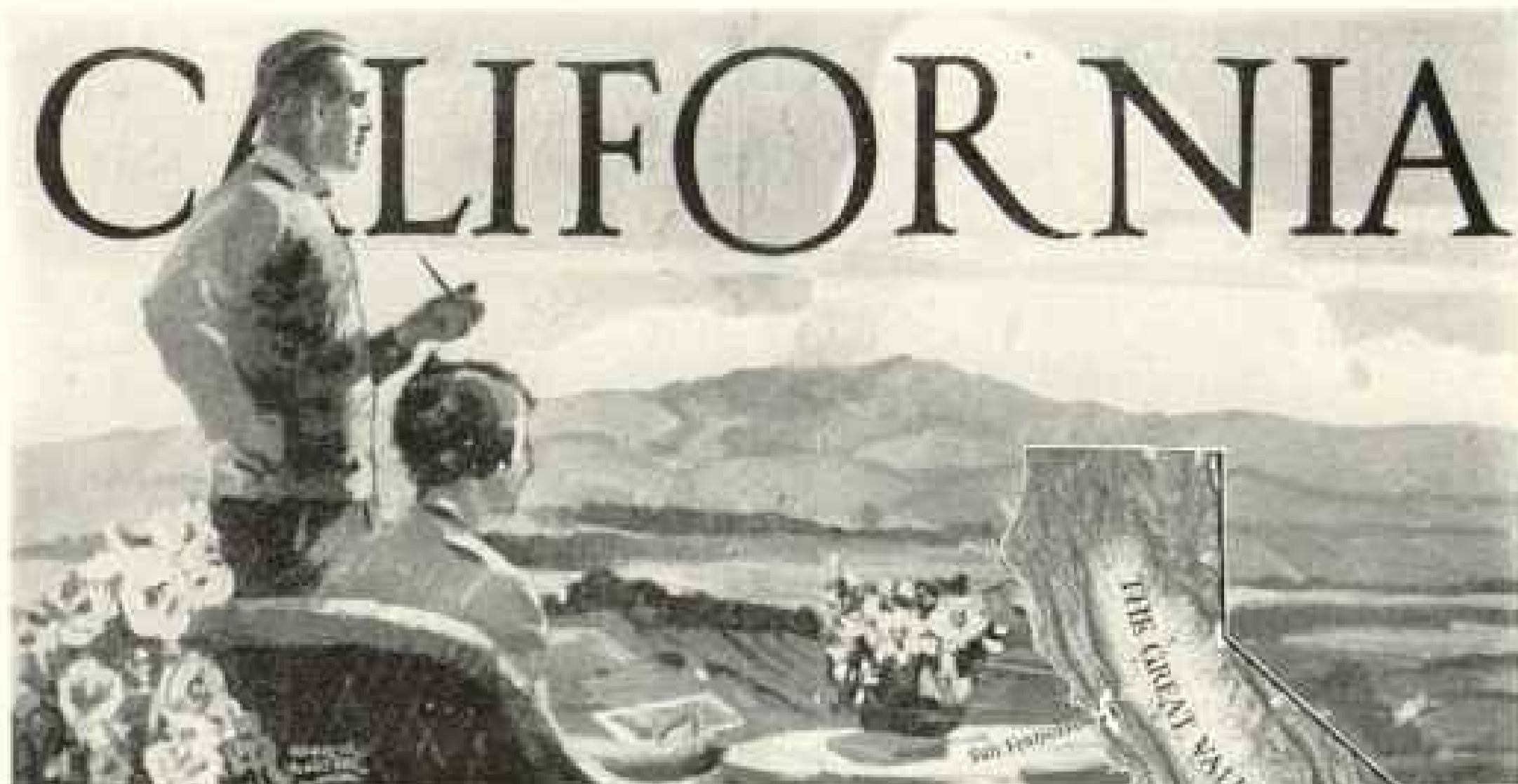
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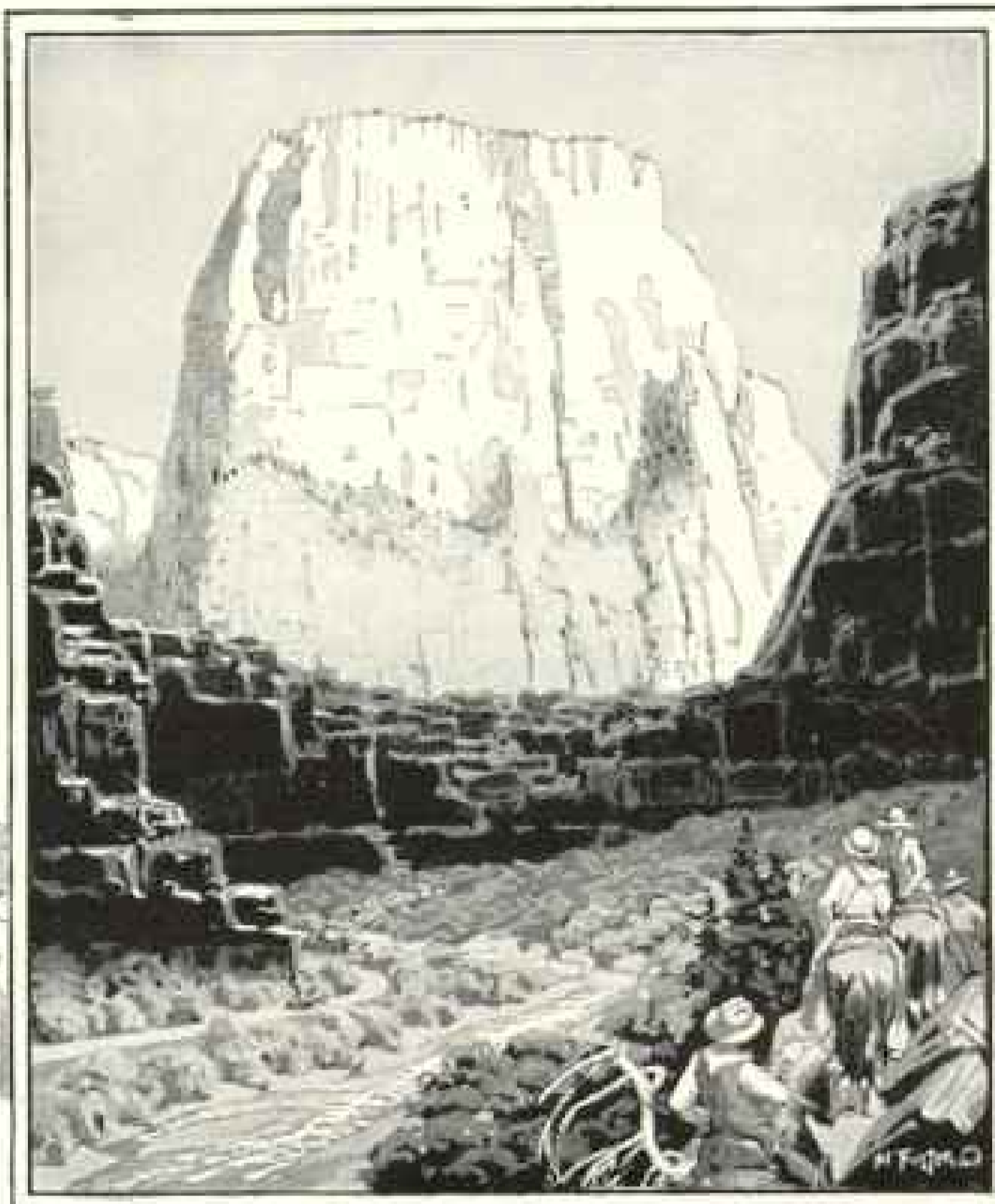
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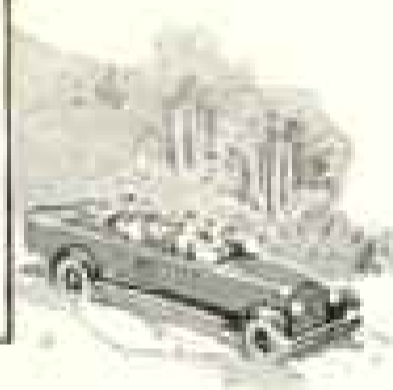
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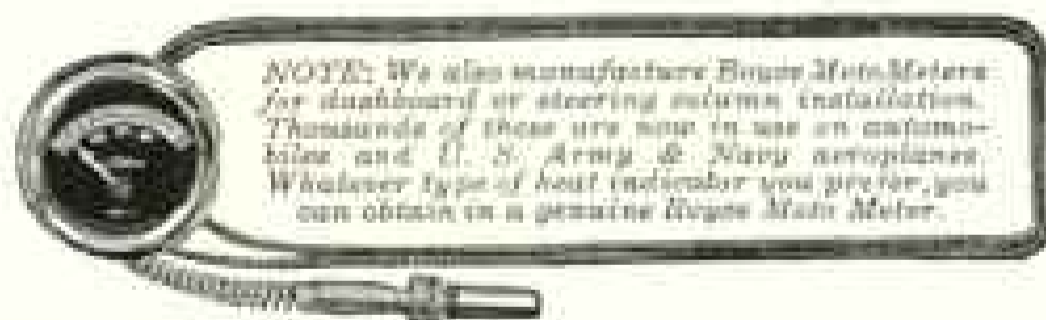
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their motor — an instrument which never requires adjustment and outlives any car. Its noticeable rise will always enable you to detect motor trouble. Its unique combination of beauty and downright utility makes it not merely a radiator ornament of the moment, but the permanent mark of the driver who is kind to his motor.

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Dealers everywhere have the Boyce Moto Meter on sale in various designs, models and prices—\$3.50 to \$15.00. Three minutes after you buy it, the Boyce Moto Meter starts to guard your motor.



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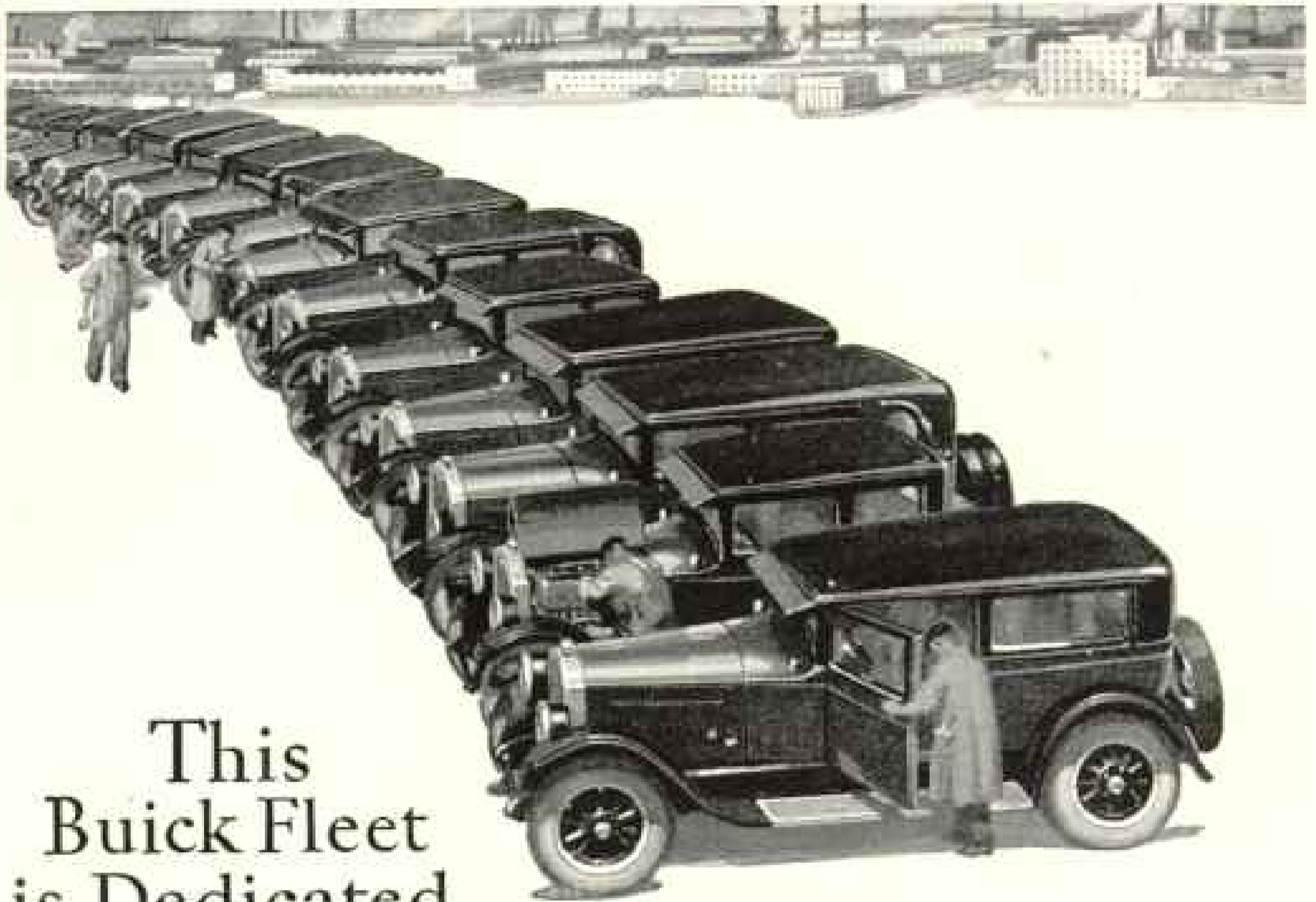
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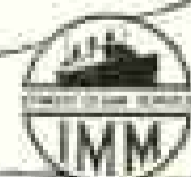
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-and Everybody Else Seemed *Speechless!*

HE looked around the table. To think that he had been afraid—had hesitated about coming to this dinner-party! Among all these important and cultivated people, he alone could speak easily and with calm assurance of literature, history, philosophy, art.

These others—they seemed speechless! They all turned to him with questions, amazed at his great fund of information.

At first they had hardly noticed him at all. He had seemed so quiet and unassuming. But then conversation began to lag. Not even the latest murder trial could revive it. No one seemed to know what to say.

"I wonder if capital punishment will ever be abolished," someone ventured.

"More than a generation ago," said the quiet guest whom nobody had noticed, "Victor Hugo predicted, that the dawn of the twentieth century would see the end of hangings. His prediction hasn't come true yet."

Why They Began to Notice Him

Everyone looked at him. He spoke so confidently. He saw that they were interested, and he continued to speak. He knew what to say, and he said it with the assurance

and ease of one whose mind is simply stored with information.

And suddenly he realized that he was being noticed, admired. He saw now how valuable it is to have a well-furnished mind. He was the best-informed man at this dinner! He could talk readily and authoritatively on almost any subject.

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How Did He Acquire His Great Store of Information?

"How do you ever get the time to read so much?" someone asked him at last.

"I really read very little," he answered with a smile. "Every now and then I browse a bit in Elbert Hubbard's famous Scrap Book. It's a digest of the best thoughts and ideas of the last four thousand years, and it gives you all the information you want in a few words—without wading through

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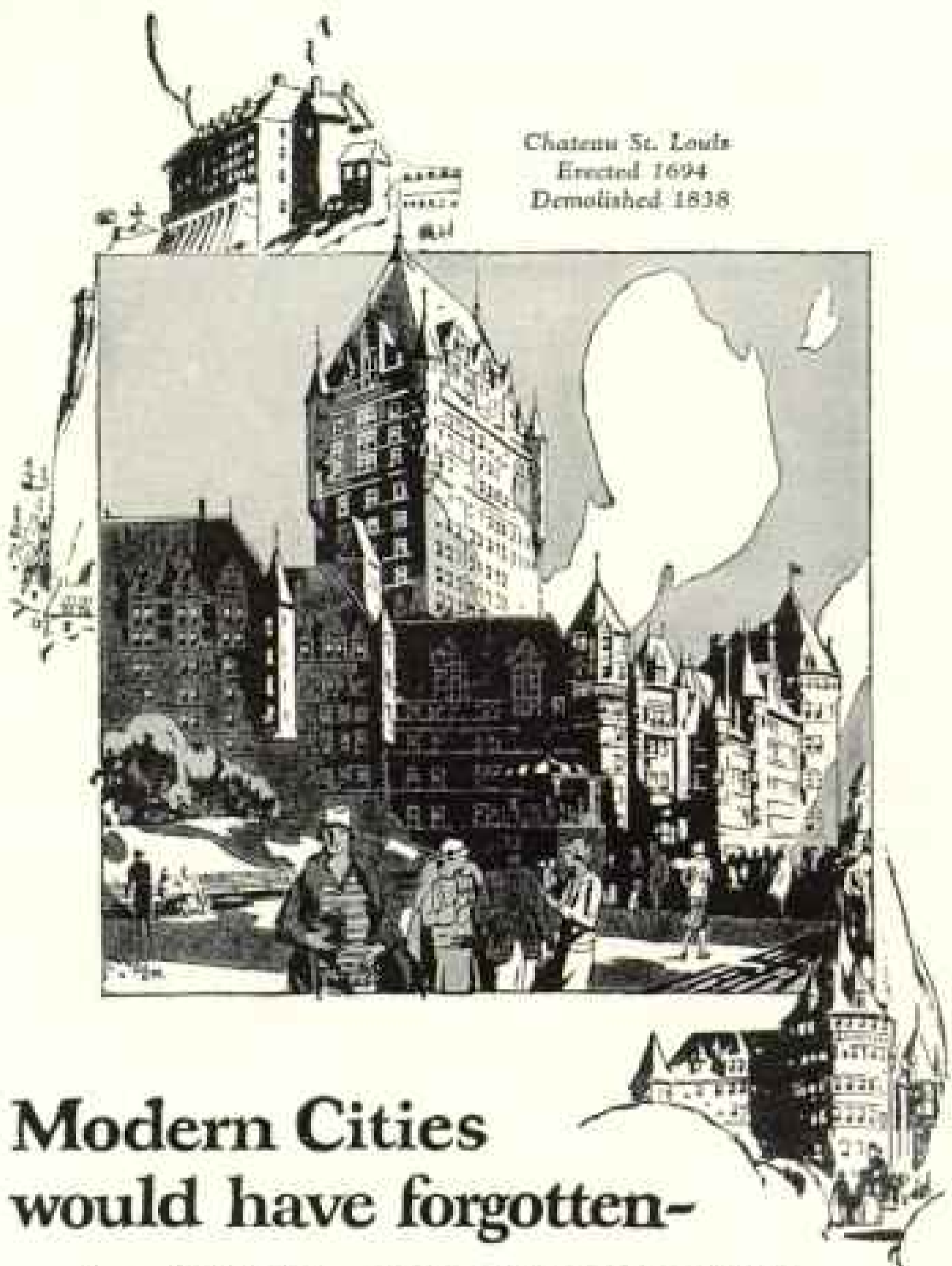
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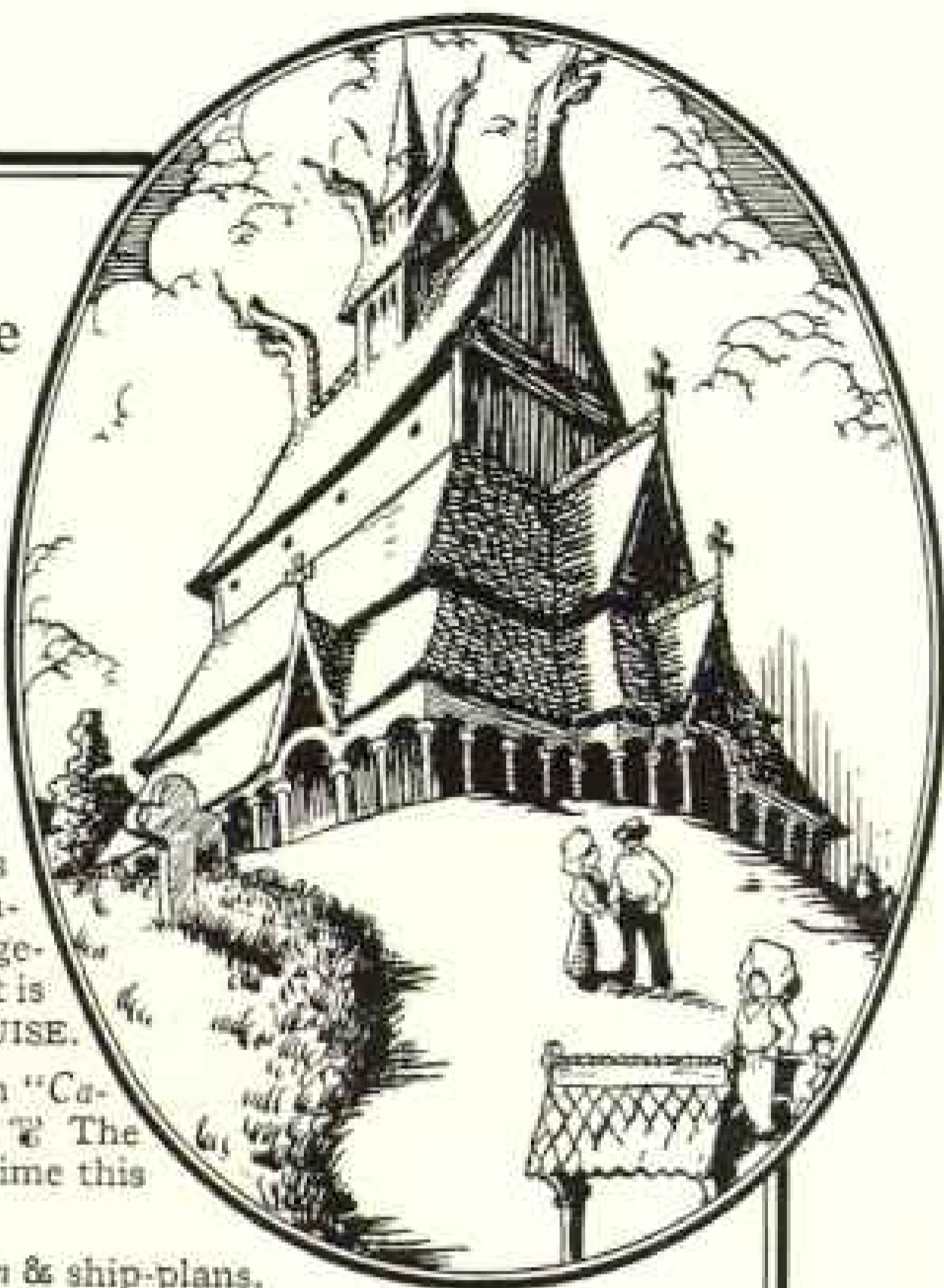
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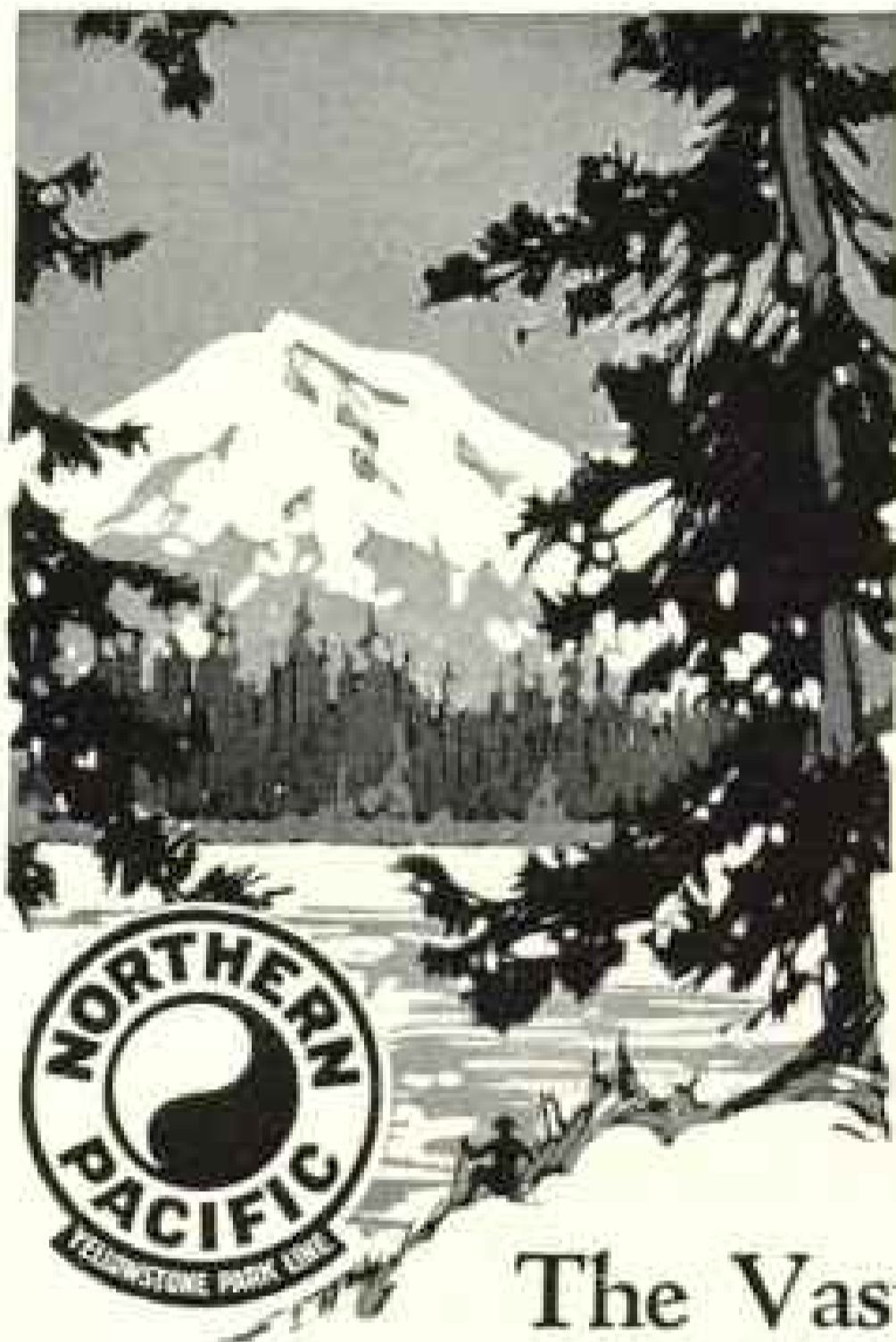
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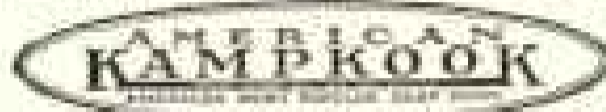
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To the
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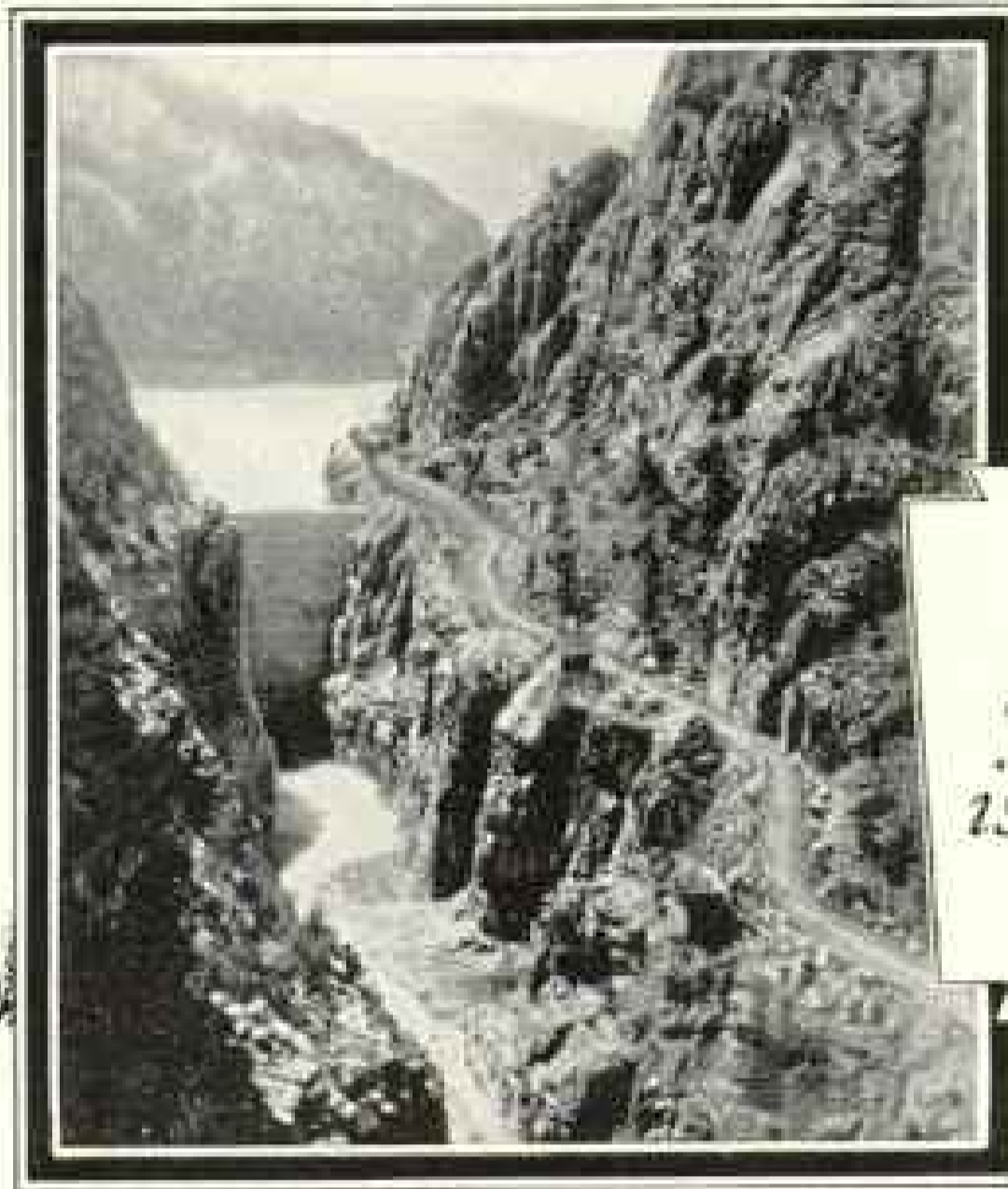
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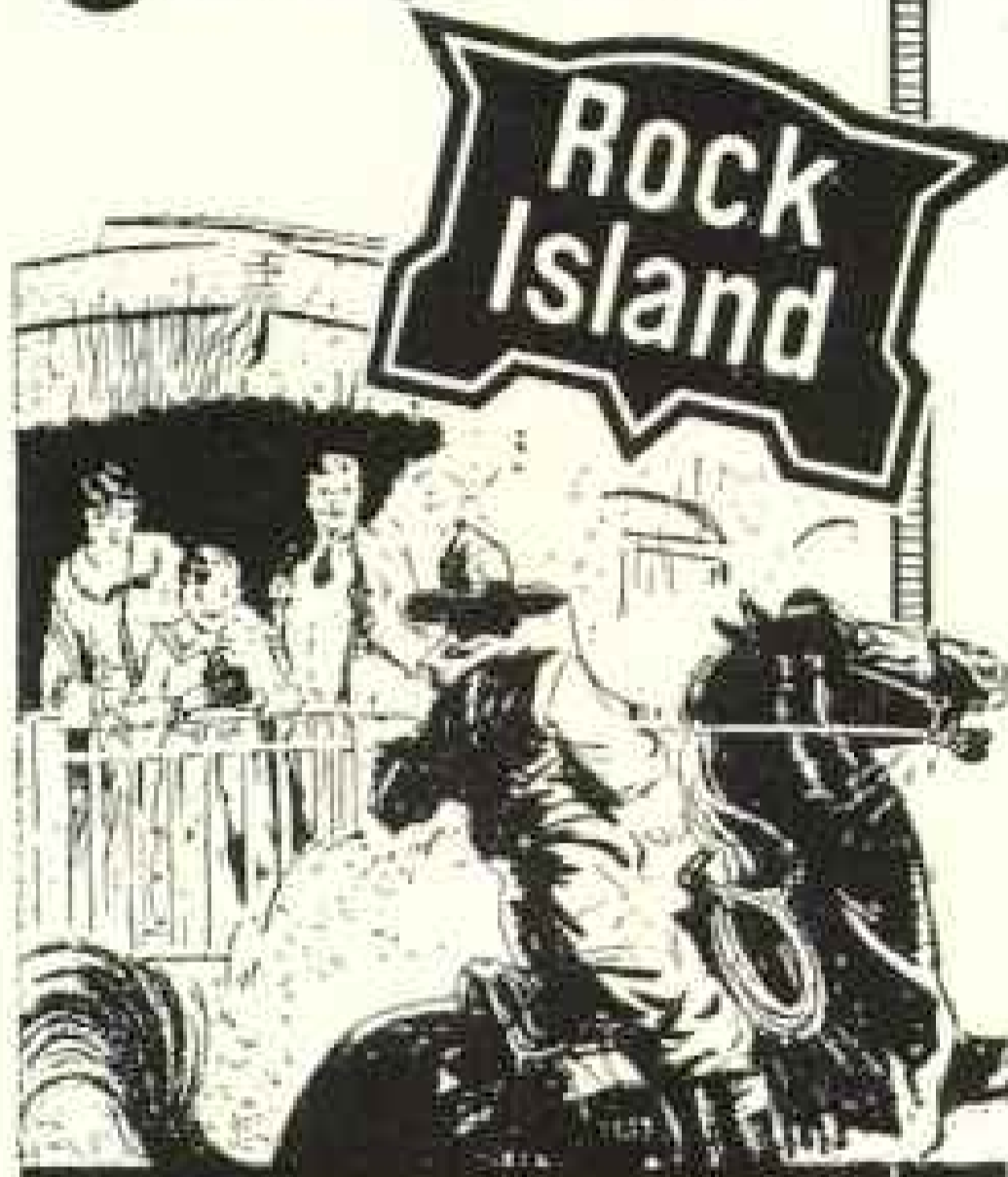
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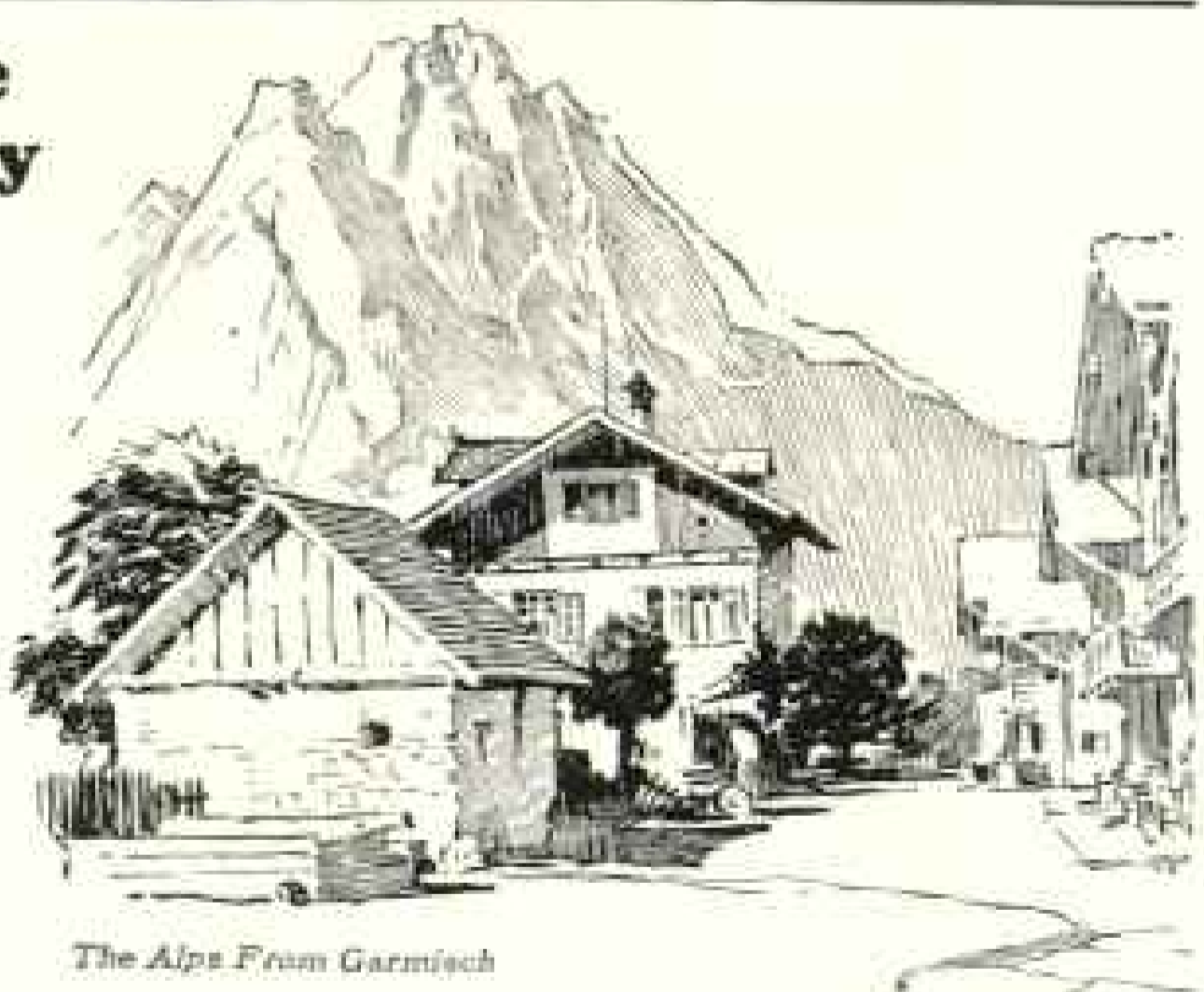
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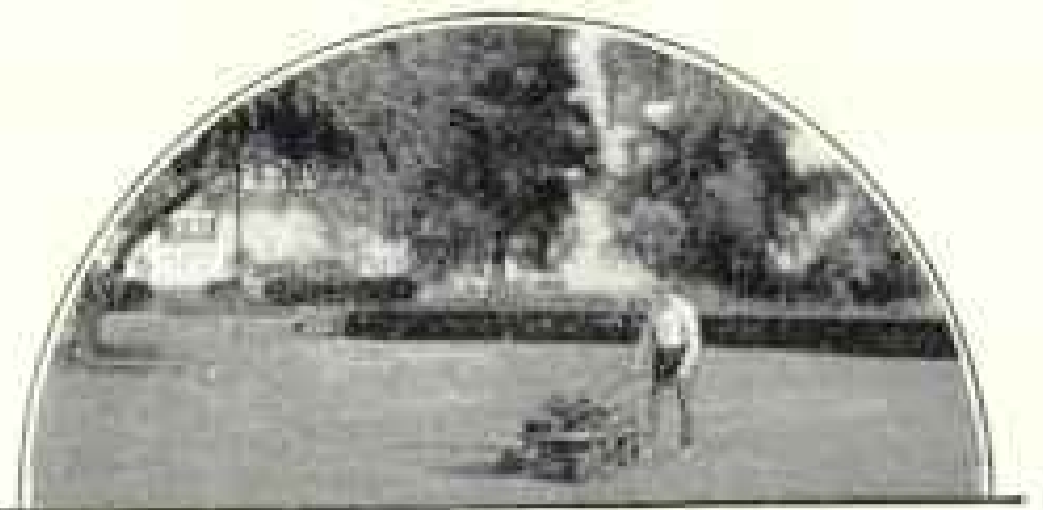
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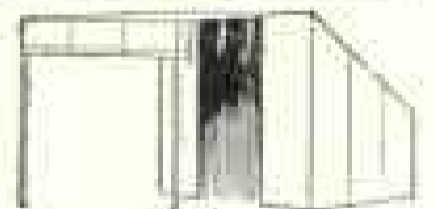
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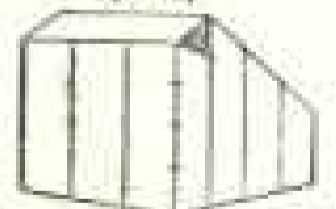
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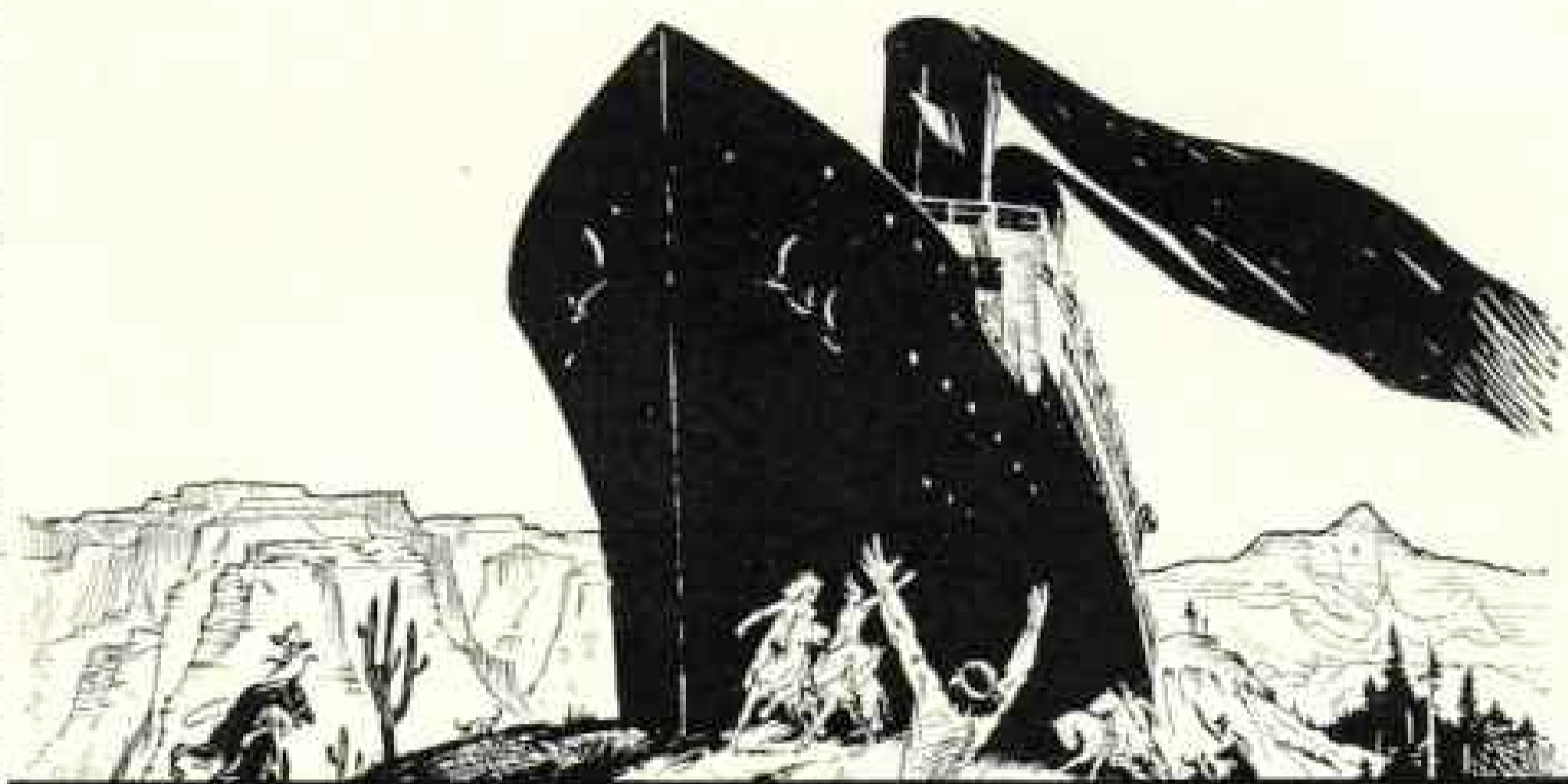
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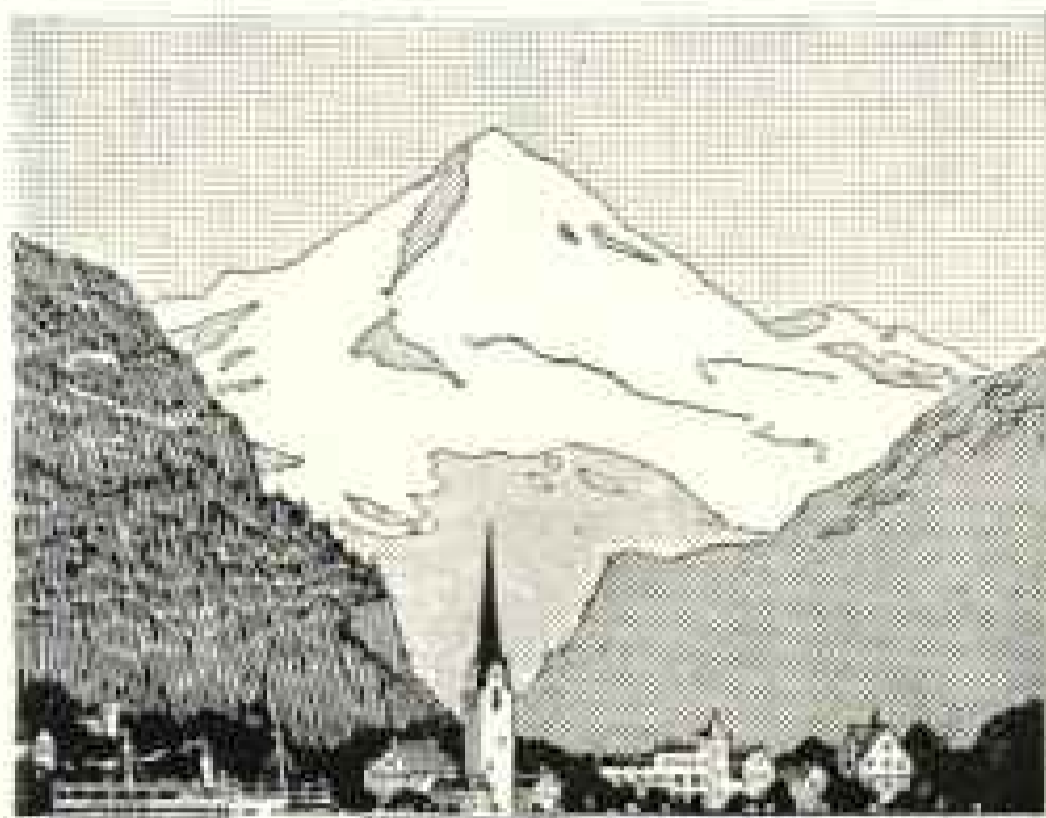
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Men and women usually have a milder form of diabetes than children. In many adult cases it is possible, through diet alone, to keep the disease under control.

Physicians advise that insulin be used immediately in severe cases, or before surgical operations upon a diabetic, or where the amount of physical work done by the diabetic makes a more liberal diet necessary for comfort.

So new is insulin that it is not safe to make sweeping promises of what it will do, although it has been known to bring men, women and children back from the very brink of death. Because insulin is so powerful it should be used cautiously and only under the direction of the best physician obtainable.

diabetes follows. The body cannot then utilize sugars and starches. The first thing to do is to curtail the amount of carbohydrates in the diet and, when necessary, use insulin derived from outside sources.

Diabetes may be caused by an infection of the pancreas as the result of disease in some part of the body; it may be that overeating or some other cause has brought it about. But too much food and too little physical exertion are said to be the main factors in producing diabetes.

Occasionally a patient, under insulin treatment, feels so much better that he is tempted to abandon his diet and eat everything he wants. But when he does he is likely to suffer a relapse and die. Then insulin is blamed. Insulin does not take the place of diet, but carefully supervised diet, plus insulin, is enabling diabetics to live useful lives in comparative comfort.

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METROPOLITAN LIFE INSURANCE COMPANY—NEW YORK

Biggest in the World, More Assets, More Policyholders, More Insurance in force, More new Insurance each year

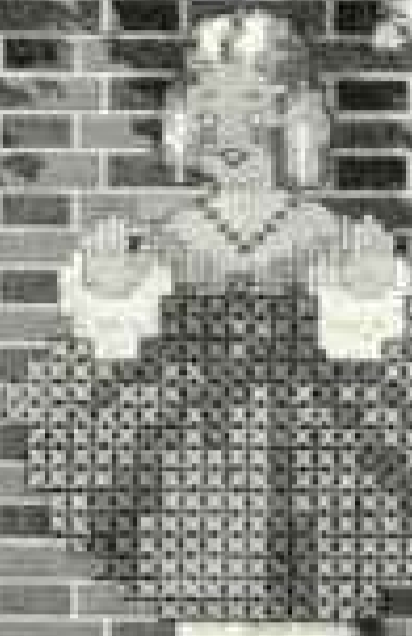
"Mention the Geographic—It identifies you."





NOTICE

Use *forethought* in your candy gift. In every neighborhood advance orders for delivery on anniversaries and holidays are welcomed by the local agency for *Whitman's* Chocolates



Now there are more than sixteen thousand active "agencies"—stores serving the public with Whitman's Chocolates.

These are *selected* stores, one in nearly every neighborhood in the land. They are drug stores, mainly, because the "drug" store today is the outstanding public servant among retail stores, a popular store by day or night.

Last year these progressive stores were able to serve thousands of people better by taking their orders in advance of holidays and anniversaries. At the proper time they sent the candy containing the customer's card and greeting. It is human nature to remember—and then forget. Our agencies did the remembering.

Let the local Whitman agent have your order when you think of it—for the Mother's Day remembrance, the *bon voyage* package, for the birthday or wedding anniversary. Then though you forget it, your remembrance will be on hand at the proper time.

Whether you buy Whitman's in a large city or a remote village the dealer is a selected agent, with an interest in maintaining our reputation for quality and service. The candy is sent him *direct* from Whitman's, not through a jobber or middleman. Every package he sells you must give complete satisfaction. It is doubly guaranteed, by the agent and by Whitman's.

STEPHEN F. WHITMAN & SON, Inc., Philadelphia

New York

Chicago

San Francisco

Whitman's

Sampler

Pink of Perfection

Fairy

Pink of Perfection

Whitman's

Pink of Perfection

Whitman's

Whitman's

Whitman's

Whitman's

Old Time

Whitman's

So many vegetables! Such delicious flavor!

Such good vegetable soup can only be made with thirty-two different ingredients.

It takes fifteen vegetables of splendid quality to give all the enjoyment you take in eating Campbell's!

That invigorating, appetizing flavor can only be produced when the soup contains rich beef broth.

Alphabet macaroni and selected barley are necessary to make the soup so hearty and substantial.

And for extra pleasure to your appetite there must be these savory herbs and this skillful seasoning.

Then—and only then—you get the best vegetable soup that can be made—Campbell's!

12 cents a can

32
different ingredients



LOOK FOR THE RED-AND-WHITE LABEL



Telephone Preparedness

NINE years ago, when this nation was preparing for war, it found the Bell Telephone System ready for service at home and abroad. The war found the Bell System prepared. From its technical forces so needful to meet our war-time activities in this country, fourteen battalions were organized to carry to the front the highest developments of the telephone art. No other nation had so complete a system of communication to aid in mobilizing its resources. No other nation was able to put into the field a military communication system of equal effectiveness.

Fifty years ago Alexander Graham Bell, the inventor of the telephone, gave to the world a new art. He had the vision of a nation-wide telephone

system by which people near at hand and far apart could talk to one another as if face to face. He foresaw a usefulness for the telephone which could not be achieved without innumerable developments, inventions and improvements, to him unknown. But not even he foresaw the marvelous applications of telephony which gave to the American armies that fighting efficiency which is possible only when there is instant exchange of complete information.

Since the completion of its service in time of war, the Bell System has devoted itself to the extension of the telephone art as one of the great agencies for the development of the pursuits of peace.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

BELL  *SYSTEM*

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

"Two incomes are better than one"



ONE from Salary—
ONE from Bonds

SALARIES are not always sure nor earning powers permanent—that's why so many forward-looking workers set aside part of their incomes regularly for bond investment. Money thus invested will produce a *second* income, an income free from most uncertainties.

Our offices in more than fifty leading cities are ready to help you plan an investment program, making sound recommendations which will fit your own personal needs.

The National City Company

National City Bank Building, New York

BONDS - ACCEPTANCES



SHORT TERM NOTES



*They pass the
word along*

THERE is something universal about the good word for General Cords. Certainly no other tire has given its users the satisfaction from which such comment springs.

General has so many "talkable" advantages that stand out in the user's daily experiences. He is not called upon to seek his enthusiasm in the hidden technicalities of manufacture. You can look at a General Cord and see the extra thickness. Take hold of it and you feel the same thing.

As you mix the way with good roads and had you experience the *full meaning* of low-pressure.

You soon notice that the gasoline saving and added motor power are considerable items. And the protection of the mechanical parts of your car, due to General's low-pressure features, tells its own story in longer car life.

These are some of the advantages that have made the good word for General so universal. These are the things that have brought General into such popular demand because these, *together with almost unbelievable mileage*, are advantages the user can actually see and feel.



The Mark
of Leading
Tire Stores
Everywhere

THE GENERAL TIRE AND RUBBER CO., AKRON, OHIO

The **GENERAL**
CORD

— GOES A LONG WAY TO MAKE FRIENDS

NOW CHRYSLER "58" GIVES YOU THIS SUPERB PERFORMANCE AT NEW LOWER PRICES



Chrysler "58" Sedan,
\$225, f. o. b. Detroit

Price for price—more emphatically today than ever—Chrysler "58" gives the utmost in mechanical performance, economy and dependability, riding comfort, driving ease, and charm of appearance.

Its effortless speed ability carries you mile after mile at 58 miles an hour, if you wish, in quiet, vibrationless comfort.

Its wealth of power whisks you through traffic tangles, from 5 to 25 miles in 8 seconds.

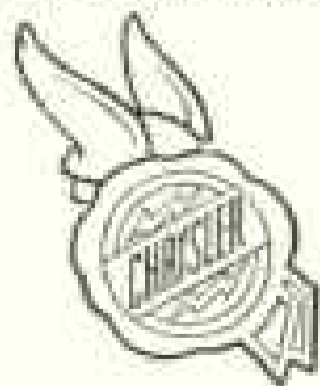
Its nicety of appointment and workmanship betokens precision manufacture of the highest order.

As much as anything, we believe, you will appreciate its ability to give you the satisfying economy of 25 miles to the gallon of gasoline.

And perhaps you will better understand the growing preference for the Chrysler "58" when you know that its new lower prices give you the identical performance, identical quality and unmatched beauty which have always placed it above comparison in its field.

Your nearest Chrysler dealer wants to prove, by personal demonstration, the scores of quality advantages, which, at its new electrifying low price of \$845, make Chrysler "58" the supreme motor car value of today.

CHRYSLER SALES CORPORATION, DETROIT, MICHIGAN
Chrysler Corporation of Canada, Limited, Windsor, Ontario



CHRYSLER "58"—Touring Car, \$845; Roadster Special, \$895; Club Coupe, \$895; Coach, \$935; Sedan, \$905. Disc wheels optional. Hydraulic four-wheel brakes at slight extra cost.

CHRYSLER "70"—Phaeton, \$1395; Coach, \$1445; Roadster, \$1245; Sedan, \$1695; Royal Coupe, \$1795; Birmingham, \$1865; Royal Sedan, \$1995; Crown Sedan, \$2095. Disc wheels optional.

CHRYSLER IMPERIAL "80"—Phaeton, \$2845; Roadster, (wire wheels standard equipment; wood wheels optional), \$2895; Coupe, four-passenger, \$3105; Sedan, five-passenger, \$3395; Sedan, seven-passenger, \$3595; Sedan-limousine, \$3995.

All prices f. o. b. Detroit, subject to current Federal excise tax.

Radles by Fisher on all Chrysler enclosed models. All models equipped with full balloon tires.

There are Chrysler dealers and superior Chrysler service everywhere. All dealers are in position to extend the convenience of time-payments. Ask about Chrysler's attractive plan.

All Chrysler models are protected against theft by the Fedco patented car numbering system, exclusive with Chrysler, which cannot be counterfeited and cannot be altered or removed without conclusive evidence of tampering.

CHRYSLER "58"



Table Accessories
Courtesy of John Wimmer




Chief Amiel's Recipe
for - Black Bass Pulner

Fashion Decrees GLASSWARE for the Table

Whether it be when you serve that long-looked-for fish dinner, celebrating his triumphant return from waters where the Bass were big, bold and baffling—or no matter what the occasion—*fashion decrees glassware for the table.*

Truly, *glassware* has never been so much in vogue as today. *Glassware* now always dominates all other appointments on the table that reflect discriminating taste.

If you might come to Newark and see how and where Heisey creations have been fashioned with such scrupulous care for several generations, you would surely realize why it is that *glassware* which represents this name has won unique distinction for quality in homes where only the best is desired.

Certain it is that Heisey's Diamond H on Glassware is regarded as the symbol of quality, both by the public and the trade. You can always identify Heisey products by the  trade-mark. Look for this when your dealer shows you glassware. Ask to see the new Moon Green and Flamingo colors.

A. H. HEISEY & COMPANY
NEWARK, OHIO

HEISEY'S

GLASSWARE *for your Table,*

Try this delicious recipe from a famous American hotelier. Courtesy Chef E. H. Amiel, Palmer House, Chicago.

Scale. Trim off fins of a Green-pinned Black Bass. Wipe thoroughly.

Cut in julienne two fresh mushrooms, a carrot, a few branches of celery.

Place in a saute pan with two ounces of butter and cook slowly for about five minutes.

Lay Bass on top, season with salt and pepper, add two gills of hot tomato sauce, and the juice of one lemon.

Cover this with buttered paper. Simmer about five minutes on top of range, then set in slow oven for twenty-five minutes.

Remove from oven, take off paper and dress Bass on a hot dish. Give sauce one more boil, pour it over fish and sprinkle a few chopped olives over top. Serve.





A famous professional woman speaks to American women-owners



About to build a home, the successful business man seeks the best architectural talent available. When Madame herself would have expert counsel as to decorative effects and home-furnishings de luxe, she enlists the aid of an advisor of recognized standing—by preference, Miss Elsie de Wolfe, of Paris, London and New York.

What Miss de Wolfe—premier interior decorator—sees in the Willys-Knight Great Six, its thousands of discerning American owners see—

A body of exquisite beauty—long, graceful lines, distinctive, low—the nearest to smart perfection yet achieved in motor-car design . . .

Its interior—an inviting expanse of automobile—done throughout in rich, heavily-piled Mohair Velour—a subtle cloister-blue, with a beautiful silver bloom. Window panels,

“Quite obviously someone with a true sense of the fitness of things conceived the appointments of this motor-car.”
(Signed) ELSIE DE WOLFE

dash, and door panels are of genuine walnut, inlaid in dull gold; door-handles, door-releases, window-lifts—all hardware is antique silver type, of chaste, conservative design. . .

Opalescent corner side-lights and ceiling light with separate ebony switches set in antique silver design, smart, antique silver type vanity case, match holder and ash receiver in compartmented walnut case.

In the Willys-Knight Great Six is present every known con-

venience and elegance ever built into an automobile—everything in exquisite good-taste, each item of its appointments supplementing the other in beauty and comfort.

And this superb automobile is driven by the silent, super-efficient Knight sleeve-valve engine—the only known motor-mechanism that *improves* with use. A sweet-running car, powerful, quiet, smooth; from the first turn of the engine, the power-plant of your Willys-Knight Great Six *improves* in power, in activity, in smooth and silent operation with each succeeding mile!

The new WILLYS FINANCE PLAN offers easy time-payment terms at the lowest credit-cost in the industry.

We reserve the right to change prices and specifications without notice

Willys-Overland, Inc., Toledo, Ohio
Willys-Overland Sales Co., Ltd., Toronto, Can.

WILLYS-KNIGHT *Great* SIX

with an Engine you'll never wear out



The Third of a Series of
Selected Designs
from a
National Architectural
Competition.

Lewis E. Welch, Architect.

An Unusual and Distinctive Modern Six-Room House

Complete Working Plans \$15⁰⁰



THE charm and coziness of this house would attract attention in any setting, combining as it does the freedom of the country dwelling and the compactness exacted by present-day city and suburban life.

The house is planned to use standard sizes of lumber; and so will build economically.

The floor plan is as distinctive as the exterior; note the size and proportions of the rooms, and their convenient arrangement, the lavatory on the first floor and the generous supply of closets. Altogether, a good house to look at and to live in.

If you like this house send \$15.00 for a complete set of working drawings from which you can take bids and build this home just as shown.

Or, if you would like to look over the 12 houses in this series, a portfolio of illustrations will be mailed postpaid on receipt of 25 cents.

WEYERHAEUSER FOREST PRODUCTS

809 Merchants National Bank Bldg., Saint Paul, Minn.

Burroughs



At Last!

Have you, too, just emerged triumphant but worn out from the work of compiling your income tax return? That's the penalty for keeping records that hide the essential facts where you can't find them.

What a contrast with the Burroughs Simplified Accounting Plan! With this plan the essential information about your business is

always at your finger tips—ready for Uncle Sam when he wants it—and, more important, ready for you daily when you want to know how and where to make more money.

It will make money for you, just as it already has for thousands of others in your line of business. Can you afford to postpone investigating? Write today.

BURROUGHS ADDING MACHINE COMPANY
DETROIT, MICHIGAN

ADDING · BOOKKEEPING · CALCULATING AND BILLING MACHINES

Remington - The Official Typewriter of the Sesqui-Centennial Exposition



Model 1 Remington
The First Practical
Typewriter

Fifty Years of Progress

1876 1926



Model 12 Remington
The Standard Writing Machine of Today

Fifty years ago at the Centennial Exposition at Philadelphia the Model 1 Remington, the first practical typewriter and the ancestor of all present-day writing machines, received its initial public exhibition.

THE Centennial Exposition of 1876 celebrated the One Hundredth Anniversary of American Independence. This year another great exposition is to be held at Philadelphia, the Sesqui-Centennial, commemorating the One Hundred and Fiftieth Anniversary of the Nation. The Executive Committee of the Sesqui-Centennial Exhibition Association has designated Remington The Official Typewriter of The Sesqui-Centennial Exposition.

This means that Remingtons will be used exclusively for all the clerical work of the immense project, the Remington-Noiseless by the executives, the Remington Standard Models and Accounting Machines by the various departments, and the Remington Portable by the traveling representatives.

The fifty years from the Centennial

of 1876 to the Sesqui-Centennial of 1926 cover the entire commercial history of the writing machine. The advent of the first typewriter, the Model 1 Remington, at the Centennial of fifty years ago marked the beginning of a new business era, and the designation of the Remington as the Official Typewriter of the Sesqui-Centennial is signal recognition of its commanding position today as founder and leader of the industry.

The outstanding feature of Remington leadership in this Sesqui-Centennial year is the completeness of the Remington line—which includes a machine for every purpose. And every one of these machines is the last word in typing efficiency. Let us study your problems and recommend the equipment that will serve you best.

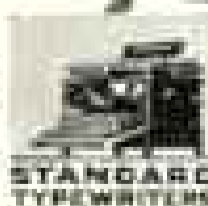


REMINGTON TYPEWRITER COMPANY

374 Broadway Branches Everywhere New York
Remington Typewriter Company of Canada, Ltd., 68 King Street, West, Toronto

Remington

TYPEWRITERS



A MACHINE FOR
EVERY PURPOSE

Remington-made Paragon Ribbons and
Red Seal Carbon Papers always make good impressions





Dummer Mansion, Built 1716, by
Lieut. Gen. William Dummer

PITTSBURGH
Proof Products
Glass-Paint-Varnish-Brushes

THE Dummer Mansion, built 1716, and the buildings of Dummer Academy, South Bayfield, Mass. which has been a distinguished college preparatory school since 1763 are protected and beautified by use of



Sun-Proof Paint

—protects property from depreciation and saves repair bills by a weather-proof armor that keeps out moisture and decay. Does not check, peel or blister.

"Guide to Better Homes"
sent free — a valuable book on
home furnishing and decoration.
Write Dept. C, today

Whatever you need—Glass, Paint, Varnish or Brushes—the Pittsburgh Plate Glass Company has a product that exactly fills your requirements. Sold by quality dealers; used by exacting painters.

PITTSBURGH PLATE GLASS CO.

Paint and Varnish Factories — Milwaukee, Wis., Newark, N.J., Portland, Ore., Los Angeles, Cal.

Refuge!

YESTERDAY they were married . . . today there may be dreams and plans . . . but tomorrow, certain as the seasons come and go, there is going to be a home of their own.

It isn't, after all, entirely the economy of a home, or the showplace it may be to friends, or the profit on an investment, that decides them. It is the refuge a home pledges . . . haven that it can be from the day's incessant demands.

"Now we have a home!" . . . you have heard it from the lips of young friends . . . and you may well imagine that this pride is hitting at something more than dollar-and-cents value.

It is those prideful people, wanting a home refuge and home charms for more than a day . . . for all the tomorrows . . . who most deservedly insist on good materials and good workmanship. They know the fallacy of slighting construction . . . and then regretting it through the years.

So often they have been best assured of the permanence of the home by the use of Long-Bell trade-marked Douglas Fir and other products . . . manufactured with the aim of giving the user maximum construction value!

Ask Your Retail Lumber Dealer

THE LONG-BELL LUMBER COMPANY
E. A. LONG BLDG. KANSAS CITY, MO.
Long-Bell Bldg. 1811

Douglas Fir

—with the trade-mark

The Long-Bell trade-mark on Douglas Fir lumber and timbers is something more than a name. It not only represents the experience of fifty years as lumbermen—it actually means unsurpassed manufacturing methods and a resulting quality of lumber of unquestionable dependability. With electrically operated equipment of the most modern type, operated according to the highest standards known in the industry, this production has high value for builders planning durable construction.

Southern Pine

—with the trade-mark

The years have proved the satisfaction of Long-Bell trade-marked Southern Pine lumber and timbers. Long-Bell production of Southern Pine is the largest in the world; the dependability of this lumber is known wherever Southern Pine is sold.

To Shippers

Boxes and containers made of wood reach destinations safely.



Long-Bell

Trade-Marked LUMBER

Douglas Fir Lumber and Timbers; Southern Pine Lumber and Timbers; Crossed Lumber; Trestles; Posts; Poles; Pine; Guard Rail Posts; Pilings; Southern Hardwood Lumber and Timbers; Oak Flooring; California White Pine Lumber; Sash and Doors; Box Shooks.

KNOW THE LUMBER YOU BUY



THE CURTIS INSTITUTE OF MUSIC

PERMANENTLY ENDOWED BY MARY LOUISE CURTIS BOK



WHERE QUALITY
IS THE ONLY STANDARD



RITTENHOUSE SQUARE
PHILADELPHIA



Women and Children First

A TRADITION as old as civilization, this deference of man to the weaker and more helpless of the race. That is as it should be.

Unsung heroes, transformed in the twinkling of an eye through some tragedy into magnificent stalwarts, have died smiling, satisfied that by such sacrifice they have saved the life of a woman or a child.

That is the stamp of the thoroughbred.

It is an amazing commentary on human inconsistency, however, that the same man who unhesitatingly would go to his death for such a cause in a great emergency will gamble with fate at the risk of permanent injury to those for whom he has the profoundest affection: his wife and children.

Keep Your Life Insurance in Force

THE PRUDENTIAL INSURANCE COMPANY OF AMERICA

EDWARD D. DUFFIELD, *President*

HOME OFFICE

NEWARK, N. J.





“...and Jane, dear... Jack just raved about my teeth.”

“I just smiled my prettiest smile . . . and let him rave. I could have said, ‘Of course I have beautiful teeth. . . . I’ve used Colgate’s all my life.’ But I didn’t want Jack to think I was a living advertisement for Colgate’s tooth paste.”

Beautiful teeth glisten gloriously. They compel the admiration of all who see them. And there is health as well as beauty in gleaming teeth, for when they are scrupulously kept clean, germs and poisons of decay can’t lurk and breed around them.

Remove Those Causes of Decay

Colgate’s will keep your teeth scrupulously clean. It reaches all the hard-to-get-at places between the teeth and around the edges of the gums, and so removes causes of tooth decay. It is the dependable tooth paste for you to use.

Washes—Polishes—Protects

The principal ingredients of Colgate’s are mild soap and fine chalk, the two things that den-

tal authorities say a safe dental cream should contain.

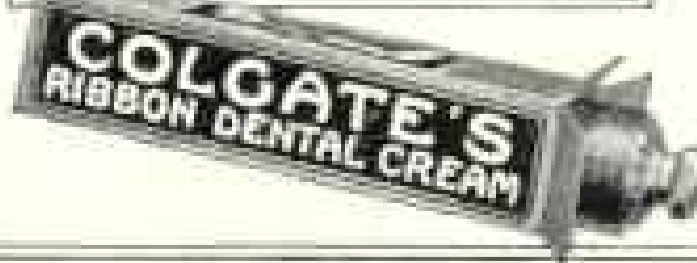
Use Colgate’s Regularly

Just remember that beautiful, healthy teeth are more a matter of good care than of good luck. Use Colgate’s after meals and at bedtime. It will keep your teeth clean and gloriously attractive.

And you’ll like its taste . . . even children love to use it regularly.

Priced right, too! Large tube 25c.

Here are children in Passaic, N. J., using Colgate’s to fight tooth decay. Colgate co-operates with thousands of school officials and health authorities in teaching dental hygiene.



This might have been prevented

“Nerves” Keep Her From Enjoying Life



Nervous Breakdown May Be Caused By Bad Teeth

Authorities Trace Many Other Diseases to Poisons of Tooth Decay

It hardly seems possible to those who haven’t studied the question, that bad teeth can have such harmful effect upon a person’s health.

But just ask your dentist or physician. Either one will give you the same, simple reasons why decaying teeth may cause heart disease, rheumatism, and even shorten your very life itself.

Nervousness is very often caused by unhealthy teeth. Walter J. Burns, D. D. S., writing in the *American Magazine*, says:

“We Americans are peculiarly liable to ‘nerve trouble’; and this is one reason why we need to keep careful watch over our teeth.”

Today it is recognized that tooth decay is a menace to the nation’s health. That is why preventive dentistry is sweeping the United States.

In schools where preventive oral hygiene has been introduced, children have shown striking advances in health and mental vigor, and increased immunity to disease.

Conditions are improving but much more yet to be done. Fight tooth decay before it starts.

Give yourself a chance.

Special Trial Tube Offer

COLGATE & CO., Dept. 713
381 Fifth Ave., New York City
Enclose two cents in stamps. Please send me a generous trial tube of Ribbon Dental Cream.

Name _____

Address _____

In Canada, 72 St. Ambrose St., Montreal.



What good is a Screen that Rusts?

A single rust hole makes an entire screen useless because disease-spreading insects will find the hole. The way to keep them out is by using BRONZE or COPPER insect screens. They do not rust. They cost a little more. But they give complete protection and their lasting service makes them cheaper in the end.

**COPPER & BRASS
RESEARCH ASSOCIATION**

25 Broadway • • New York

Let us send you a
useful book about screens.
There's no charge.



THEY SMILE NOW at their Timidity Over Oil Heat

The blessings and happiness that have come to this old couple sums up the story of oil heat as you would like to know it in your home.

In years, they are past three-score. Too old to be burdened with the care of the heating plant. Too needful of even heat to withstand the fluctuations of a temperamental furnace.

They are living all over again

It was difficult for them to decide on an oil burner. It was so new-fangled. Could one be sure of it? Suppose it did not work—what then? How could it hold the temperature at exactly 75 degrees? And the cost. It must be terribly expensive!

They smile now at their timidity. For four joyous years they have basked in generous warmth. They are living all over again.

No longer do they huddle over the radiator on the sheltered side of the house. Their Paisley shawls are left in the cedar chest. Upstairs, downstairs, it is always the same. They have seven "living" rooms in place of one.

In this atmosphere of sublime comfort, life for them is a sweet song. The benign influence of even, dependable heat is melting their natures. Good health has returned. The ease, the comfort, the clean-

liness of it all is adding years to their span. Years to enjoy their children's children.

Burner pays for itself

Happily for these frugal folk, this wonderful transformation has cost them nothing. In four years they have saved enough in fuel bills, labor and extras to pay for their Oil-O-Matic. Each succeeding year will yield proportionate dividends.

Oil-O-Matic burns fuel oil. A cheaper fuel that supplies more heat units per gallon than more expensive, lighter oils. With no part inside the firebox and operating according to the four natural laws of oil combustion, Oil-O-Matic renders a service that makes the random purchase of an oil burner something to avoid.

A year to pay if you prefer

There's an oilomatician near you. Let him examine your heating system and quote you the cost of a guaranteed installation.

Meanwhile, write for "Heating Homes With Oil." The coupon below brings it free.



WILLIAMS OIL-O-MATIC HEATING

World's Largest Producer of Automatic Oil Burners

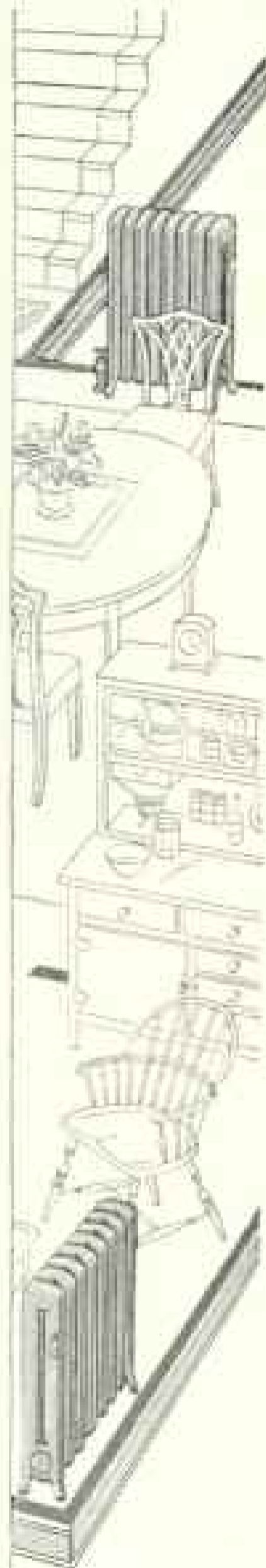
Williams Oil-O-Matic Heating Corp.
Bloomington, Illinois N. C. 46
Without obligation, please send me
"Heating Homes With Oil." by return
mail.

Name _____

Street _____

City _____ State _____

DEPENDABLE HEAT ALL OVER THE HOUSE WITH ECONOMY



June Comfort *on every zero morning*

Out the window this morning, you saw the snow melting. Yes, bitter winter is going, but not for good. It is only vacationing. A few short months of warmth and it will be back.

Now, while your memories of zero days are vivid, guard against another winter like the last.

Investigate heating equipment. You will find that with Capitol Boilers and United States Radiators you are given the most definite assurance of heating comfort for every room. No other boiler is easier to operate. No other requires less fuel.

This is the logical time to have a new heating system installed. Consult your contractor. Write for a free copy of our illustrated booklet, "A Modern House Warming." Determine now that next winter you will have June comfort on every zero morning.

UNITED STATES RADIATOR CORPORATION
Detroit, Michigan

6 FACTORIES AND 28 ASSEMBLING PLANTS SERVE THE COUNTRY
For 36 years, builders of dependable heating equipment

Capitol Boilers

and

UNITED STATES
RADIATORS

GUARANTEED HEATING

Your contractor receives a written guarantee on the heating capacity of every Capitol Boiler. No other heating equipment assures you satisfaction so definitely.

SUPPLIED AND INSTALLED NATIONALLY BY ESTABLISHED HEATING CONTRACTORS

*With a little mirror,
look **behind** and
between your teeth,
in the places seldom
reached with a brush.
That's where decay
and tartar work de-
struction.*



Behind and between your teeth---that's where trouble starts

NEARLY forty years ago, Dr. W. D. Miller, an American dentist practicing in Germany, demonstrated that colonies of acid-forming germs attach themselves to the enamel by means of the sticky mucin film. If allowed to remain in one spot for any length of time, these germ colonies secrete sufficient acid to eat through the enamel.

After Miller's discovery of the cause of tooth decay, it was thought that decay could be prevented simply by killing the germs. Thus antiseptic dentifrices were introduced. Needless to say, they proved unsuccessful, for the germs were apparently snugly protected in, or under, the heavy accumulation of mucin (mucin plaques).

By and by, scientists agreed that it was necessary to find a mucin solvent, so that the germ-laden mucin film could be thoroughly removed, especially from **the inaccessible spaces between teeth, where a brush cannot be effectively applied.** It is in these places that your dentist looks first for trouble—and invariably finds it.

After nearly 30 years of fruitless search for such a solvent, the problem was laid before the Mellon Institute of Industrial Research, an endowed scientific institution, operated without profit. Here a formula was gradually perfected for a harmless, yet exceedingly effective, mucin solvent. It was called Mu-Sol-Dent.

Mu-Sol-Dent is a liquid, for *only a liquid can reach and clean the inaccessible spaces behind and between teeth.* Before being given to the public, it was submitted to the leading dentists for clinical tests. Soon a flood of letters came pouring in from these professional men, all testifying to amazing results obtained by this revolutionary new method of cleaning teeth. Over 5,000 such reports were received in a short time.

Mu-Sol-Dent not only is a great step forward in preventing decay, but also practically prevents tartar from forming. Tartar is the commonest cause of bleeding gums, pus pockets, pyorrhea, loss of teeth and health. Dentists found Mu-Sol-Dent very healing for sore gums and after tooth extraction. Physicians value it as a gentle, efficient solvent for mucus in nose and throat.

Mu-Sol-Dent is so pleasant to use that even children like it. It entirely does away with the messy old way of cleaning teeth, doing the work of paste and mouth-wash combined in a safer, more effective way.

Send with 10c for Mailing

**The V. B. Corporation Dept. IV.
916-N Forbes St., Pittsburgh, Pa.**

Please send Sample Bottle of
Mu-Sol-Dent to

Name _____

Address _____

Mu-Sol-Dent

*At all leading drug stores. Get a bottle
today or use coupon for sample.*



Clever new furniture—

you'll want to see

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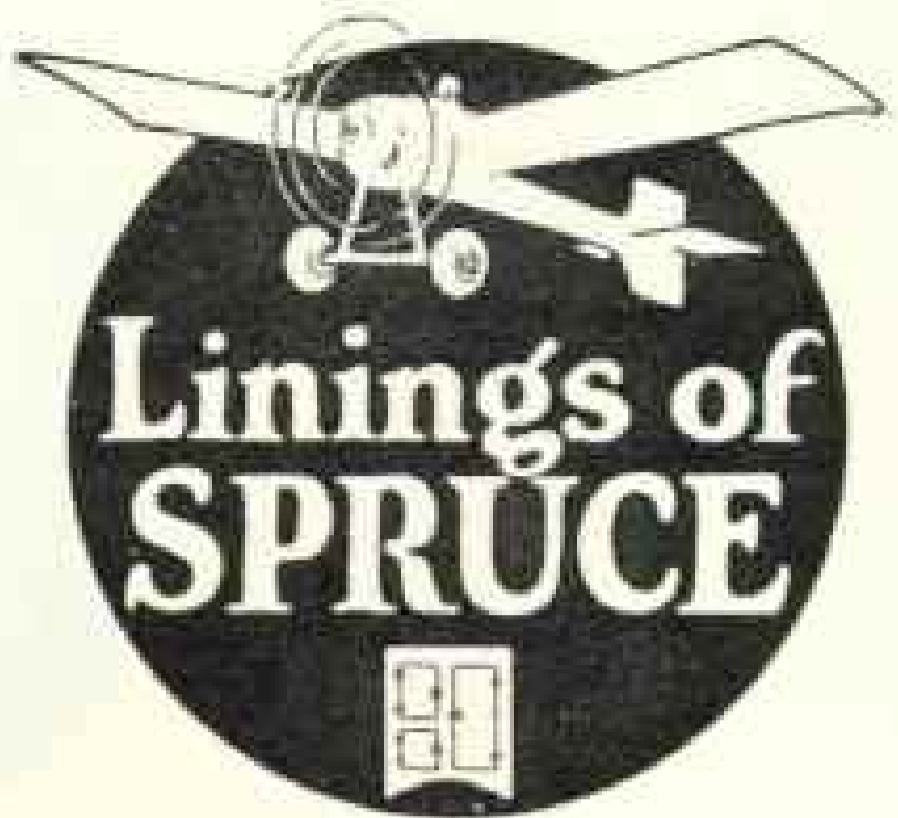
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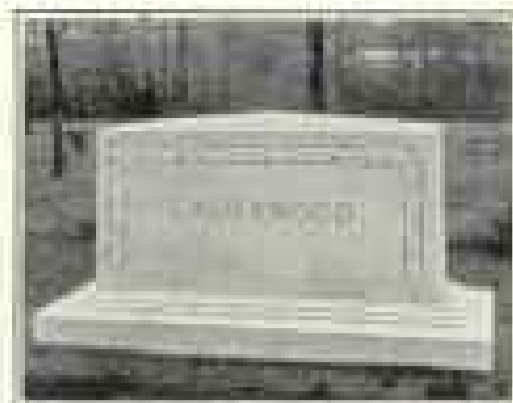
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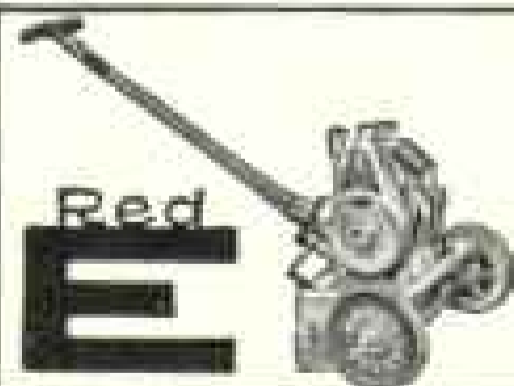
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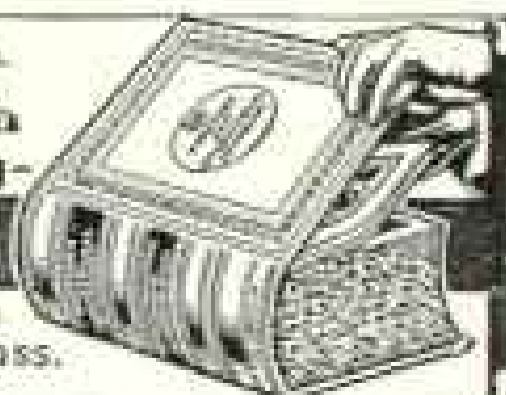
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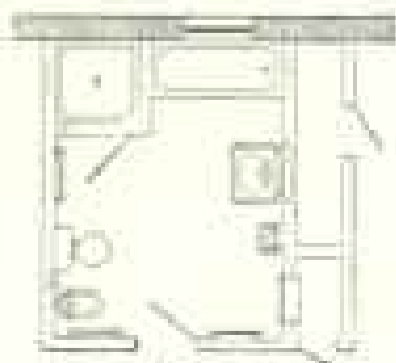
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Designed for Service Department, American Face Brick Association

This is one of the 120 houses, embracing a wide variety of architectural styles and interior arrangements, shown in our "Face Brick Bungalow and Small House Plans."

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THE beauty and charm of the Face Brick house have always excited the admiration of home lovers. But it was not until the public learned about its many economies that Face Brick won its present popularity. Today most home-builders know that slow depreciation, a minimum of upkeep and repairs, painting only around doors and windows, low insurance rates and smaller fuel bills soon wipe out the slight additional cost of the Face Brick house and, in the long run, make it the most economical to own. The facts are fully presented in "The Story of Brick." Sent free.

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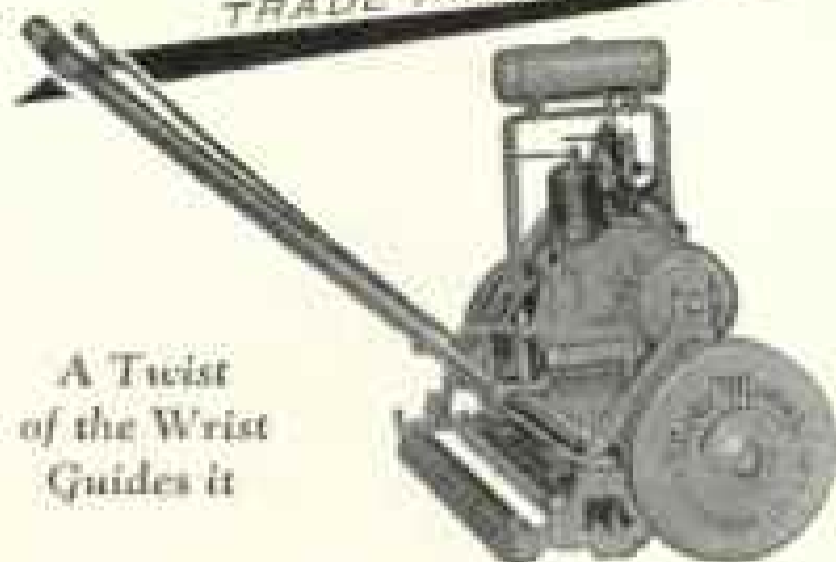
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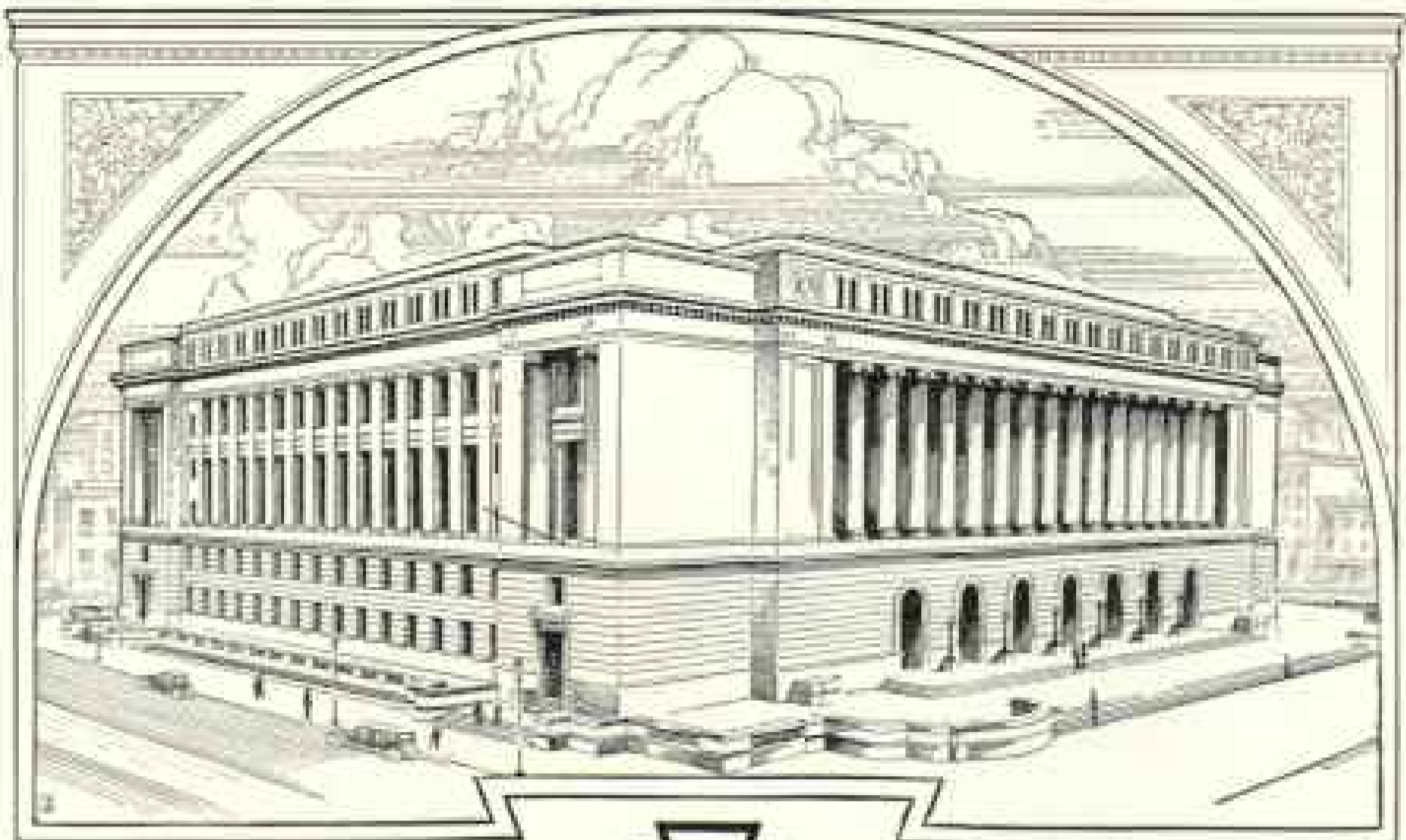
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New York, 111 Broadway; Boston, 131 State Street; Buffalo, 116 Oak Street; Chicago, 900 West 18th Street; Cincinnati, 659 Freeman Avenue; Cleveland, 820 West Superior Avenue; St. Louis, 722 Chestnut Street; San Francisco, 485 California Street; Pittsburgh, National Lead and Oil Co. of Penna., 316 Fourth Avenue; Philadelphia, John T. Lewis & Bros. Co., 437 Chestnut Street.

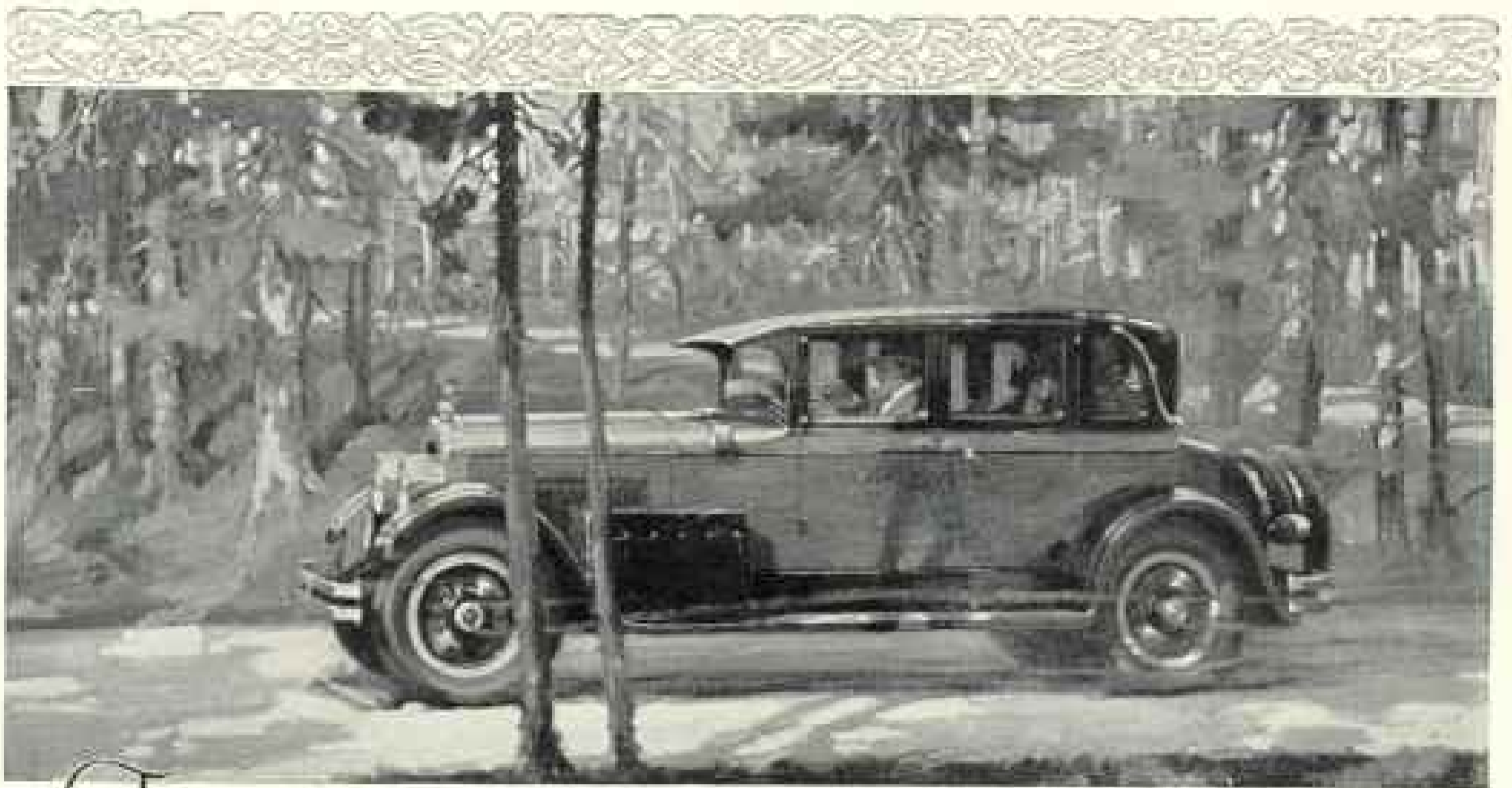


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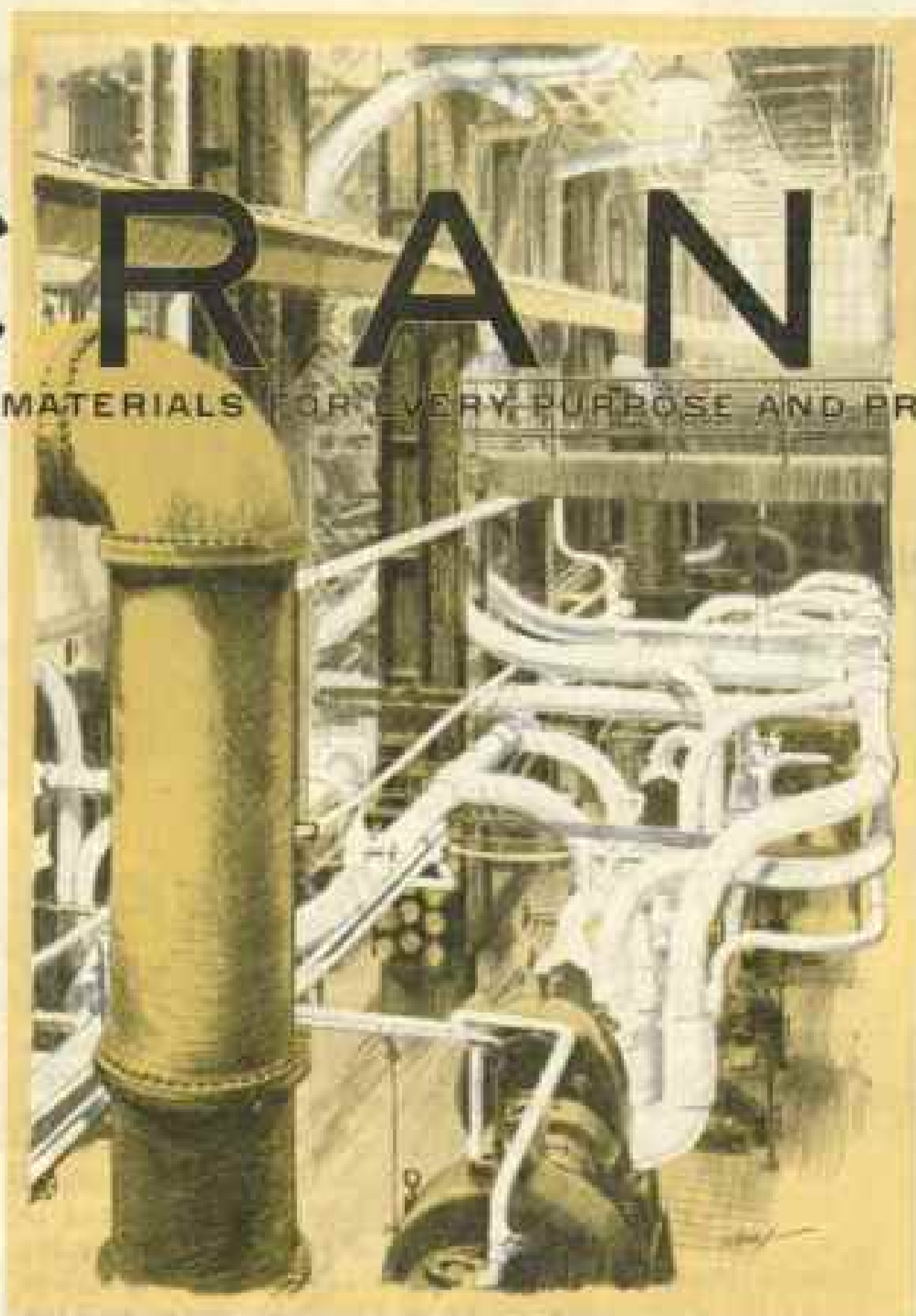


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