VOLUME LXXXII NUMBER SIX

THE NATIONAL GEOGRAPHIC MAGAZINE

DECEMBER, 1942

Map of Asia and Adjacent Areas

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

$4.00 A YEAR 50c THE COPY

VOL. LXXXII, No. 6 WASHINGTON DECEMBER, 1942

THE NATIONAL GEOGRAPHIC MAGAZINE

The Miracle of War Production

For Victory the United States Transforms Its Complex Industry into the Biggest Factory and Mightiest Arsenal the World Has Ever Known

By ALBERT W. ATWOOD

THIS country which we love is producing all-out for war. At first there was only a trickle, then it became a mighty stream, and now it is a deluge of ships, planes, tanks, and guns roaring down the assembly lines of America.

True, the war finally must be won on the battlefields, but it cannot be won without production, and it can be lost in the shops and factories.

The enemy has had a head start of ten years in mobilizing all of his resources for the sole purpose of building an invincible military machine.

Japan began to pile up armaments in 1930 and Germany in 1933, in addition to which they now have the booty seized in conquered countries. We have not only to overcome their current production but their enormous reserves as well.

War's Voracious Appetite

This war has an incredibly voracious, an unbelievably stupendous appetite for materials, supplies, equipment, machines, munitions, and armaments.

According to President Roosevelt, value of next year's production of war goods may be almost one-quarter more than the total national income for the prosperous year of 1940.

When the President announced last January that 60,000 planes must be produced this year and 125,000 next, he was stepping up the manufacture of military aircraft in much the same ratio as if he had asked for nearly 15,000,000 new automobiles this year and 30,000,000 new ones next year!

Even this startling comparison doesn't take into account the fact that a military airplane is larger than an automobile, far more complicated, and far more subject to change in design.

Wanted: An Airplane Every Four Minutes!

The President asked for a new military plane every eight minutes, on the average, this year and every four minutes next. He was asking for this year alone more than three times the number that have been manufactured in the thirty-two years since Orville Wright delivered the first such plane to the Signal Corps of the Army.

But the President also asked for 45,000 tanks this year and 75,000 next, although in the 14 years up to 1934 only 30 tanks had been built in this country and those only in Army arsenals.

In fact hardly a manufacturer had ever seen one of these monsters, which, even in the medium type, weighs twenty times as much as the average automobile.

But the President asked for more than planes and tanks. He demanded 800 new merchant vessels this year and 1,500 next, although, except for oil carriers and passenger ships, only two had been built in this country from 1922 to 1937 and only two were added in 1938. Besides he asked that each one be constructed far more rapidly than ever before.

But that is not all. There must be equivalent quantities of naval vessels, of guns of every description, of shells, bombs, torpedoes, explosives, parachutes, and searchlights. The Army alone buys in excess of half a million

items, nearly three thousand being major ones.*

Even before any weapons are provided it is a colossal task to transport, house, feed, clothe, and otherwise service millions of troops in all parts of the world. Nearly two-thirds of all cotton goods being produced this year are for military use.

It is routine for the Army to order such items as 9,000,000 barrack bags, 10,000,000 neckties, 18,000,000 undershirts, and 78,000,000 pairs of socks.

By a sheer miracle of production America is now satisfying the yawning maw of the war god.

The United States is blessed with the most abundant actual production resources of mine, farm, and forest of any country in the world. Science and inventive genius enable us in peacetime to transform Nature's gifts into myriad manufactured products.

Only by opening up the industrial machine for the first time absolutely full blast in one single direction can we overtake the Axis in the battle of production.

Hence this country has become the most gigantic factory the world has ever seen, turning its plowshares into swords, transforming itself into an all-embracing, universal arsenal —all to meet the Axis challenge.

Changing Over the Auto Industry

No doubt the most dramatic single transformation, and certainly by far the largest, is that of the automotive industry. Including those that supply parts and accessories as well as the few great final assembly structures in and near Detroit, the industry has no less than 986 plants in 31 states.

Taken together it operates what is the world's largest machine shop. Naturally it is counted upon for a larger share of the war effort than any other single industry.

Having stopped making passenger cars and commercial trucks early this year, its capacity for aircraft engines, tanks, machine guns, antiaircraft guns, shells, airplane parts, and airplanes, as well as military trucks, scout cars, and jeeps, is enormous.

Besides converting many of its expansive factories, the automotive industry has also had turned over to it by the Government various giant new "special-purpose" plants in which to apply its mass production "know-how" to instruments of war.

Like magic out of the Arabian Nights these fabulous shining structures, big enough to swallow whole towns, have risen in a year's time out of cow pastures, wood lots, and wheat fields.

The modern workshop, especially when it is built from scratch for war production, is not set up in crowded cities.

These astonishing creations are prodigious in area not only because the assembly of bombers and tanks requires space, but because the whole tendency of modern workshop construction, started about 1920 by Henry Ford, has been to get away from the multiple-storied factory.

Mr. Ford decided that it was wasteful to raise and lower materials; that with one level, or with occasional portions two stories high, and with no columns, operations would be more economical and expansion simpler.

Seventh Wonder of a Warring World

Most symbolic and legendary of these buildings, looming up in awesome vastness, one of the seven wonders of the world at war, is Mr. Ford's own Willow Run plant for the production of heavy bombers, the B-24's.

Until the first tree was pulled up late in March, 1941, Willow Run was a lazy little creek on which Mr. Ford had built a small power plant and one of his forty tiny village industries. Surrounding it were thousands of level acres of wood lot and wheat fields, with an occasional farm house or rural school.

When I visited Willow Run a few months ago, there was parking room for 30,000 automobiles and an immense air field. As for the plant itself, the guide who took me around carried and constantly referred to a detailed map of the structure, as you would in an unfamiliar city, lest as he wandered about, I become confused and practically lost.

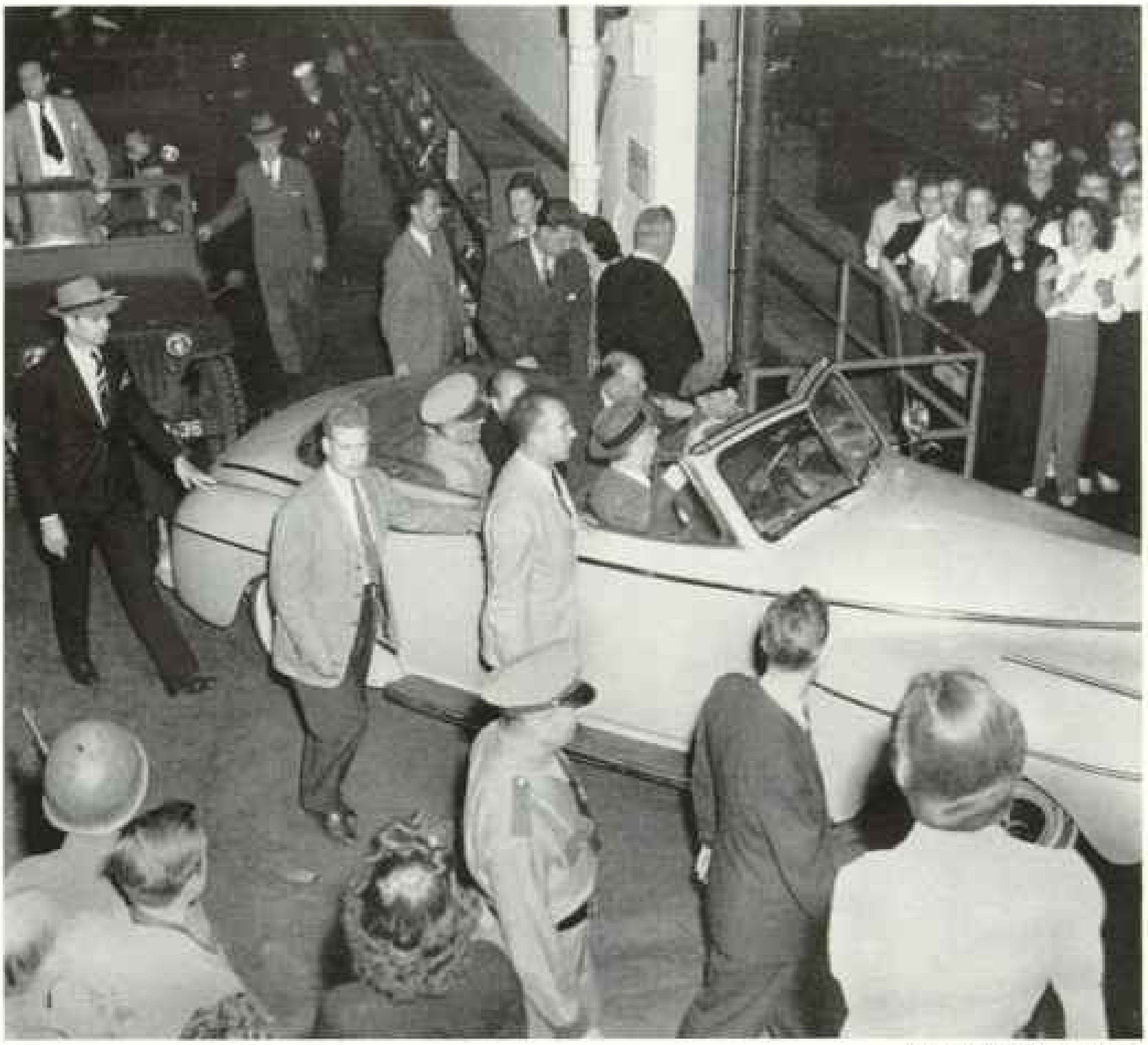
No recital of figures and no description can give an impression of the size of such a building nor of the might of the machine-age processes within it. But it is so long that when I stood near the west wall the open east end looked exactly like the other end of a long railroad tunnel.

At this writing no other building under one roof in the world is so large. Here is the most enormous room man has ever devised.

While of only one ample story in height, what appears to be literally endless and innumerable balconies lie under the roof, each one big enough to tuck away a whole department of clerical workers.

On the floor itself, where the bombers will grow by accretion, my chief impression was of the puniness of man in such a gigantic jungle of monstrous machine equipment, veritable behemoths of steel.

* See "QM, the Fighting Storekeeper," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, November, 1942.



Wide World from Press Assn.

The Commander in Chief Inspects the Front Lines of the Battle of Production

President Roosevelt's unannounced visit to a Boeing plant in Seattle was one of many during his nation-wide inspection tour of war factories between September 17 and October 1, 1942. In the automobile also are Brigadier General Charles E. Branshaw, District Supervisor of the Army Air Forces Procurement; Philip G. Johnson, president of the Boeing plant, and Governor Arthur B. Langlie of Washington.

Five thousand tooling machines had already been installed and more were coming. Some are small, of course, but others are as big and tall as a house.

Tanks Roar off Assembly Line

Next to the bomber no weapon has so captured general imagination as that flame-breathing, turtlelike engine of destruction, the tank. Indeed much of the building of a military airplane is to the layman strangely silent.

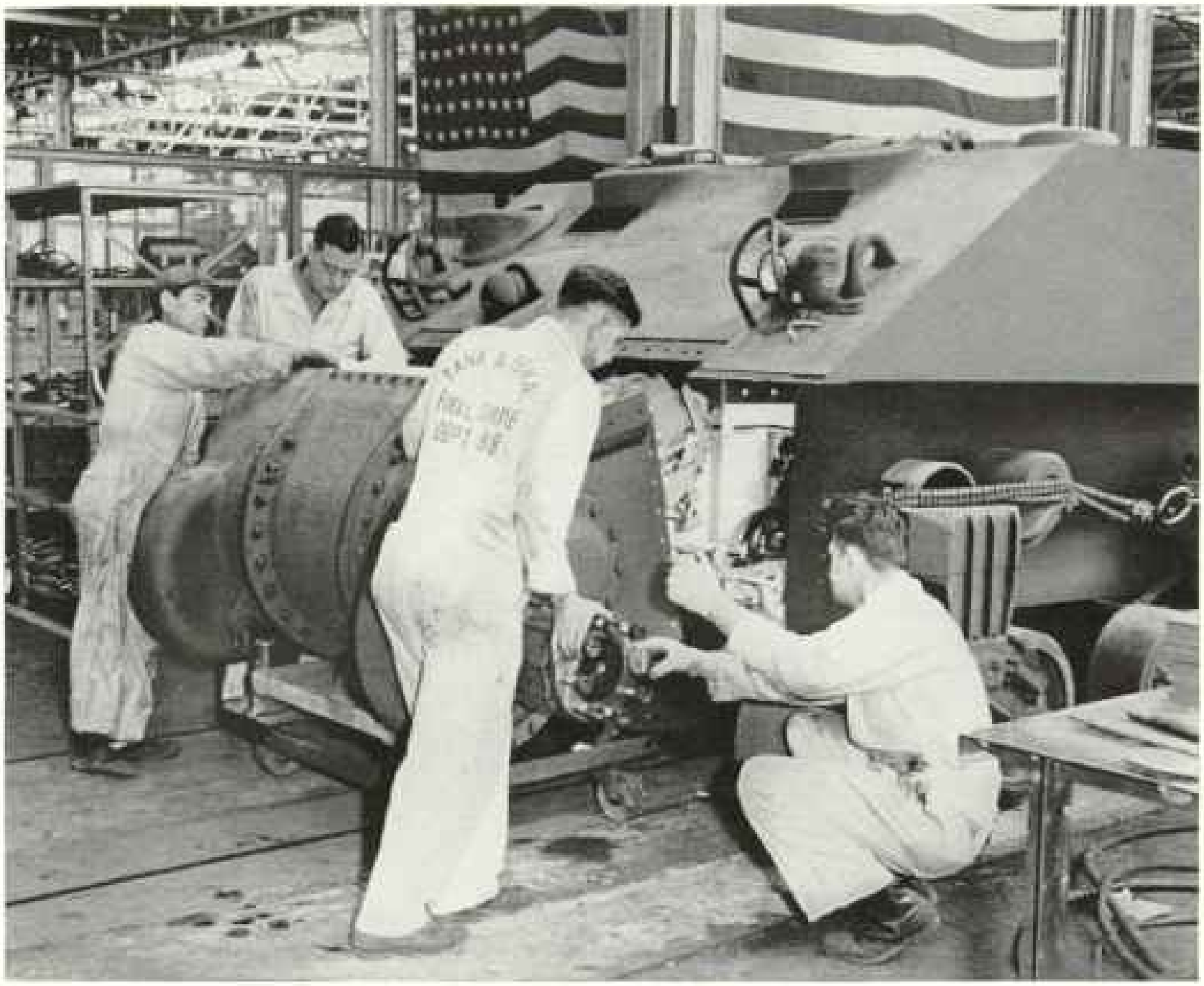
But a tank goes off the end of the assembly line, out of its cavernous arsenal and upon its testing field for a 75-mile tryout, with a roar like thunder. It is the very personification of size, noise, and motion.

The first tanks were built by a railroad car-building company and two locomotive manufacturers.

In fact, to get into mass production it was necessary to enlist not only the car-building, locomotive, and automobile industries but also the makers of farm implements, road-building machinery and, for parts, hundreds of other concerns.

Compared with a tank an automobile is scarcely more than a kiddy car. In use a tank may bounce around like a ball; its full weight may be thrown on itself. The turret alone in spite of its considerable weight is so contrived that a man can move it easily by hand.

In the famous Chrysler-operated Army tank arsenal I was most impressed by the massive size and strength of the various parts and the beautiful armored steel that makes them up.



A "General Sherman," Last Word in Tanks, Gets Its Transmission and Final Drive

M-4, the Army name for this 28-ton Chrysler product, has a welded hull, leaving few rivets to be sheared off by shells—a weakness of earlier models. Its 75-mm. turret gun will revolve in all directions.

At every stage the turret itself is a veritable symbol of strength and power.

But even when watching such a dreadnaught's fabrication one is impressed by irrelevant and insignificant trifles. A workman during the lunch period calmly peeling an orange on top of a turret. Another workman screwing a small metal box onto an almost finished tank.

Crews Ate, Slept, and Lived in Tanks

"In Burma," said my guide, "the crews had to eat, sleep, and live in their tanks. They simply must have some place to put their small personal belongings. Hundreds of changes are constantly made and new things added as the result of combat experience."

In another tank arsenal, operated by an auto bodybuilding company, I saw a fixture novel in American manufacturing. It weighs more than the finished tank and holds the huge hull, turning or cradling it from end to end and from side to side, like a revolving barrel, for the convenience of the welders.

Guns were as strange to the automotive industry as tanks. Most of the factory personnel had never seen them in modern form. A number of these guns had never been made in this country at all, and others only on an experimental basis at government arsenals.

Antiaircraft guns are only one of numerous types, but serve as a good illustration. The country had no antiaircraft industry; it had to be built from the ground up. Such guns are monstrous, complicated affairs, with heavy carriages, mounts, fire-control and recoil mechanisms. Yet the President asked for 20,000 this year and 35,000 next.

In a General Motors plant which had made low-priced passenger cars and now turns out a very important type of antiaircraft gun I saw an operation on the bore of the gun barrel which formerly took one and a half hours and now takes five minutes.

I asked the manager whether his engineers had put in a great amount of study on this

This Huge Motor Will Be Tested as Closely as a Doctor Studies Your Heartbeat

A Pratt & Whitney engine, made by Buick and equipped with Hamilton Standard propellers, is an illuminating example of how American industries are pooling patents and manufacturing secrets to help win the war (page 699). In the center, under the test stand at Flint, Michigan, is Harlow H. Curtice, Buick's president. To his left is Lt. Col. E. H. Bowman, representing the Army Air Forces.

O. W. I. by Palmer

This Giant Oven for a Ten-foot Tire Can Vulcanize a Self-sealing Gas Tank, Too

Rubber-lined fuel containers, first used by the Germans in this war, now give American planes an advantage over the Japs' leaky, metal tanks which easily catch fire. Bullet holes are sealed automatically. The six-foot four-inch worker is dwarfed by the lid, which he is cleaning with compressed air.

gun, the plans of which a British naval officer had somehow managed to get out from a small European neutral country, where production had been very small.

"We had no time," he replied, "we had to go to work. We had no antiaircraft experience back of us and no one to go to for help. The gun was not designed for mass production, but we made sufficient changes to make it a production job.

"We had turned out as many as 1,200 automobiles a day here, but we had very few machines we could use, and had to retrain all our men. We are unable to buy more than half the parts and make the other half ourselves, cutting costs on one part from $23 to $3."

A trip through the spacious plant, as well as through a Chrysler shop making another type of antiaircraft gun, left the impression of almost silent, matter-of-fact efficiency, utterly without any trace of fuss or confusion.

No detail is neglected. A refrigerator full of cartridges is cooled to the freezing point. In testing the gun, a certain number of rounds are fired with this chilled ammunition to duplicate the conditions in Arctic regions.

"Our Job Is Making Things"

"Antiaircraft guns must be very different from automobiles," I said to the manager of the first plant upon leaving, "and yet you and your men act as if you had been making them all your life."

"In a sense we have," he replied. "It's just making so many more machines. Our job is making things."

At another General Motors plant, converted on colossal scale from spark plugs to machine guns, the transformation of tools and machines seemed to the works manager relatively minor. The great problem was to secure men, "the transformation of people" as he worded it.

Pointing to a roomful of serious-faced, earnest youths he said they were just out of high school and CCC camps, and added that his three best "set-up" men had shortly before been hotel bellhop, service station attendant, and soda jerker, respectively.

As I left I asked if he felt that he had been making machine guns all his life instead of a few months. "Surely," was his veiled but searching reply, "production goes up all the time."

Then hesitating a moment he added, "There is so little connection between spark plugs and machine guns. Close as I am to the transformation I never cease to marvel, even now, that it could have happened."

That industry has been able to convert from peace to war without a back-breaking wrench and a ruinous period of confusion and delay is indeed a marvel.

Manufacturers Pool Designs and Methods

It has been possible only because rival manufacturers and industries have been willing to pool and exchange their designs, production technique, and even machines, without profit to themselves.

On a vast scale different concerns are educating in their own shops the engineers and artisans of other concerns, both competing and non-competing. In one airplane engine plant I walked through a whole series of offices given over solely to men from other companies learning how to make that particular engine.

One automotive-parts concern, for example, turned over to the Government two years ago free rights for its competitors to build its choicest possession—a wheel that had won high praise in World War I. At present three-fourths of the wheels are being made by the company's peacetime competitors without royalties.

Henry Ford did not build a single bomber at Willow Run until hundreds of his engineers had spent many weeks on the Pacific coast in the plants of Consolidated Aircraft Corporation learning how that concern had been making the product which Ford had been commissioned to duplicate.

But that is not all. The planes which Ford had learned to make from Consolidated Aircraft were being powered, when I visited Willow Run, with engines turned out by Ford's erstwhile rival, Buick, which Buick, in turn, had learned to make from Pratt & Whitney, one of a few pioneer aircraft engine manufacturers (page 697).

Nor is Buick the only concern licensed to make these engines without profit to Pratt & Whitney; five other American corporations have the same privilege.

It is only by cooperation like this that industry is able to meet the extraordinary difficulties of war production. As strategy shifts or as a particular area of the earth's surface comes in or goes out of the war, production programs change.

At one moment fighter planes are needed; at another medium, at another heavy bombers, and at still another transports.

The number, size, and complexity of machine tools to be used depends upon the quantity of output. More factories must be torn apart and done over, as well as expanded, to meet the changing demand.

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Allied Air Force Chiefs Inspect a Ball Turret for a Bomber

Lieut. General Henry H. Arnold, Commanding U. S. Army Air Forces (right), shows this device to increase fire power to Major General Alexander I. Belyaev, of the Soviet Air Force. The inspection was made in the Briggs Aircraft Plant, Detroit, during a tour of war factories by a group of United Nations officers. The turret, in effect an aluminum ball moved electrically, can be quickly revolved. It also rocks through an arc of 60 degrees, enabling the gunner to cover his entire field of vision.

Nor is it merely that programs multiply almost overnight with shifts in the fortunes of war. Each weapon is constantly improved. The airplane grows bigger and more complicated. It must carry more armor and gun power. It must travel farther and faster.

Pioneers in Aircraft Industry

Fortunately for the salvation of the country a little group of young enthusiasts, with slender financial resources, but pioneers in the truest sense, started the modern aircraft industry after the last war.

Donald W. Douglas and Philip G. Johnson, heads of the Douglas Aircraft Company and Boeing Airplane Company, respectively, joined the infant industry as young engineers just out of college.

Frederick B. Rentschler, chairman of the United Aircraft Corporation, was a captain handling production in the Air Service in the last war.

Guy W. Vaughan, president of the Curtiss-Wright Corporation and chairman of the Wright Aeronautical Corporation, was a designer and racer of automobiles before the last war.

But Glenn L. Martin has had the most picturesque career of any. He began building gliders in 1907 and taught himself to fly. He established one of the first airplane factories in the country, in an abandoned church in Santa Ana, California, in 1909. He earned money to build planes by exhibition flights at county fairs.

San Francisco paid him $2,000 for carrying a message from its mayor to the mayor of Oakland across the bay. His flight to Catalina Island from the coast of California, 34 miles, was a wonder of the time. Movie stars paid him handsomely for their first rides.

But most interesting of all, he is the only American manufacturer of military planes in this war who also made them in the last war.

If it had not been for the pioneer persistence of these and a few other young men in airplane research, design, and development, as well as holding to the conviction that air power is essential to national defense, there would probably be no way of catching up with the nations so long bent upon aggression.

These pioneers had to face a long depression and a period of intense pacifism. Their goals were the best planes technically and

Robert Yarnall Richie

As a Navy Visitor Looks On, the Workman Assembles a "Cyclone" Power Plant

Here in a Wright factory, a production line turns out engines for such bombers as Lockheed's famous Hudsons. Other assembly lines produce Cyclones and Whirlwinds for fighters, training and cargo planes, and combat tanks. Alongside the official visitor is a girl guide in trim blue uniform.

the ability to expand. In the Thirties the picture looked black for some of them, but they made sales to the French and British, and thus had a nucleus for the prodigious expansion since 1940.

Plane Assembly Room Big as Four Football Fields

Today the country is fairly dotted with aircraft plants, and most of them are huge affairs. The Glenn L. Martin plant on the Atlantic seaboard is no exception. One assembly room would house four football fields.

Several things impress the visitor upon entering. One is the prevailing quiet, despite the presence of thousands of workers. Another is the seriousness and earnest devotion to their tasks of these young men and women.

Women are everywhere in the great plant. They sort and arrange the small parts. In their small hands is practically all of the wiring, which, in a bomber, seems incredibly intricate to a layman.

The women come from all walks of life and almost daily spread from one department to another. My guide suddenly exclaimed, "Why, this is the first time I've seen a woman on final assembly!"

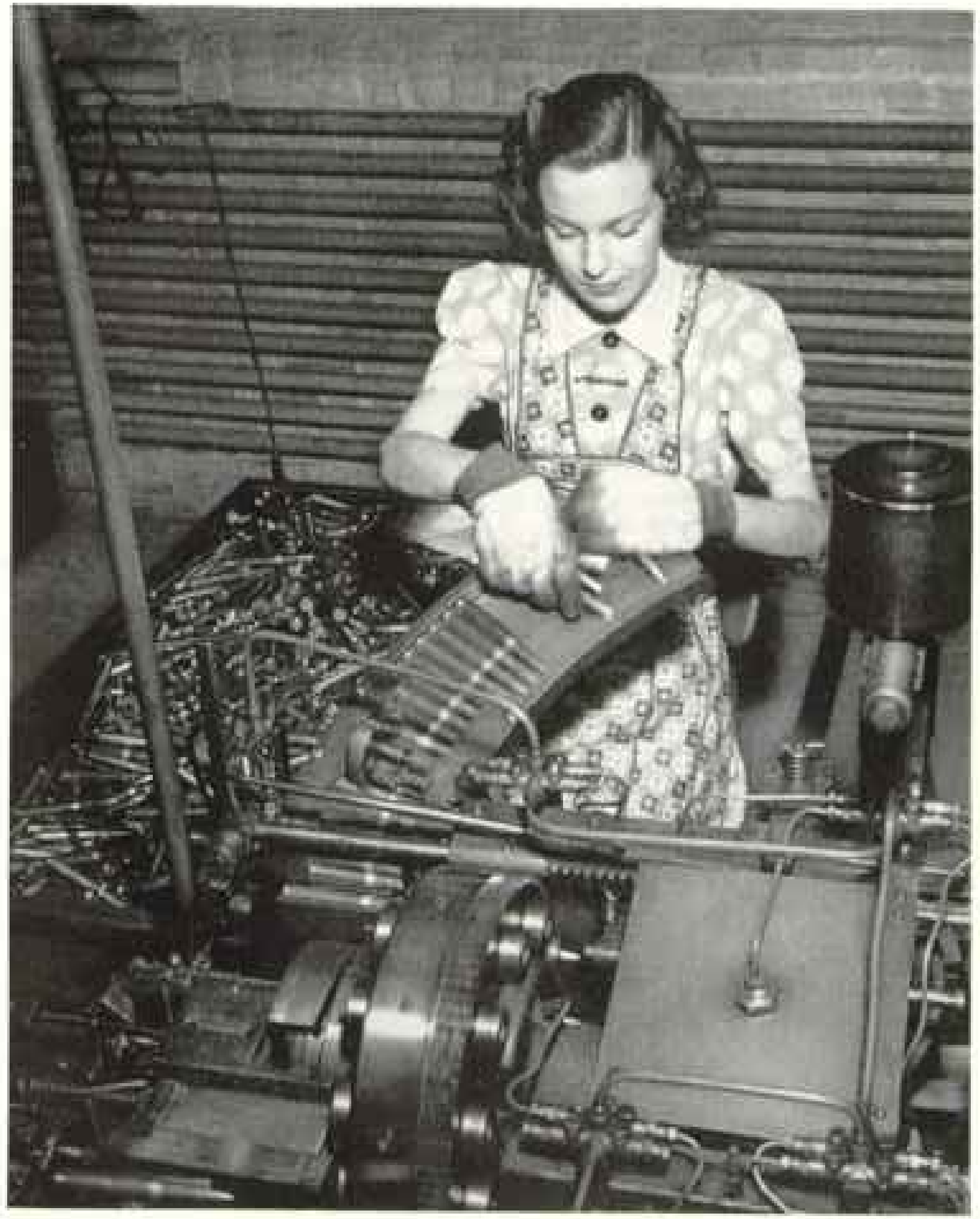
It is plain that the women are proud of their work and that their superiors are proud of them. Where frames or mounts for the engines are made out of tubing, women are highly skilled as welders. The head of the department indicated one woman of evidently superior abilities and said she had had 270 hours training in vocational school.

In visiting a plant like this for the first time one is impressed by the almost constant inspection of parts as they flow toward final assembly. Inspection is just another way of spelling the words "eternal vigilance" in the manufacture of such a large and extremely complicated mechanism as a bomber.

It is thrilling to step into an almost completed ship, just a few stages before it moves away under its own power, and with as many workmen as can get into the cramped space putting on the final touches. Already there are enough gadgets to give a layman nightmares and he realizes how much is lost when such a bomber goes down.

Airplanes of Tomorrow

Unlike an automobile, nothing here is for show or decoration; each of several hundred thousand parts must bear the greatest possible



A Dainty War Worker Checks Man-killing .50-caliber Cartridges

They pour in an endless stream from this weighing and gauging machine at an Army arsenal. Shot from the wing of an American plane, the bullets rip a lightly armored Zero to pieces. Flying Fortresses use them against Nazi fighters with devastating effect. Carrier-based fighter planes returning from a raid on Tulagi Harbour (page 817) turned their .50-calibers against a Japanese destroyer and crippled it.

O. W. I.

Inventor of the Garand Rifle, the Army's Jap-shooter

John C. Garand, at work in his model shop, is a native Canadian who came to the United States at 15 years. He developed the famous nine-pound semi-automatic at the Army's Springfield (Massachusetts) Armory. Later he designed tools for mass production, giving our troops an eight-bullet, rapid-fire weapon of deadly accuracy. The gas behind each bullet ejects the empty shell and prepares a fresh one for the next squeeze of the trigger.

Press Association

Men Who Built Your Tires Now Mass-produce Antiaireraft Guns and Mounts in Rapid-fire Order

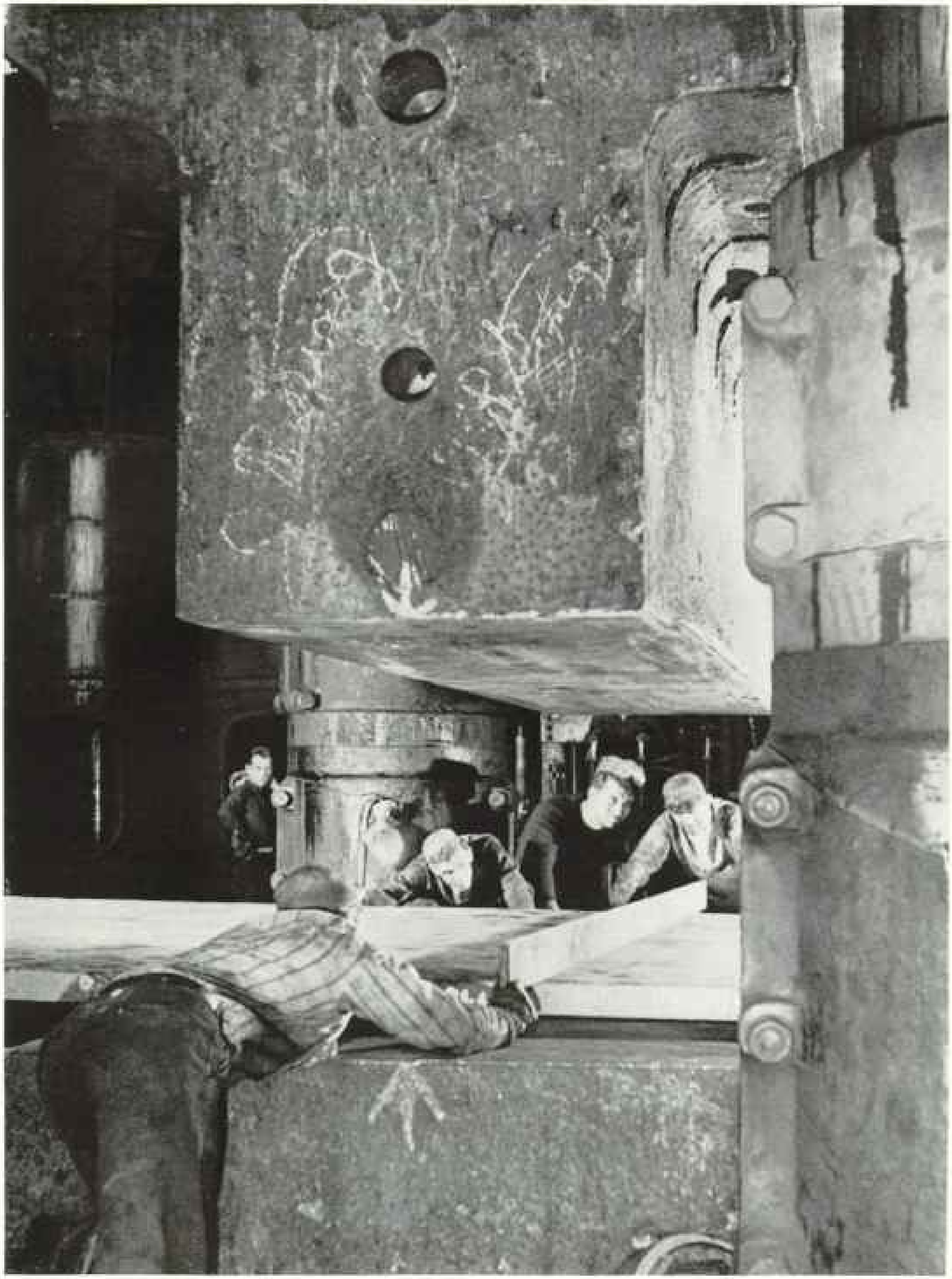
Carriages are ready for assembly with their 40-mm. Bofors guns at this Firestone plant. The wire cage is a power plant. Starting in March, 1941, the company translated Swedish metric specifications into inches, built a five-acre plant, organized 1,500 skilled workers, and began production in October, same year. By October, 1942, output had increased 1,000 percent.

O. W. I. by Brasher

While Enjoying Their Own Lunch, Workers in a Western Aircraft Factory Watch the Screen's Popeye Eat His Spinach

This shift is munching sandwiches in one of the recreation areas provided by the company. In addition to animated cartoons, they are treated, from time to time, with dances, style shows, boxing matches, visits from movie stars, and talks by heroes who fly the planes they build.

Flying Fortresses, Which Swat Down Nazi Messerschmitts Like Flies, Grow before Your Eyes in Boeing's Fuselage Line



Ron Partridge from Black Star

A 14,000-ton Press Straightens Out the Kinks in Cold Three-inch Armor Plate

When the jaws of this prodigious "nutcracker" close, they remove any curvature that may have formed in the steel during cooling. To make sure that the tremendous squeeze has thoroughly trued the slab, workmen apply a gauge at a United States naval ordnance plant.

strain. In one place aluminum must be used, in another magnesium, in another steel, and in another plywood or plastics will do.

Outside the plant was Mr. Martin's pride and joy, the giant flying boat *Mars*. It was only an experimental model when I made my visit, not in commercial production. But the aircraft companies never cease to experiment with new and bigger and better planes. They are always figuring on the plane of tomorrow.

Engines and propellers are vital components of the aircraft industry, but they are not always made in the same plants as the planes themselves.

The heart of an airplane is of course its engine, and if the makers had not learned to combine power and lightness the resulting contraption would be as big as a locomotive.

Visitors to the main Pratt & Whitney engine plant in Connecticut are struck not only by its cleanliness and quiet but by the fine caliber of the workmen, New England indeed being famous for its skilful craftsmen.

It takes such craftsmen, working steadily, but not in frantic haste, to do the good job required to machine and polish the 9,000 parts of an engine to tolerances as small as one ten-thousandth of an inch.

"How do we speed up production?" repeated my guide in reply to my question. "As much by keeping good men, having them know their jobs and all the short cuts—by stabilizing production, in other words—as by putting in new machines."

After completion each engine is tested for hours, its temperature, speed, and the behavior of fuel, oil, and air being watched the way a doctor studies your heart beat and blood pressure. Each engine is then completely disassembled, inspected, and assembled again.

If delicacy of outline and harmony of proportion make for beauty in an object, as the dictionary says they do, then one of these finished engines is indeed a beauty of the first order.

That such a shining, sensitive, elegant, and, incidentally, from a monetary viewpoint, costly mechanism can develop 2,000 horsepower is incredible to the beholder until he goes into one of the many test rooms and is convinced!

Moisture is deadly to such a symphony of metal, and the earlier method of protection was to cover it with grease before transportation or storage. But these engines are now covered with a pliofilm envelope, all air is exhausted, and the envelope sealed. In addition, dehydrating chemicals are placed inside, and a card in plain view turns pink if there is moisture and remains blue if all is well.

In the near-by Hamilton Standard Propellers plant production has gone up without increasing floor space by installing vertical equipment machines that go up in the air.

But the visitor to this propeller factory first notices two things. He is in a world of aluminum and he is in one where perfection of balance is the very aim and object of existence.

The propeller is the gear shift of the air. The blades automatically adjust themselves to conditions of take-off and flight. In manufacture the blades go through seemingly endless stages of trimming, milling, and buffing.

On the final polish the best men are employed to get perfection of balance. At that stage it is necessary by means of screens to exclude drafts from the room in which the work is done.

Far-seeing Planning by U. S. Army and Navy

There is danger that this article may convey a mistaken impression to the reader. The miracle of war production is by no means entirely due to industry. Credit also should go to years of quiet, careful, and far-seeing planning on the part of Army and Navy.

After functioning in World War I the War Industries Board, headed by Bernard M. Baruch, made a final report which led to the passage of the National Defense Act of 1920 and the setting up in 1922 of the Army and Navy Munitions Board. Also in the same year Army district ordnance offices were opened in 13 key cities.

As a result 20,000 industrial plants were surveyed, 10,000 were given schedules of what they might be expected to produce in case of war, a few "educational" orders were let, and in other ways the groundwork was laid for the program which began to take shape after 1940.

But back even of all this planning lies the Government's so-called arsenal system, founded under George Washington as an outgrowth of the Revolutionary War.

The Garand Rifle

In these relatively few arsenals there is in peacetimes experimentation in the different branches of ordnance, models are made, "pilot" production goes on, and detailed reports are rendered available to manufacturers who are expected to go into military production in time of war.

Different arsenals specialize on such branches as fire control, powder, large guns, small guns, and gun mounts.

U. S. Army Signal Corps. (Official)

A Man-sized 500-pound Demolition Bomb Gets Its Nose Pointed

Casing and nose are a single piece of metal. One end of the "can" is forged into a rounded nose-heavy snout by the 1,700-pound steam hammer. After high explosives have been loaded into the bomb case and the tail assembly screwed on, it is ready for delivery. Just before use, the bomb will be fused and the fins attached to guide its fall.

One of the most interesting of these manufacturing arsenals is that officially known as the Springfield Armory, in Massachusetts. Not only is it the oldest, but there the semi-automatic Garand rifle, which has now replaced the old Springfield for Army combat use, was invented and there it is being produced in volume for wartime purposes.

The oldest building in the Springfield Armory "Hilltop" group goes back to 1807; the administration building to the Civil War. Being in the center of a large city there is very little room for expansion, but transportation problems for employees are reduced to a minimum. The manufacture of small arms on this site actually began in 1795.

John C. Garand, an unassuming but determined inventive genius, took two years, beginning in 1934, and the help of 18 expert toolmakers, to complete 80 of the rifles which now bear his name. But he also designed a number of machines which were later to turn out these modern rifles in quantity (page 702).

Mr. Garand was born in the Province of Quebec 54 years ago. He first became interested in machinery when as a child he saw a steam engine pull stumps out of the ground. He came to this country as a boy of 15, and after working for the National Bureau of Standards in Washington went to the Springfield Armory many years ago. As an ordnance engineer he now has charge of a shop where models are made.

To follow the mass production of Garand rifles in the old Armory buildings from the original small castings to the finished weapon is a breath-taking experience. The actual daily production cannot be published, but it is much in excess of that of more than a year ago which amounted to 1,000 a day.

Even 1,000 rifles a day means that one is completed in only a little more than a minute, and that sort of production requires the most intense activity on the part of many thousands of men and women.

Subdivision of labor could hardly go any farther than in the manufacture of Garand rifles; there are machine operators who do nothing except make a single notch in the black walnut stocks which the conveyor belt carries past them.

In visiting any kind of factory where complicated mechanisms are made, the tendency of the layman is to be interested only in final assembly. But assembly is relatively easy; what counts in this war is having enough parts at the right place at the right time.

"A War of Spare Parts"

In fact this has been called a war of spare parts, although the word maintenance, or replacement, would be more correct. In any case the mechanization of military equipment has created a gigantic, a literally savage appetite for parts.

An enormous aggregation and variety of highly technical apparatus on many different fronts all over the world must be maintained in serviceable condition. Therefore, when the President asked for 60,000 airplanes this year, the program meant, in a sense, that practically all the parts for at least 80,000 planes must be produced.

But parts signify far more than maintenance and replacement, vital as these are. Provided engineers and other technicians break down, or "explode," a finished article into as many simple parts as possible, hundreds of thousands or even millions of wholly unskilled workers can be taught quickly to make one of these parts or perform one or more simple operations upon it.

Obviously there are nothing like enough skilled workers to make the necessary ships, planes, tanks, and guns. So the skilled worker's job has been subdivided, or exploded, into its component parts, and usually the skilled worker himself has been upgraded to instruction or supervision.

Then millions of utterly unskilled workers have gone into classes operated by the public school systems, or the manufacturers, or both, and in about six weeks' time have learned to do a small piece of the total job. In a gun factory the manager stopped directly in front of a girl working at a machine.

"She does seven things," he said to me. "Watch her. 1. She wipes the machine clean. 2. She puts the piece in clean. 3. She clamps it up. 4. She starts the machine. 5. She takes the piece out. 6. She tries it on the gauge. 7. If it doesn't fit the gauge, she stops the machine and calls for her immediate superior. That doesn't take much training."

Thus we have practically all the implements of war and parts thereof, including ships as well as tanks, guns, and planes, made and assembled by men and women who never saw them before.

In an article entitled, "As 2,000 Ships Are Born," in the May, 1942, NATIONAL GEOGRAPHIC MAGAZINE, Frederick Simpich described the details of the shipbuilding program.

But the months since then have accentuated the fact that ships are now being assembled from pieces built in many different places. That is, they are now being built in parts rather than in a unit as formerly. In consequence thousands of workers who had never seen an ocean-going ship, much less a shipyard, are doing the job.

Parts for naval vessels are being built in Denver, where obviously shipyard experience was lacking. Many of the employees of a Manitowoc, Wisconsin, job were farmers. In a Texas shipyard with 6,500 employees only about 100 were experienced at such work at the start.

Schooling Follows the Assembly Line

The training of the workers who make the machines of war, and of the Army and Navy crews who care for them, is a story in itself. It is one of the most colossal educational undertakings the world has ever known.

A single illustration must suffice. In the great Buick plant in Flint, Michigan, was the largest classroom I had ever seen. It is where 150 new cars a day were formerly turned over to retail buyers who went to Flint to take personal delivery at the factory.

Here come privates from the Army to study aircraft engines and, in a sense, their instruction proceeds on an assembly-line basis.

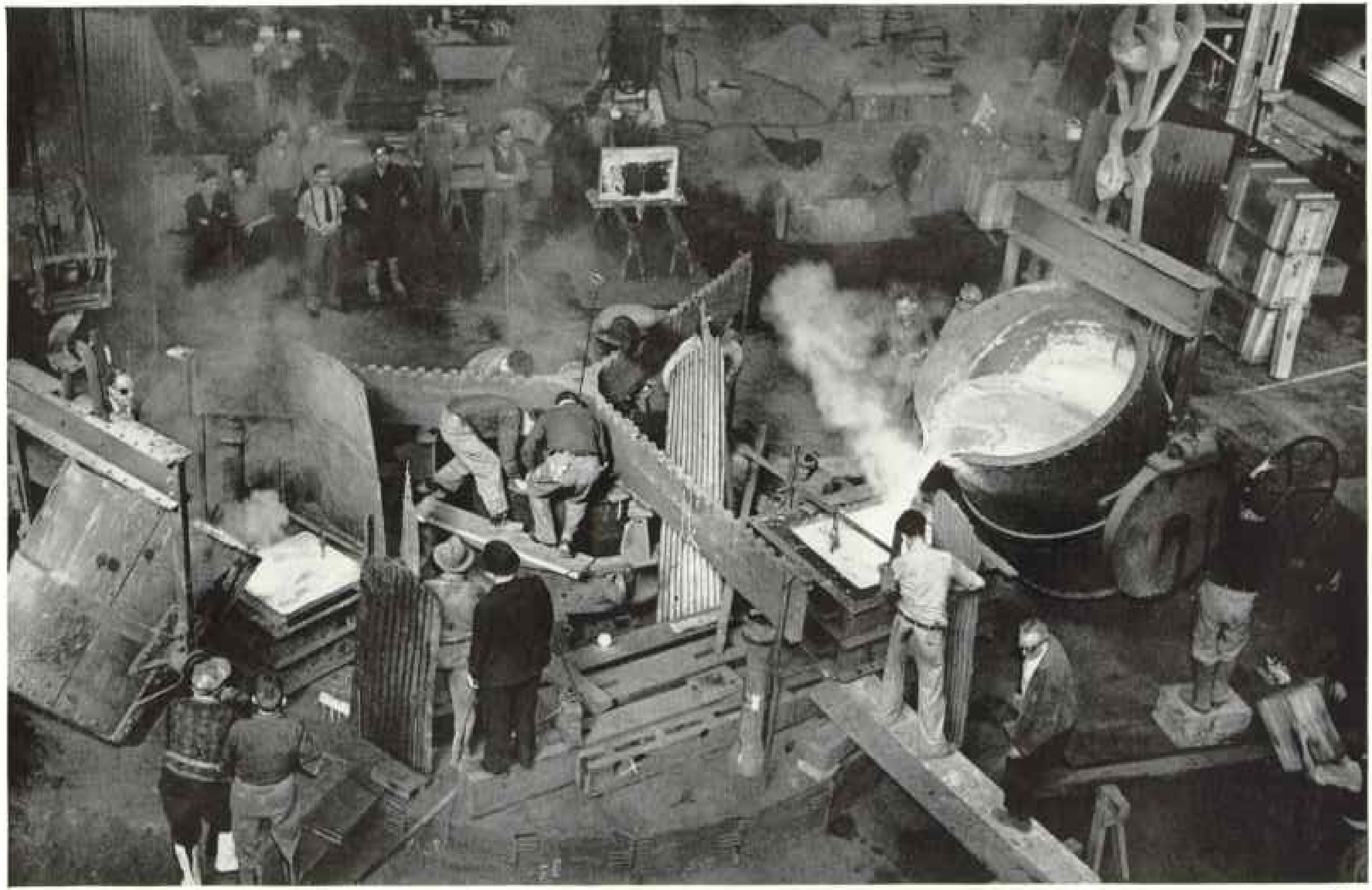
For a week they are lectured to on the principles of engines, horsepower, fuel consumption, and mechanical fundamentals. Then they go for a week into an adjoining room where they take down and build up the simplest part of the engine again and again.

Week by week, each in a successive room, they take down and build up the increasingly more difficult portions until in the final week in the last of the rooms they disassemble and assemble the entire power plant.

But no amount of worker training or simplification of manufacturing processes will spell mass production unless there is also subcontracting. In England it is known as "bits and pieces," and there is ample precedent in both British and German experience.

In 1936 Hitler's plan was to leave the task of meeting civilian requirements to Germany's 2,000,000 small handicraft shops and have large plants concentrate on war production. But the little shops proved less able to produce complete civilian items than to make bits and pieces of war machines.

After Dunkirk war materials were so desperately needed in Britain that there was no



Armor

Casting a 17-foot Propeller for the Battleship *Washington*—Somewhere at Sea Today Fighting the Axis

Press Association

Another Merchant Marine Ship Hits the Water—Fourth Liberty Ship Launched from This Yard in a Single Day

The freighter goes down the ways at midnight at the Kaiser Oregon Shipbuilding Corporation, Portland, Oregon. If enough steel can be had, an average of four ships a day may be delivered from the nation's shipyards by January 1, 1943.

Courtesy Yachting Magazine

"Roll Over, PC!" Says the Shipbuilder, and Over She Goes

Because down welding is easier and faster, the Defoe Shipbuilding Company at Bay City, Michigan, assembles sections of these 173-foot submarine chasers upside down. When the hull is welded, two collars are placed around it, and it is rolled over to its upright position for outfitting. Before the new ship feels the ocean's surge, she has a 2,100-mile fresh-water road to travel. She will steam up Lake Huron, down Lake Michigan to Chicago. Then passing through the Chicago Drainage Canal and the Illinois River, she will go down the Mississippi to the Gulf of Mexico. These handsome, seaworthy little ships are doing a magnificent job fighting submarines and as convoy escorts.

time to build plants or build tools to make them. The larger firms, or "prime contractors," who assemble the finished article, simply couldn't do the whole job.

Thousands of little shops, on the other hand, could not undertake the large government contracts, because of their limited facilities, but could make parts for the prime contractors on a "hen-and-brood" basis.

The British soon found that a high percentage of their aircraft parts, even of their aircraft engine parts, and of their tank parts could be made in shops not originally counted upon for war production. It is said that at least 6,000 small firms make tank parts in Britain.

Many Small Plants also Serve

This country has followed substantially the same system, and experience has taught that some prime contracts can be subdivided as much as 90 percent. This brings small plants into the war, takes work to facilities already in existence rather than compelling the building of new ones, and keeps the workers in their own familiar surroundings.

How far the process will go depends upon the length and severity of the war. But it has already reached 275 engineering students in the shop courses at Purdue University, LaFayette, Indiana, who, instead of following the routine practice work, are engaged part time on a subcontract for the Westinghouse Electric & Manufacturing Company, with their instructors acting as shop foremen.

Subcontracting has gone so far that numerous hobbyists, who have small machine shops in their basements or garages, have taken on war contracts. In some instances they have given up their regular occupations and, with several assistants, devote themselves entirely to completing the contract.

Manufacturers, both big and little, have taken war orders not only because of an eager desire to do their part but in many instances because they had no alternative if they wished to remain in business.

Industry after industry, especially those that work in metals, have been forbidden to use materials for civilian consumption. Naturally they have turned to war production. They have had to face the question which Charles F. Kettering, distinguished scientist and inventor, propounded years ago:

"What are you going to do when you can't do what you are doing now?"

In some instances an entire industry, or a substantial part of it, has taken a large subcontract, pooling everyone's resources to perform it. A good example is the automobile spring and bumper industry which is building armor plate for tanks, one concern acting as parent or top subcontractor.

Not every one of the fifteen different concerns can make a complete set of tank armor plate, but each firm can do part of the job.

Out of Frying Pans into the Firing Line

But ordinarily conversion is by individual companies. A stove factory in Indiana is making lifeboats, a maker of telephone pay stations is now turning out machine-gun parts, a fishing-tackle producer has gone over to bomber parts, a manufacturer of frying pans and egg poachers is now making flap hinges and other bits and pieces for aircraft.

A mid-western electric company which had built up a big business in motors and fans is now one of the world's largest producers of power-driven machine-gun turrets for fighting planes.

A maker of compacts and rouge containers redesigned parts of an incendiary bomb so that he could adapt it to his own equipment.

When you drink homogenized milk you do not ordinarily think of the engineering that went into the making of the machines that treat the milk. One such manufacturer is now turning out oleo struts for airplanes, a highly complicated article.

Twenty-four different war jobs have gone to a firm which in peacetimes made steak "tenderizers" for restaurants and hospitals.

Also many airplane parts, as well as scaffolds by which repair crews reach the nose of bombers, are being made by one of the world's largest peacetime manufacturers of merry-go-rounds and other amusement park devices.

A veteran of the last war had become an exceptionally large producer of metal frames for ladies' pocketbooks and handbags. Anxious to get into war production he was shown a cartridge-loading device but did not have the tools to make it as designed. So he redesigned it to bring it within the scope of his own equipment and now turns them out in vast quantities, cheaper, lighter, and stronger than before.

It is inspiring to visit factories engaged in war production and encounter not only skill and ingenuity on the part of those in charge, but an admirable confidence, spirit, and pride. Almost without exception they delight in exceeding their quotas and in being months ahead of schedule.

"You must be proud that you have been able to convert so extensively," I said to the assistant engineer in charge of one of the greatest automobile plants in America, after he had shown me the many kinds of war work being done and also thousands of idle machines for making automobiles which had been piled up out of the way.

"You're damn right we are," was his blunt reply. "All we ask now is for more work to turn out."

On a Tuesday afternoon I visited a tank arsenal going full blast although it had opened for production only on Saturday. Many of the outlying buildings were unfinished, roads and grading remained to be done, and offices were still practically bare. But one of the production officials sat on a pile of lumber and told me gleefully how much better his tanks are than those of another make.

A manufacturer may not have seen a particular implement of war until a few months previously, but he will tell you with shining eyes how strong and simple and effective it is.

To an extraordinary degree the workers at the bench also are devoted to their wartime tasks. Naturally men and women of every type, including many from "white collar" occupations, have been drawn into war work with its high wages.

Every kind of family combination is encountered, mother and daughter, father and daughter, father and son, brother and sister, twin brothers, twin sisters, and husband and wife. The wife in one husband-and-wife combination in an aircraft plant puts her entire wages into war bonds. At the Glenn L. Martin plant 18 persons from one family, that is, 18 blood relations, are working.

Of course there are always a certain number of workers who take very little interest in their jobs, even since Pearl Harbor, and despite speeches made to them by famous pilots who have had combat service. The manager of one machine-gun plant told me that he uses a device that never fails when he notices a slackening of interest on the part of a group.

"I call in a few wives and sweethearts of boys in the armed services and ask them if they won't quietly act as assistant production managers for me."

"We have been especially pleased at the showing of men and women, both from city and country, who grew up in the depression years," said an official of the General Electric Company, which has trained more than 70,000 new employees for war work.

"Predictions that members of this so-called 'lost generation' would not make good when they had a chance, have proven to be so many fairy tales. We find them fine people. They work hard. They are ambitious. I think that they are as good as any generation I have known."

Inventive Genius Spurs War Effort

Whether we are considering management or men, the outstanding fact is that inventive genius and mechanical ingenuity are being applied to the war productive effort in an untold number of ways.

From the workers themselves in thousands of different factories come suggestions for improvements in methods. One company alone reports 15,000 such ideas in six months' time; in the same period another company received 5,000 ideas and paid $15,000 in prizes for 1,619 of them.

Whether dazzling new inventions will come out of the war is too early to say. Of the part played, for example, by a new science like electronics, which the public knows chiefly through radio and X ray, little has been said, but much will one day be written.

We do know that electronic devices detect planes at great distances, aim and fire guns, explode mines, guide planes and ships through fog, and detect fires and poisonous fumes.

"While war commands the energies of science for its own purposes it also pushes forward research and application," says the General Electric Company. "Under the lash of necessity, developments which might have taken years are compressed into months. The world will reap these fruits of war and they will not be bitter."

It is no military secret, however, even at the present time that in practically every workshop in the land there is someone who is constantly improvising, improving, and finding short cuts.

Improvements are made not only in manufacturing processes but in providing armies with food and clothing. Britain is in sore need of meat, but ship refrigeration is scarce, costly, and space-consuming. The British need lard also, and the shipping people have developed a practicable method of lining the bottoms and sides of ship holds with several layers of boxes of frozen lard, thus surrounding the meat with self-refrigeration.*

By deboning and freezing meat a space-saving of as much as three-fourths has been effected, which is especially important when armies have to be fed in the most distant parts of the world.

In industry welding is not a new invention, but its enormously expanded use in making ships, planes, and tanks is equivalent to one.

Photography is an old art, but a giant camera, a sort of robot photo draftsman, is being used by aircraft and automobile firms to save hundreds of man hours of work.

Until recently million-volt X-ray machines were used by only a few hospitals for the treatment of cancer, but now several manufacturers use them to inspect castings and large welds.

Years ago a famous surgeon developed the bronchoscope to remove safety pins from babies' lungs. A very similar apparatus has been adapted to wartime industry and is used to inspect drilled oil lines whose inner surfaces are invisible in the ordinary way.

It is sometimes said that the only real limitations upon war production lie in a scarcity or unbalanced flow of raw materials.

A solution no doubt involves a reduction in civilian consumption and an increased emphasis upon the conservation of waste products utterly new to American life. But as Donald M. Nelson, chairman of the War Production Board, has said:

"From the beginning I have been convinced that the American people will gladly accept any sacrifice if it will help to win the war."

However, sacrifice is not the only answer. "Substitution" products are being developed on such a scale that even the listing of them is almost impossible.

Surely the inventive and industrial genius of America, which is solving the production problem, will solve that of materials also.

No one who really grasps what the nation is doing to turn out implements of war can fail to be encouraged and inspired by this miracle of production. As Lieut. Gen. Brehon B. Somervell, in command of the Army's Services of Supply, has said:

"When Hitler put this war on wheels he ran it straight down our alley. When he hitched his wagon to an internal-combustion engine he opened up a new front, commonly called Detroit. When he took this war into the skies he rose into our own element."

* See "Revolution in Eating," by J. R. Hildebrand, National Geographic Magazine, March, 1943.

O. W. I.

Future Builders of Airacobras Listen Carefully to How It's Done

These new employees of Bell Aircraft, in Buffalo, are taking a short but intensive course on the building of a fighter plane. Few students are listless or inattentive. Hundreds of thousands of men and women are taking such courses the country over and constitute one of the nation's most popular universities (page 709).

American Industries Geared for War

By Thornton Oakley

From the brush of the distinguished American artist, Thornton Oakley, comes the accompanying series of 16 paintings. Mr. Oakley's canvases are his response to an assignment by the Editor of the National Geographic Magazine *to portray vividly the highlights of America's vast war production effort. To carry out this assignment the artist visited industrial establishments from coast to coast. Below, he sets forth the firsthand observations which inspired his works, painted especially for* The Geographic.—Editor.

THE most gigantic war of history, the most stupendous catastrophe of time engulfs the globe. Into the titanic struggle America has cast her lot. To win freedom for mankind her people pour out blood and treasure. To the forging of her weapons her foundries now are dedicated. Never before has our country created from the elements such servants to her needs.

The Battleship—Plate I

The battleship towers on the ways. Her lines and her bow carry the eye, the mind, the heart upward until the sky appears her crown. Within her frame, through networks of scaffoldings, flow and toil her builders. Some, lifted by the cranes, ride against the clouds. About the riveters, the welders, the acetylene workers, the tallow handlers, smoke and vapors roll. These are the final days before the launching. Soon, with crash of glass on prow, multitudes assembled, the national anthem ringing in all ears, this now inert mass of steel, this largest ship of war ever reared by man, will glide into the waters.

Grain Elevators—Plate II

Cathedrals of the modern age are these cylinders of concrete which in stately phalanxes line the waterways as columns do a nave, lifting verticals to the roof of heaven. These, too, uplift the spirit even as the spires of old. Within these vast containers is stored the grain which will uphold our people in strength of body and of limb, that we may vanquish the sinister, dark powers that threaten the world.

Oil—Plate III

Oil to drive the engines of war for the fighting forces of America! Where the raw petroleum is purged of its impurities along the quays of the refineries, the gray tankers ride. Their crews have brought their cargoes from far shores, braved the waters where the U-boats lurk. Pumps empty the long hulls, fill vats with liquid treasure. Above the ranks of storage tanks, above multitudinous pipes and trestles, rise the silvery towers where day and night stay not the catalytic processes, the last inventions in chemical and molecular transformation, which turn crude oil into 100 octane gasoline.

Water Power—Plate IV

Earth, air, fire man commands. Water, too, the fourth element of the ancients, he has harnessed for his needs. At Grand Coulee Dam, that concrete mass flung across the ice-cut canyon, which dwarfs all other structures built by human hands, the Columbia River fulfils his insatiable demands. A spillway of 1,000,000 cubic feet per second; a falling water energy of 32,000,000 horses; 1,200,000 acres of barren land to be irrigated and reclaimed; electric current generated to operate the war plants in all our Northwest territory.

Coal—Plate V

By the shore of Lake Erie the coal trains gather. From the bituminous mines they bring their endless miles of freight to be transferred to hulls that will bear it to inland ports. Thick with drifting coal dust is this region. Ceaseless is the movement of the cars, the ships, the machinery of the unloading towers. Grimed are the men who tug and sway at levers. One by one, day by day, night after night, the laden gondolas, shunted by locomotives, pushed by electric mules, arrive upon the platforms of the elevators, rise amidst the trusses of the towers, overturn and send their contents hurtling into the lake ships' hungry holds.

Copper—Plate VI

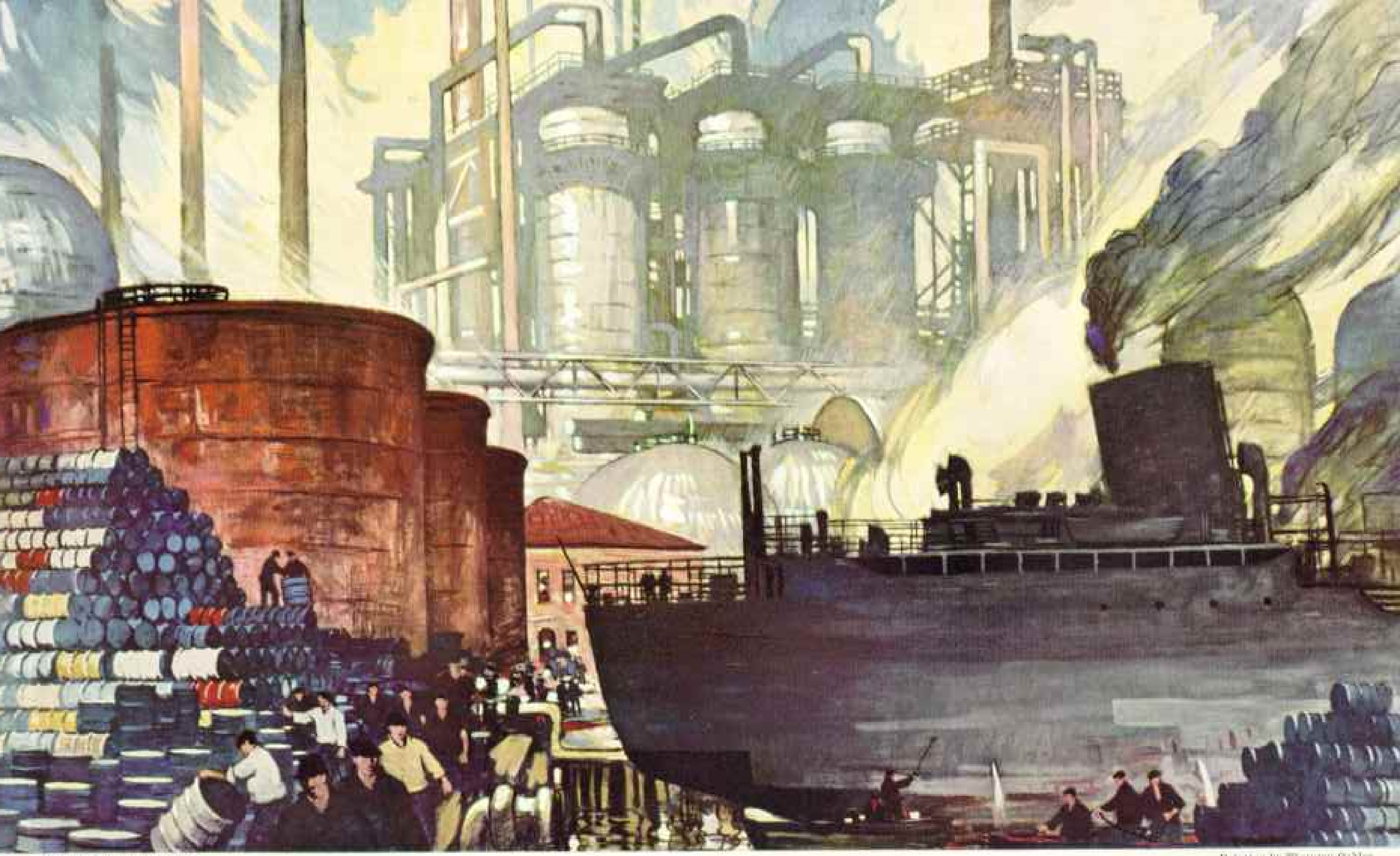
Ores of copper, zinc, manganese, lead, arsenic, bismuth, cadmium, are torn by miners from the deeps beneath our western hills to make the tanks, the planes, the ships, the guns, the shells which will defend democracy. Surrounded by snow-clad peaks, roar the crucibles that reduce the metals from their ores. Foundry upon foundry, roof upon roof, framework upon framework rise upon the hillside until against the sky, dominating all that region, lifting its gaunt height through purplish vapors, stands the culminating structure, a gigantic chimney.

Painting by Thornton Oakley

Our Growing Naval Power: Battleship *Alabama* Ready for Launching

Painting by Thornton Oakley

Towering Like Castles of Old, Grain Elevators Store Golden Wheat, Energy for Fighting Men

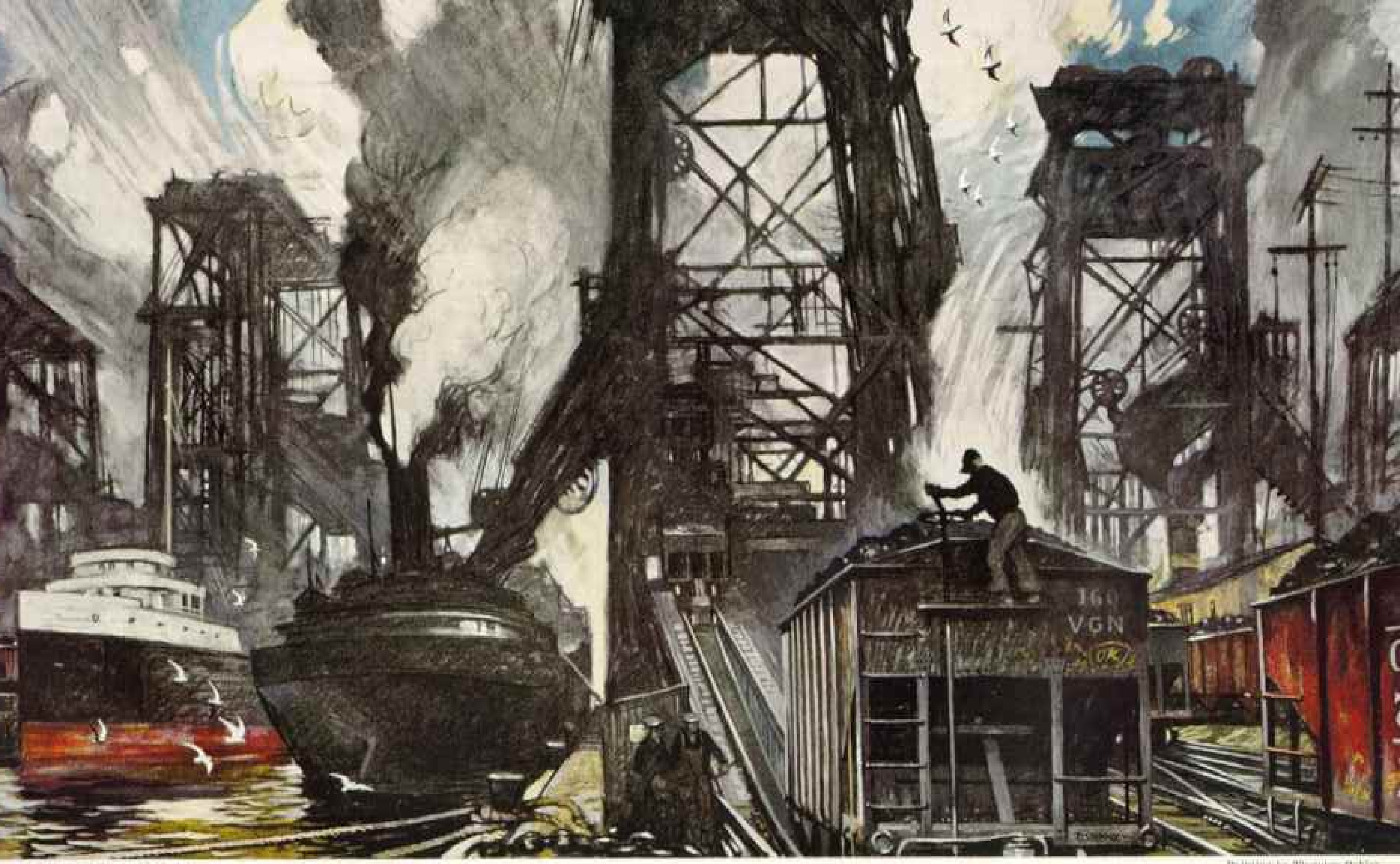


Painting by Thomas Oakley

III Like a Giant's Chemical Laboratory, a Refinery Turns Petroleum into Gasoline, Lifeblood of War

Painting by Thornton Oakley

IV Thundering Waters Pour over Stupendous Grand Coulee Dam to Turn War Factory Wheels



Painting by Thornton Oakley

Fuel for Vulcan's Forges: Soft Coal by the Carload Is Dumped in Ships on the Great Lakes

Painting by Thornton Oakley

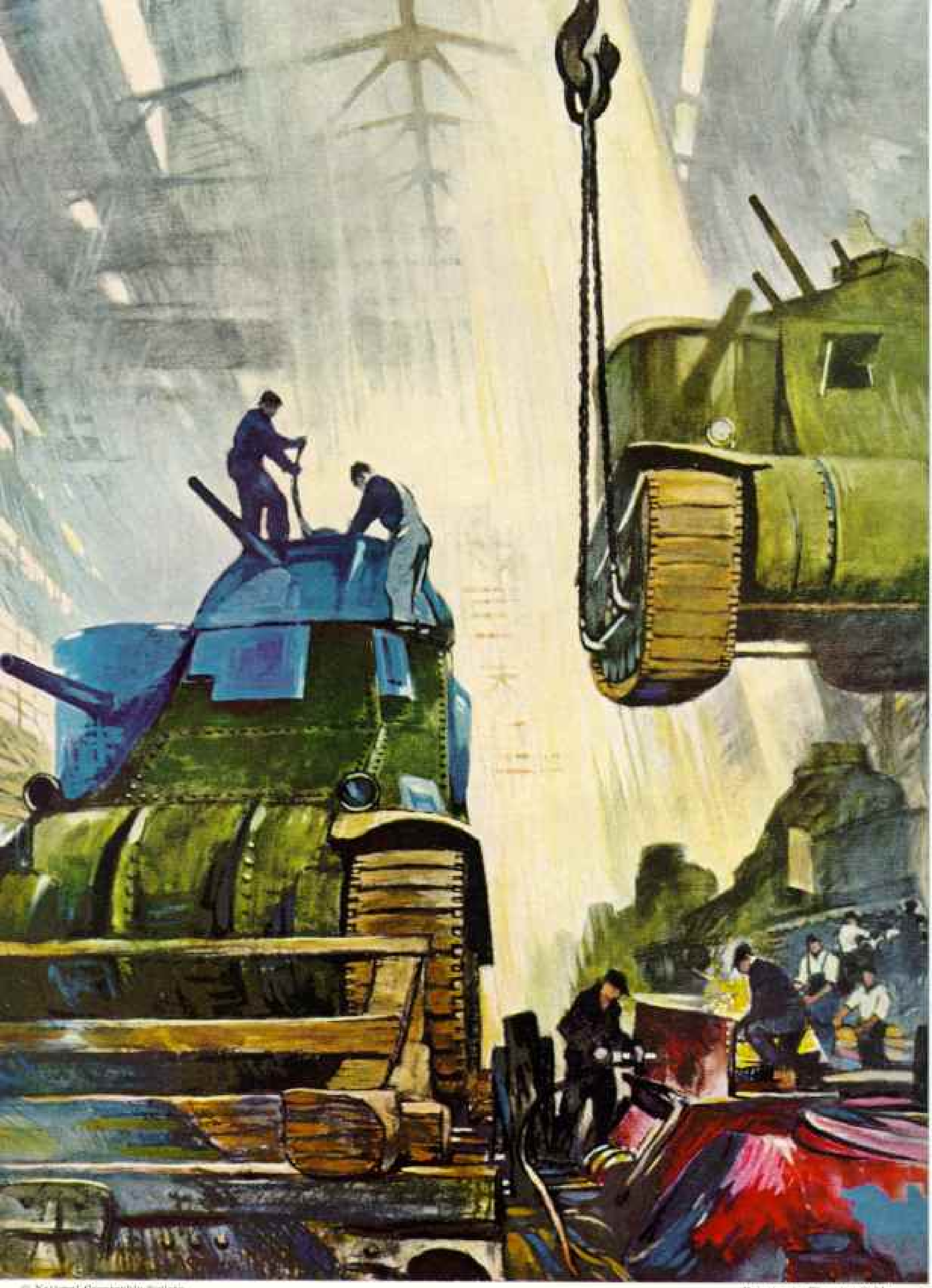
VI Roaring Smelters in Montana's Hills Transmute Copper Ore into Metal for Countless Weapons

Painting by Thornton Oakley

VII Out of the Steel Mill's Flaming Furnaces Come the Mighty Sinews of Machine-made War

Painting by Thomas Oakley

Cannon Are Born of White-hot Steel in the Mammoth Gun Press



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Painting by Thornton Oakley

Like Swarming Spawn of a Dragon, Tanks Roll Out Unceasingly

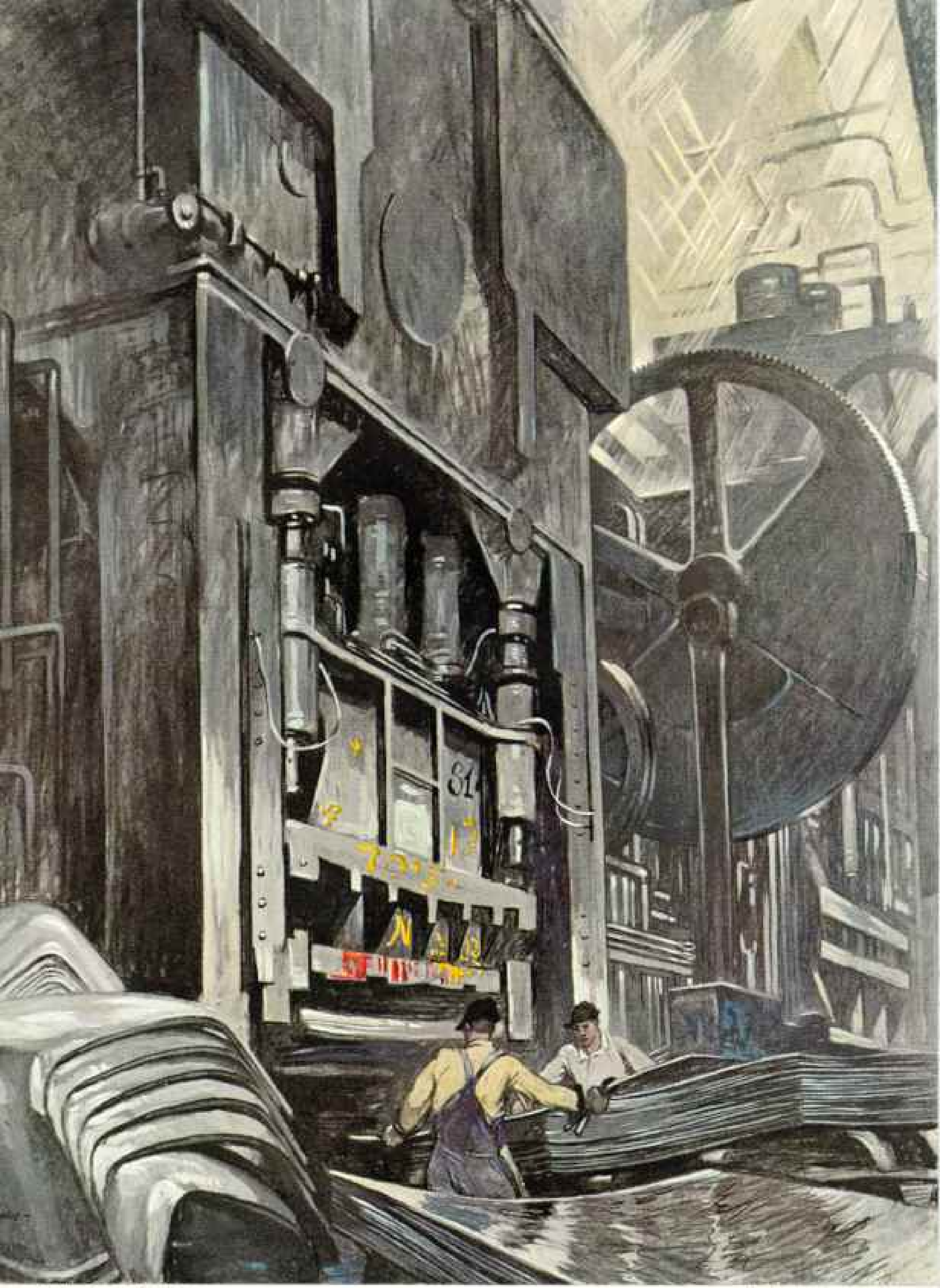
IX

Painting by Thomas Dahlov

Blimps and Barrage Balloons Are Made Ready to Hunt Submarines and Guard the Skies

Painting by Thornton Oakley

Stretching as Far as the Eye Can See, Swarms of Great Bombers Take Shape



Painting by Thornton Oakley

Jaws of a Huge Press Shape Steel Sheets into Truck Parts

Painting by Thornton Oakley

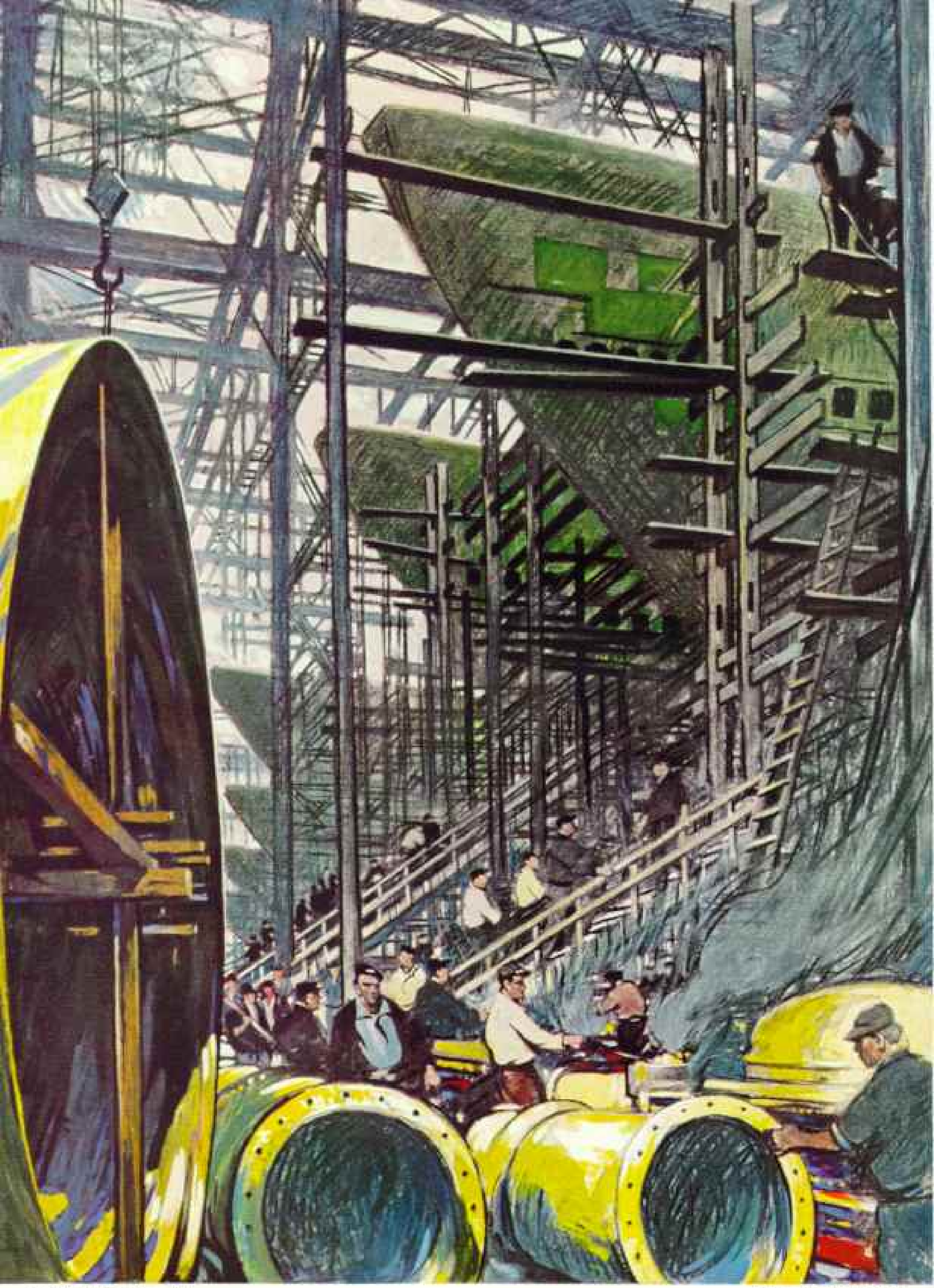
In Weird Vessels, Amid Strange Odors, War Chemicals Are Born

Painting by Thurston Dibble

XIV Merchantmen Grow Apace: Central Parts of Ships, with Bulkheads in Place, Await Stern Sections

Painting by Thomas Gilder

XV In Roomy Cabins of Monster Cargo Planes, Men, Cannon, and Supplies Will Fly to War



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Painting by Thornton Oakley

Grim Threat to Enemy Navies: U. S. Submarines in Mass Production

Steel—Plate VII

Along the Monongahela crowd the steel mills. Their stacks stand in serried rows and belch smoke, forming lowering curtains, backdrops for leaping tongues of fire. Mountains of iron ore wait to be cast into the red, colossal furnaces. Molten metal pours from maws, and trains of liquid iron make for Bessemer converters where flash sheets of flame. Thus is steel produced, thus made ready to equip the nation with sinews for its total struggle. Well do the mill men know, who battle in the searing heat, that without their labors their land would be enslaved.

The Gun Press—Plate VIII

No mere Vulcan's forge is this, where are wrought the cannon of the free. Contrasted with these indomitable toilers, whose will their monster press obeys, that god of high Olympus was but a child tapping brazen baubles. And puny were the blows of Thor compared with these that mold the incandescent steel. No fantasy has outstripped in scale the magnitude of this mass of metal, designed by untrammeled man to fashion his weapons of victory.

Tanks—Plate IX

Tanks, tanks, ever tanks move through the assembly shop. By cranes they are transported to waiting lines to receive their grueling tests. Where will fate direct them? To China? To Libia? To the plains of the Soviet? To the black heart of the nation of the swastika? Their guns point menacingly. Turrets, sealed with intense blue weatherproofing, show themselves ready for deck shipment overseas, camouflaged against the blue of oceans. From the roof streams sunlight, cutting paths through haze, enveloping the tanks with splendor. Is it the Spirit of Creation that sanctifies this modern weapon even as an effulgence hovered round the sword of Galahad?

Balloons—Plate X

Fantastic as creatures of a dream are these blimps and balloons that float within the Akron hangars. Can these inflated shapes with elephantine trunks, immense proboscises, be but rubber? The blimp patrols our coasts, discerns approaching submarines. Barrage balloons, buoyed by helium gas, by fins and tails maintaining assigned positions at ten, at fifteen thousand feet, support steel cables that, curtaining the objectives of the enemy, cut through attacking planes as cuts a knife through cheese. Sleek, rotund, shimmering, exhaling curious odors, these lighter-than-air ships tug upon the anchoring sandbags, await command to push by the wide-flung doors and into Ohio's sky to try their fins.

Bombers—Plate XI

In America's workshops where bombing planes are born, the hammering of riveters and the roar of the testing of motors never cease. To and fro the workmen stream, intent on myriad tasks. In the assembly buildings the all-but-completed ships spread their wings and tails in rows that vanish in a distant haze. Men clamber amidst webs of ladders, swarm about the olive-drab bodies of the planes, the glistening aluminum of the noses. Here and there a shaft of light strikes upon insignia, stars gleaming white against circles of lustrous blue. The ships seem to quiver as though impatient for their flights, eager for their fateful destinies.

Cold Presses—Plate XII

In that amazing district of Detroit was it a magician's wand which, in a flash, swept the mammoth automobile plants clear of civilian car production and in the place of their machinery set presses to serve the war? No. It was man's genius, his inflexible determination, more potent than any wizard's rod, that designed, produced, installed these thundering, crashing metal masses whose inexorable, stupendous jaws descend on plates of cold and glittering steel, then disgorge them transformed to cabs and bodies of the Army trucks essential for the forces of Uncle Sam.

Chemicals—Plate XIII

Dynamite, smokeless powder, bullet-proof lining for gasoline tanks, alcohol, ether, prestone, synthetic rubber—on and on the list may go of chemical products vital for war. Where are evolved their basic substances is a realm of wonder. Stacks throw iridescent vapors. Pipes, conductors, cooling towers, cylinders, spheres, huge and grotesque vessels cluster, jostle, rise in limitless array. These giant shapes reverberate, exude their pungent breaths as if conscious of their might, disdainful of the human figures who like pygmies move among the shadows. In these caldrons liquids churn and gases are liberated and compounded which will play their indispensable rôles in bringing victory to the United Nations.

Cargo Ships—Plate XIV

From north to south, on west coast and on east, into rivers, sounds, and bays, the cargo ships are plunging. Along the Delaware's historic shores shipyard after shipyard thunders. Here resounds one of the largest yards in the world. Its T and gantry cranes reach cloudward, lift segments of vessels incredible

O.W.I. Photo by Palmer

These Giant Earth-mover Tires Are in the Army Now

On heavy-duty equipment, they do their part in building airfields and other military installations. Some are nearly 7 feet in diameter, weigh 1,695 pounds including inner tube, and can carry a load of 32,000 pounds each. Such big 36-ply tires are more than 26 inches wide. The extra-deep, earth-gripping tread keeps them from bogging down in swamps and soft soil.

in size. Fabricated sections, wrought of steel, swing and drop. Frames of freighters rise swiftly upon ways, summoned by the genie, not of Aladdin's lamp, but of the torch of freedom. Sterns, rudders, propellers overhang the water, seem enviously to watch each finished hull as it dips into the river, soon to take its place among the fleets of the United Nations.

Cargo Planes—Plate XV

Here emerge some of the largest, most powerful two-motored aircraft yet designed. Straight to the fighting fronts they will fly, packed with jeeps, howitzers, propellers, and paratroops. Fabulous they seem as they take shape in the assembly plant, stretching monster wings, spreading prodigious tails, while to their shadowy interiors yawn the doorways eager to swallow motor cars and ordnance. Was it not Icarus who first dared the upper regions of the air, incurring anger of the sun who, melting the wax hinges of the rash youth's wings, sent him tumbling to destruction? What now says the sun to the airships of our country which in clouds intercept his rays, cast shadows on the Axis battle lines, warning of increasing clouds to come!

Submarines—Plate XVI

Jules Verne's *Nautilus* was not a dream but a prophecy. Did he not foresee the time when in the depths of oceans nation would vie with nation? To rid the seas of buccaneers, implacable and lawless as was never pirate on the Main, the shipbuilders of America launch their submarines. Behold their hulls upon the ways before they plunge into the sound. Far above the shipyard's floor they stand, thrusting their sharp prows through webs of craneways, impressive in potential might even as a line of battleships, grim evidence of man's ability to unleash the forces of destruction beneath the very waters of this lacerated earth.

The Cities That Gold and Diamonds Built

Transvaal Treasures Have Created Bustling Johannesburg and Fostered Pretoria, Administrative Capital of the South African Union

By W. Robert Moore

With Illustrations from Photographs by the Author

SOUTH Africa today serves as workshop for the forces facing Rommel. Literally millions of replacement parts for tanks, planes, machines, and guns used by the British, American, and South African troops have been made here and shipped or flown to the front (pages 737, 758, 766).

It is also doing much toward feeding these armies and the convoys that pause on their way to the Middle East or India (page 736).

Everywhere throughout all South Africa, machines are now geared to war. When the Union declared war against Germany, September 6, 1939, the country had only one plant making rifle ammunition. Not a piece of heavy armament was being made.

Fortunately for heavy industry, South Africa had embarked upon an extensive electrification project and had established her first steel plant at Pretoria. Another foundry has since been erected near Johannesburg.

For weapons when steel imports were impractical, the mills have produced, sometimes by trial-and-error methods, 120 new types of steel that hitherto had not been attempted.

Technically trained personnel of the mines and railways have been easily adapted to this war task. What they didn't have, they ingeniously improvised.

Armored cars which ousted the Italians from Somaliland and Ethiopia were improvised from imported parts of standard motorcars pieced together with parts of local design.

Mortars, gun sights, antiaircraft guns, filtration plants, collapsible airplane hangars, and myriad other necessities have been produced. Altogether, South Africa, starting from little save the will to work, has equipped her volunteer army of some 200,000 troops—that is nearly one-tenth of her total white population—from mess kits to mobile artillery and from blankets and boots to heavy bombs.

Dr. H. J. van der Bijl, as Director General of War Supplies, has coordinated the work to make these achievements possible (p. 758).

"We have gone a long way in our production of supplies and in manufacturing articles never before attempted in South Africa," he said. "But the new industries which we have created will far transcend our war requirements. In the future we will make for ourselves many things which hitherto we have imported."

"Jo'burg" Grows up to Skyscraper Age

Few cities of world importance can flip open their family albums, point to a photograph, and say, "That's a baby picture of me." Few also can boast that men still living attended their birth. Johannesburg can.

Younger than the invention of plate photography, it has a full pictorial record of its growth from the first tiny cluster of covered wagons and tents to now. So young, indeed, is this energetic metropolis of South Africa's Transvaal Province that elderly pioneers remember when only sparse grass waved here on the high barren veld.

The newcomer, too, riding up from Capetown over miles of almost barren land on the luxurious air-conditioned Blue Train, or flying up by plane, is likewise confused at the amazing panorama of Johannesburg today.

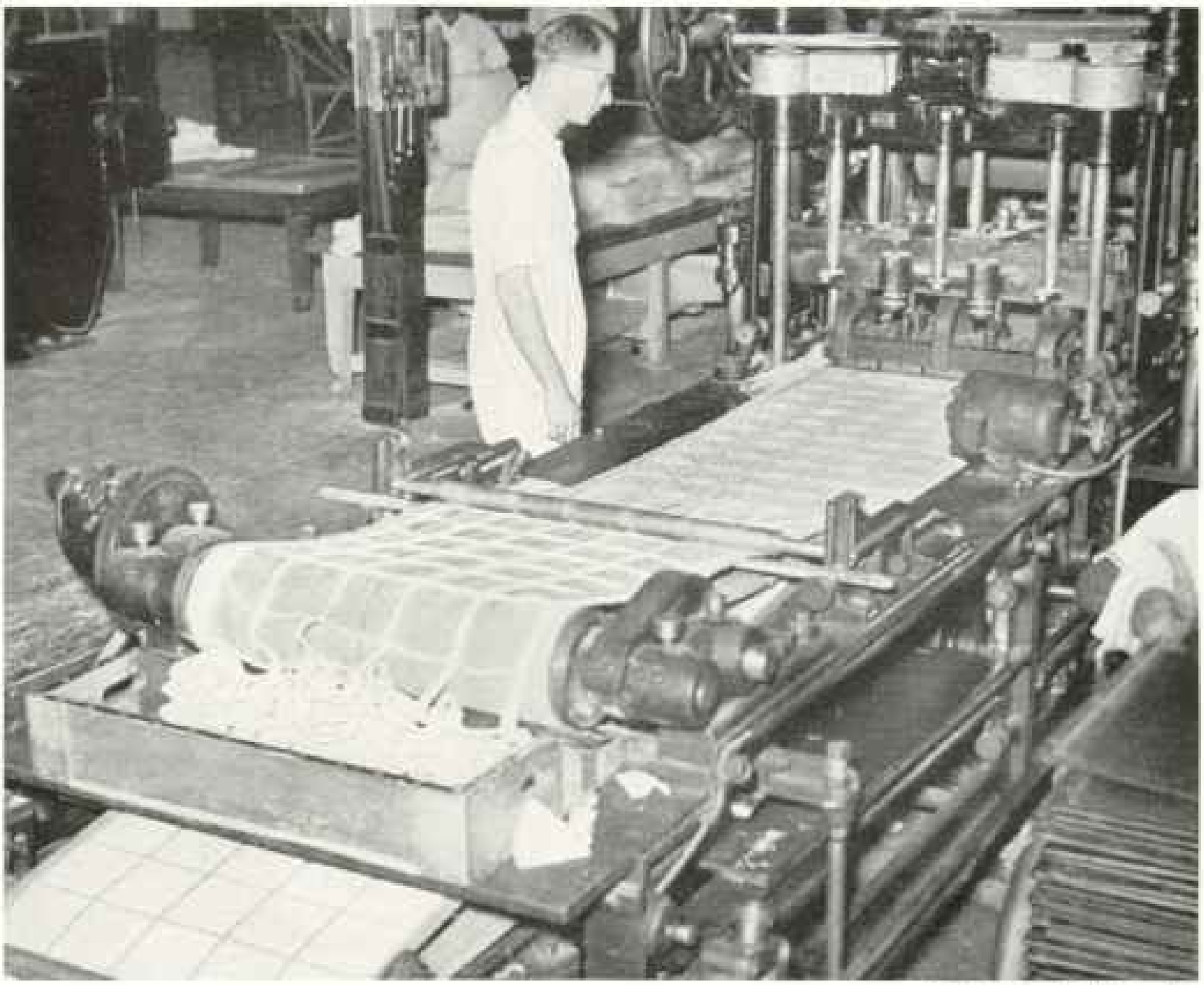
"So *this* is Darkest Africa—and a mining camp at that!" exclaimed a train companion as he gazed at shimmering 10- to 20-story structures that framed themselves in the car window.

I knew his feeling. "Jo'burg" as a mining camp has grown up! There is something of a Hollywood unreality about a city that has mushroomed from nothing to a population of more than half a million in 56 years.

And still it expands. As miners gouge deeper into the earth, architects explore new heights with their buildings.

The new Escom House, with 21 floors, is the city's tallest skyscraper at present, with several close rivals (page 738). Residential suburbs steadily creep out in an ever-widening circle; already they embrace an area of more than 85 square miles.

To its spectacular development Johannesburg has raised two monuments—its mine dumps and its trees. From the dumps has come the wealth of golden metal that has built the city, provided much of the suste-



Director General of War Supplies

Like a Five Star Final, Army Biscuits Roll from a Press

Stamped from a moving blanket of dough, they are baked and then sent north to the fighting forces. South Africa feeds her own army, and helps supply other United Nations' forces serving in the Middle East. The Union also furnishes quantities of dehydrated vegetables and fruits.

nance of all South Africa, and made the Witwatersrand (Ridge of the White Waters) mines a name in the world's gold markets.

For nearly a hundred miles along the "Rand" the colossal piles of gray rock and fine yellow sand rise on the northern rim of a vast saucer-shaped area of gold-bearing ore (pages 742-3).

Like chopped-off pyramids they tower, seemingly the fabulous creation of some forgotten civilization rather than the work of miners digging like moles deep in the earth.

"Closed on Account of the Weather"

Throughout the city these mountainous heaps form a backdrop to the scene. On windy days you feel their dust stinging your cheeks and putting an edge on your teeth. At such times shops shut their doors and hang up signs, "Come in, closed on account of the weather."

At the racecourse, horses coming down on the straightaway seem like cavalry charging one of these fortresslike hills!

Johannesburg's other monument, its trees, gives a feeling of the city's permanency. Beneath their shade and pleasant greenery people live—and intend to go on living even should gold working cease.

With elderly George Honeyball, one of the "three Georges" associated with the Rand when gold was discovered, I talked about the trees and of Johannesburg's rocketing growth (page 741).

"When I came up here 18 months before George Walker discovered the main reef in '86, there wasn't a tree on the veld. It was like that hill yonder," he explained, pointing to a grassy ridge, treeless and dry.

Now the city has thousands of trees. Australian gums, or eucalyptus, predominate everywhere. Many conifers have also been planted. Gardens are filled with flowering shrubs.

Director General of War Supplies

Calling Cards for the Axis—a Far Cry from Gold Mining!

These heavy aerial bombs are being finished in the engineering shops of a gold mine on the Rand. Though mining continues, many war materials, such as antiaircraft gun parts, bridge pontoons, and shells, are made in these shops in South Africa's all-out war production.

"I came here to find work and was staying with a relative," continued Mr. Honeyball.

"The farms weren't much good, and nobody had much money. Then Walker found the edge of the reef. Now"—and he nodded toward the business district—"look at it! When they auctioned off the first stands (building lots) I could have gotten one for a few pounds; today that land is worth thousands."

Just how many thousands I learned when I inquired into real-estate values. Eight lots in one block were bought three years after mining operations began for $4,000. A few years ago they were again sold for $1,250,000!

Lots at the northern end of Eloff Street, the north-south axis of the present commercial district, were sold practically for the amount of the yearly license tax on them, about $60; now they are valued at $200,000 to $300,000. Near by is Johannesburg's railway station, which alone cost more than three million dollars, at present rates, to build.

Many business men with whom I talked have seen the central area of the city almost completely rebuilt two or three times.

Home Sites at a Premium

In the residential sections, too, home sites are at a premium.

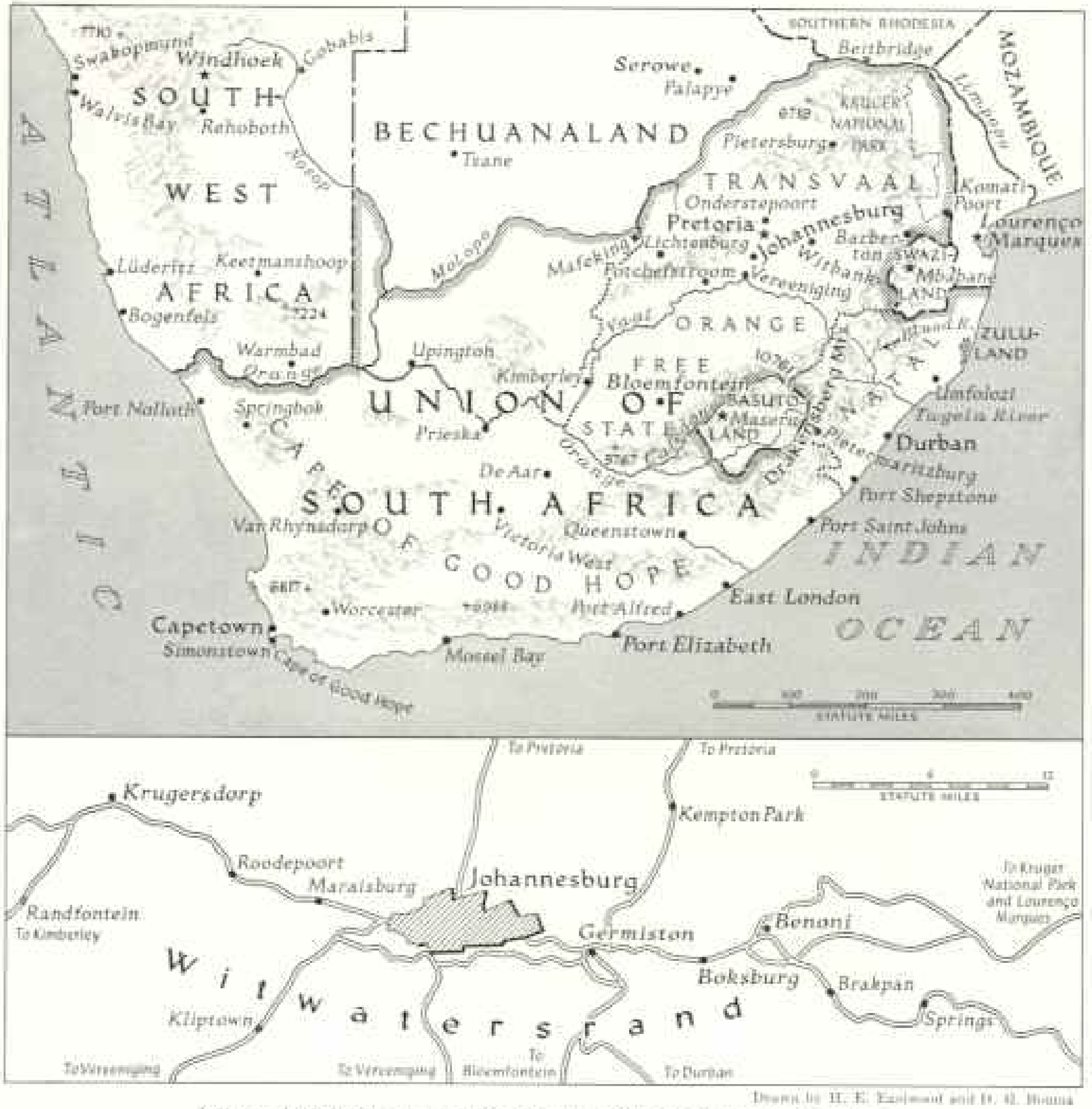
One day I called on a genial Afrikander farmer who lives beyond the fringe of the city. He had moved into the district two years before the first tent was pitched on the site of Johannesburg.

"Ja," he said, "I bought my farm for a sovereign a *morgen* [a little more than two acres]; now it is worth 300 or 400 times that. In the early days they told us that there was gold in the ground, and to buy here or buy there. But I didn't know; I stayed on my farm. People want to buy part of the place now for £80,000 to build a new township.

"But I can't be bothered. If my children want to sell, they can. One of them, my

Escom House, Johannesburg's Tallest Building, Reaches 21 Stories toward a Cloud

Its name is an abbreviation of the Electricity Supply Commission, whose offices it houses. Imposing as such modern buildings are, the Rand's greatest structural work is underground. Some 20,000 to 25,000 miles of tunnels have been hewn in the rocks (page 737). The countryside frequently shakes when diggings collapse.



Drawn by H. E. Eastwood and D. R. Hanna

Mineral-rich South Africa Plays a Strategic Role in War

Its ports feed United Nations' ships; its minerals pour into the hungry maws of the arsenals; and its machines forge weapons for the Union's armies and replacement parts for the Allied Forces in the Middle East. Mines which built Johannesburg are now busy making war machines while still digging gold.

youngest son, is up north fighting. He went through the Ethiopia campaign."

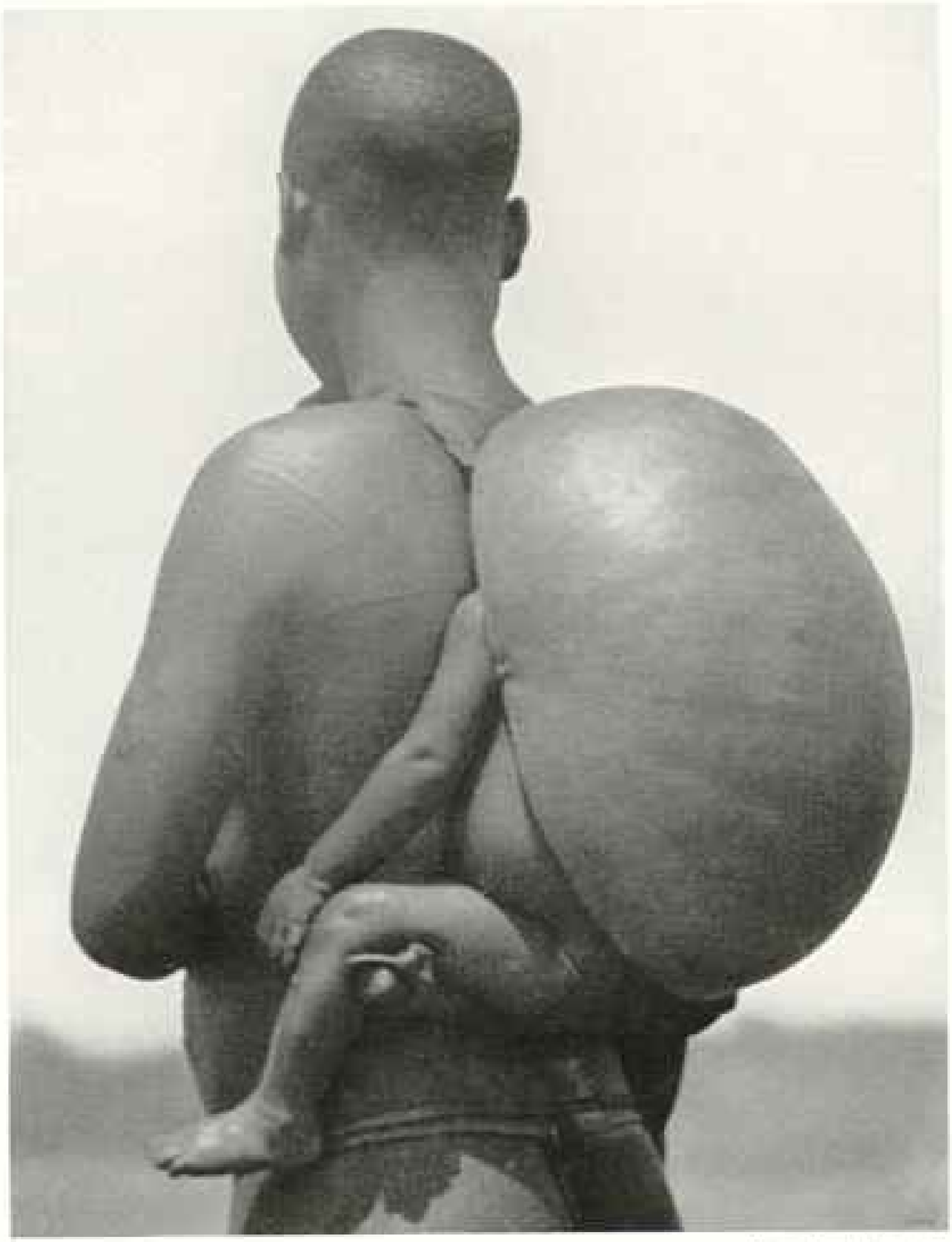
Proudly his wife showed me a small box of odd coins, worth perhaps five dollars, that the son had sent as a souvenir. Both were far more interested in talking about the coins and their lovely hand-carved stinkwood furniture than in the sale of part of the old homestead for upwards of $400,000!

Numerous apartment houses stand like bold exclamation marks throughout the city. Many of them are fanciful creations by architects with a flair for cubes and odd curves. Johannesburgers have laughingly dubbed some of them with colorful names. There's "Pyorrhea" and "Appendix," for instance, which face each other across a broad street. A dentist financed the building of one; a doctor erected the other.

With an almost unlimited countryside in which to expand, Johannesburg has fortunately provided plenty of breathing and play places in its midst. In all, there are more than a hundred parks and open spaces.

Baseball and Racing South of the Equator

At one park, besides football and other sports, you can often see baseball, for here the great American game has found a number of enthusiasts. At another, everyone "goes to the dogs." Its large stands are packed



U. S. from Black Star

Like a Tortoise, Baby Has a Shell!

But it is made from a pumpkin. He won't get too much sun-tan or get his clothes wet in a rain with this novel protective roof. The mother has come from near Victoria Falls in Southern Rhodesia to Johannesburg to be with her husband, who works at the mines.

whenever there is night racing of greyhounds.

One evening when I attended, the electrical gadget that opens the doors of the traps was accidentally tripped before the race was ready. The hounds bounded free and dashed off in their mad race, quite unmindful of the fact that the mechanical rabbit never started.

There was consternation and confusion in the stands. In those moments before the race was adjusted, I saw how seriously Johannesburg takes to its dogs. Horse racing has an equally eager following.

The city has its quota of golf clubs, country clubs, a bowling club where the Elizabethan sport of bowling on the green is played, and other centers of recreation.

Of all the play spots that the city provides, the zoo, to me, is perhaps the most delightful of all. That Johannesburg should have a good zoo, especially of African animals, goes without question. Lions were shot in the hills roundabout as late as the 1880's, and lazy hippos were blowing bubbles in the near-by marshes about the same time. Today, countless wild animals roam in the bush and streams not 300 miles from the city (Plates VI and VII).

The zoo officials here have constructed open pens, and restricted the lions and some of the other animals only by deep sloping trenches (page 744).

Close beside the zoo is an artificial lake, where young folk go canoeing on Sundays.

When you look at the lovely greenswards, flower beds, and small lakes here today, drought and the dry veld seem far away. You almost forget that the old Voortrekkers got an extremely slender living when they established farms in the region after their long, long march by rumbling ox wagon from the Cape.*

You nearly forget, too, that in its bluffer mining days queues of people often stood for hours at almost dry wells, or that men even washed in soda water or champagne!

The Geography of Rainfall

Actually, the Johannesburg area would have adequate rainfall if only Nature had chosen to distribute it throughout the year, instead of dumping all of it suddenly in summer. Much of the water drains away, because the

* See "Busy Corner—the Cape of Good Hope," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, August, 1942.

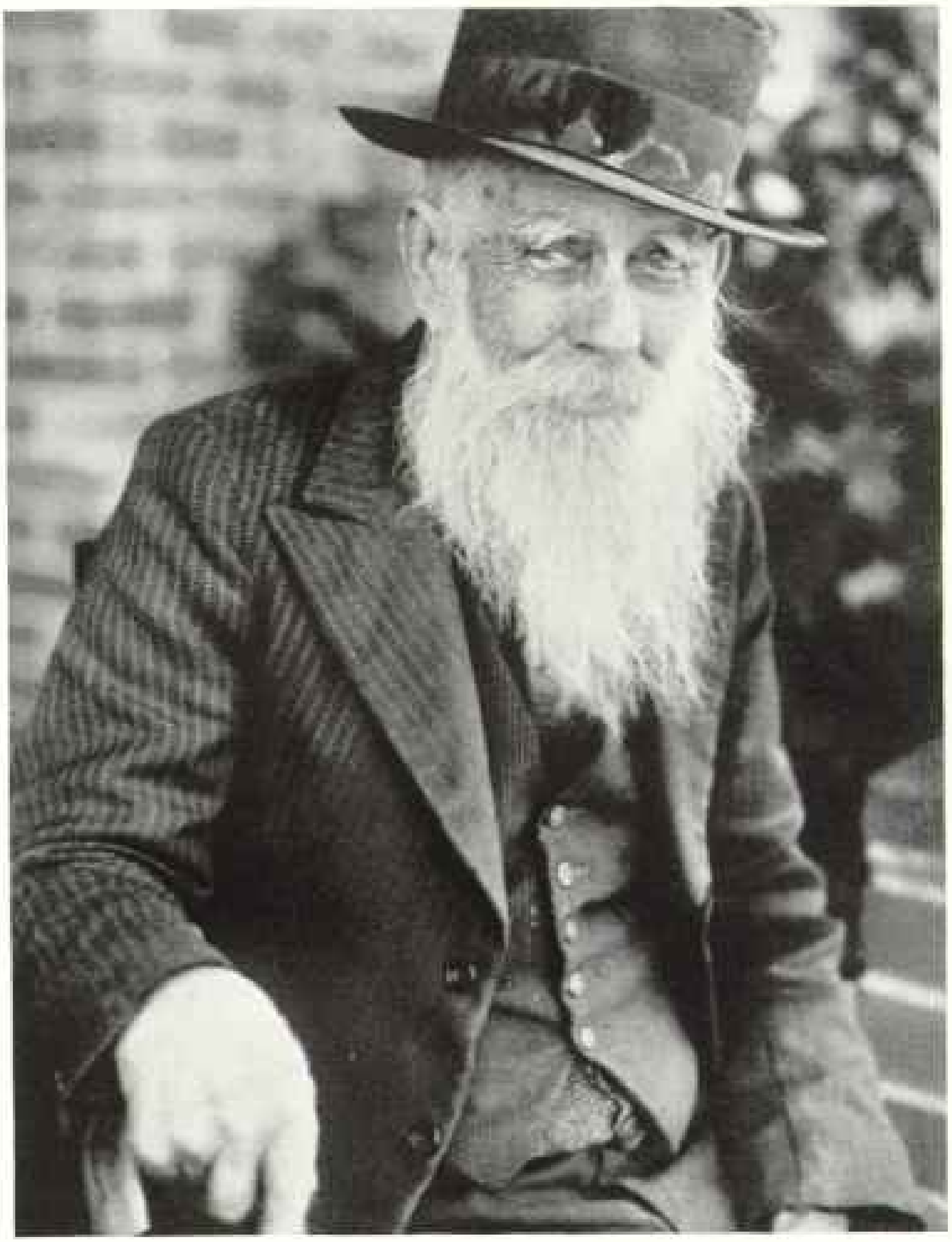
city is perched on the very top of the high veld.

The home of one of my acquaintances is so located that rain flowing down the gutters on one side of the house starts off to the Atlantic Ocean; on the other side the water runs to the Indian Ocean.

But people and plants no longer go thirsty here. Fountains bubble and taps are filled throughout the city. The Rand Water Board has dispelled the old bogy of water shortage. I sought out its director for the story.

"When I was a youngster," he recalled, "I stood in those queues with my paraffin tin and we fought for our place at the wells. Many of the watering places were only barrels with holes bored in them, sunk in the ground. During a drought they were often dry. Carters used to haul water from distant springs and peddle it on the streets, but it was pretty bad.

"Now we pump 65 million gallons into the city and onto the Rand every day from our Vereeniging plant, supplying it at cost. The mines, of course, supply part of their own needs, pumping out 35 to 40 million gallons a day from their underground diggings."



Veteran George Honeyball Saw the Birth of Johannesburg

Coming to the Transvaal 18 months before the gold-mining boom, Honeyball has watched the rise of Johannesburg to a city of more than half a million people. He lives in a suburb with his son, who works in the mines (page 736).

After the Boer War Johannesburg appointed the Rand Water Board to explore sources for its future needs. Costs were shared by the mines and municipalities concerned. The engineers went to the Vaal River and erected a barrage 20 miles below Vereeniging.

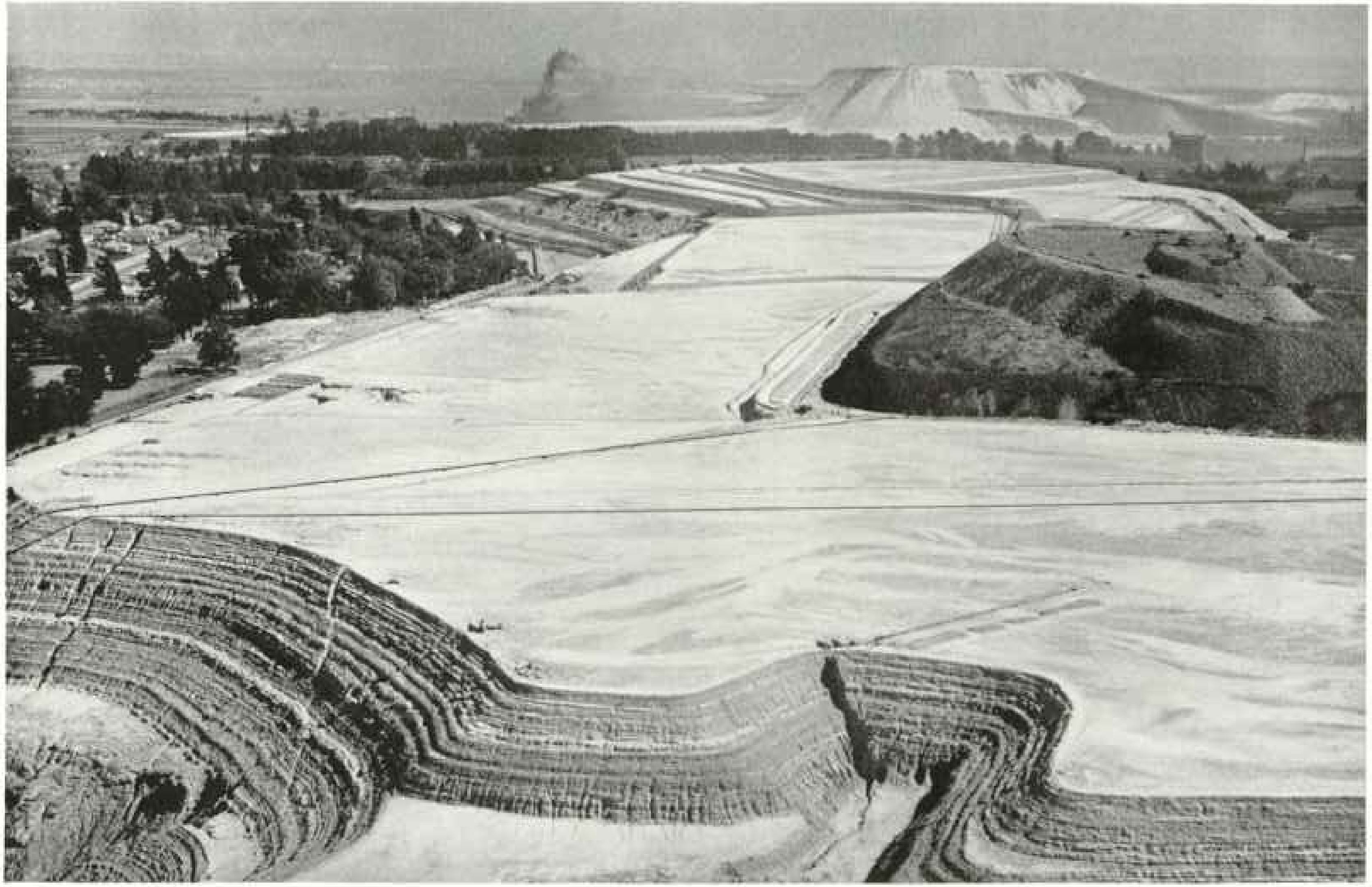
The water plant has been laid out on a big scale. Sedimentation tanks cover 12 acres. Six systems of pumps boost the water up over the hills to a maximum height of 2,000 feet and push it through more than 480 miles of mains.

"Actually, we lift more weight in water every day than the weight of the ore raised by the mines," said one of the engineers.

So rapid was the extension of water needs that the Government was induced to build another dam on the Vaal, impounding a sufficient volume to supply an additional 150 million gallons a day.

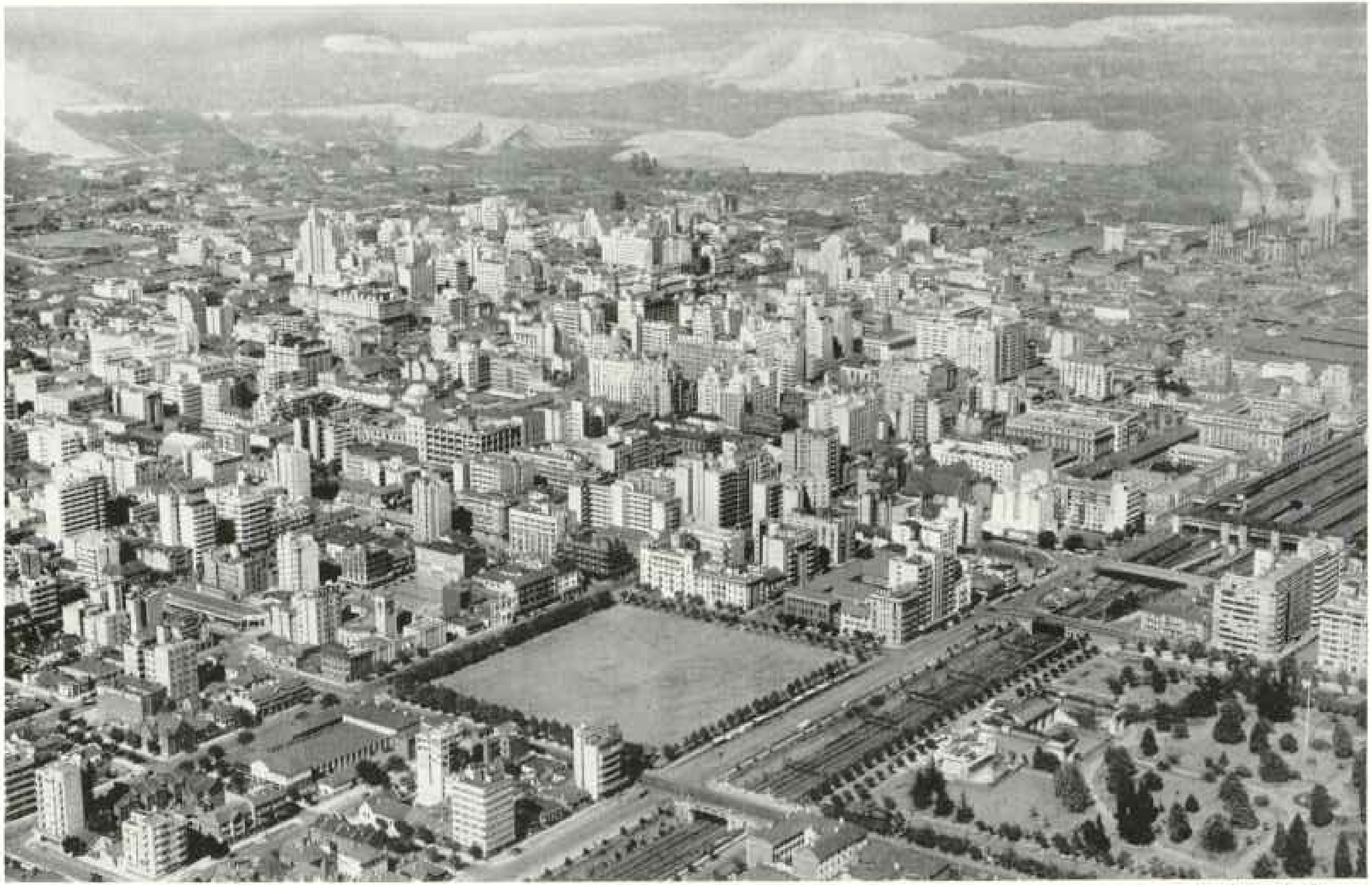
Coal, from Mine to Furnace

On the road down toward Vereeniging stands another of the Rand's achievements, the Klip electrical power plant. Other power projects through harnessed waterfalls, dammed rivers such as the Columbia, or streams turned around and dropped over a cliff as at Santos, Brazil, are perhaps more spectacular



Colossal Piles of Mine Tailings Cover the Witwatersrand Landscape for Nearly 100 Miles

The mammoth dump, suggesting an oriental rice terrace, was formed by successive floodings of sludge. Other heaps of sand and rock appear like chopped-off pyramids.



Aircraft Operating Company

Where Johannesburg's Towering Skyscrapers Now Rise, Stretched Barren Veld Only 56 Years Ago

Today this Midas-touched city is a maze of tall buildings and residential suburbs covering more than 85 square miles. Vast tailing dumps from the mines form a backdrop. The tallest structure is 24-story Escom House, upper left (page 738). Cutting across the lower right are railway lines, mostly electrified.

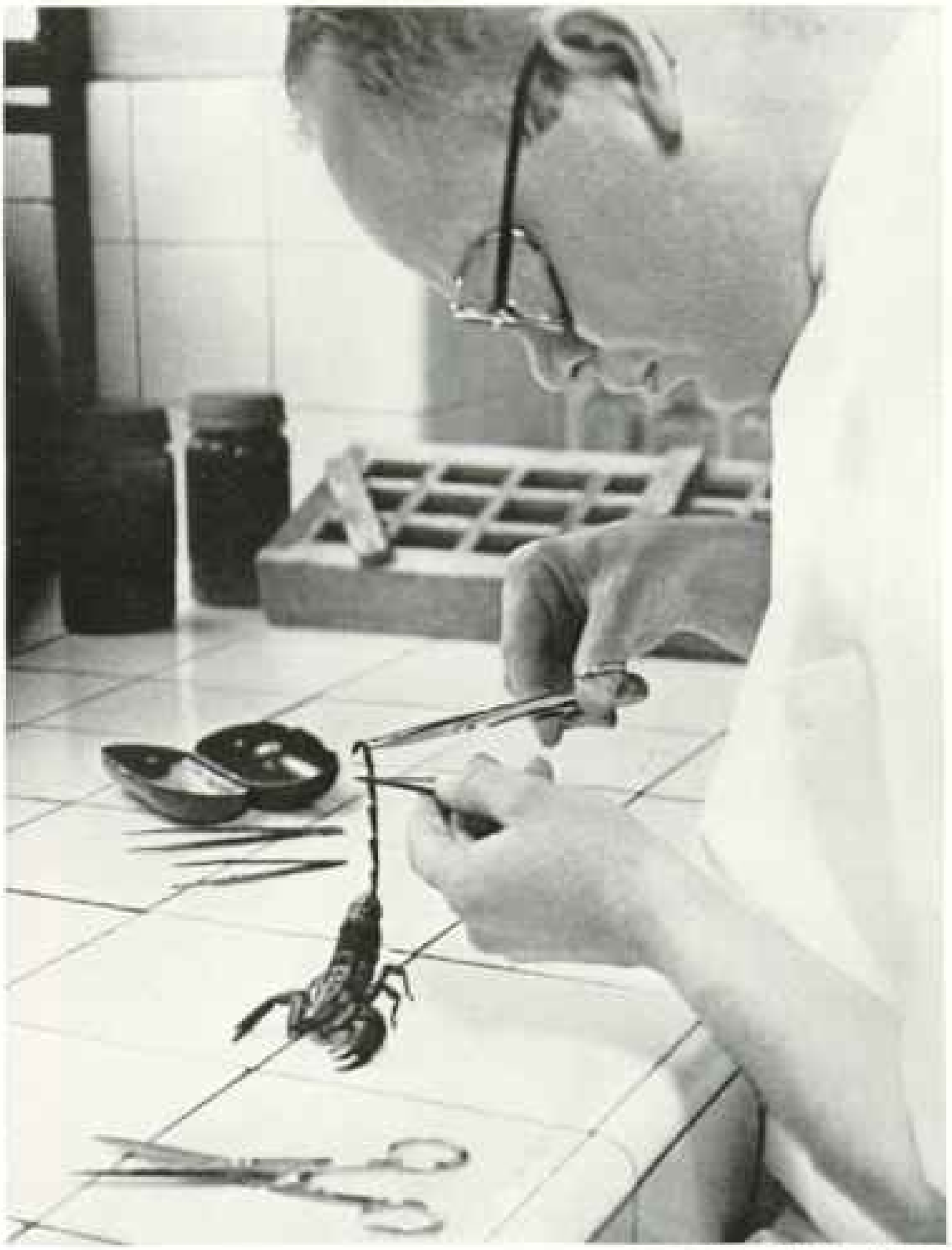
Though Africa Has Elephants, Johannesburg Youngsters Flock to Their Zoo to Ride Tame Beasts from India

They form long queues at the loading platforms to await their turn for a jaunt either on these rolling pachyderms or on bobbing camels. Lions in this zoo live in open pens, restricted by deep, wide trenches (page 740).

Merl La Voy

Klip Power Station Near Johannesburg Sits on a Rock in the Center of a Coal Deposit

This half-million-horsepower plant uses coal that comes directly from the mine to the furnaces. Inside the huge towers water from the condensers of the powerful steam turbines is cooled. The seam varies from six to 100 feet thick. At its present rate of use, well over 2,000,000 tons a year, it will last 20 years.



Institute of Medical Research

The Business End of a Scorpion Yields Poison for War Work

Antivenin is made here in the Institute of Medical Research at Johannesburg for treating soldiers "up north" stung by the vicious insects. The Institute also dries blood plasma, and conducts research on vitamin tablets for war use (p. 748).

than this, but they are hardly more novel.

Klip uses coal, coal that comes straight from the mines to its furnaces without anyone touching it in the process.

The big furnaces and generators stand on a dolomite rock, surrounded by beds of coal. The vein, varying in thickness from six feet to 100 feet, ranges from outcrop to about 400 feet deep (page 745).

I walked through two miles of underground tunnels and watched American cutting machines crunching at thick seams of coal, saw the lumps loaded into cars and then shuttled toward the head of the mine. There the fuel is dumped on inclined belts and carried directly to the washing machines and the furnaces.

At the present rate of consumption of well over two million tons a year, the coal pocket in this area is sufficient to last 20 years. Other deposits in the Transvaal are already being prepared for future use, as the Rand mines, municipalities, and Johannesburg are heavy consumers of electricity.

Much of the heating of homes and cooking is accomplished by the flick of a switch. Railways along the Rand and to Pretoria have been electrified.

Oh, yes, electricity also operates the *robots!* Just how confused would you be if a person were to direct you in this wise: "Take a tram; it costs only a tickey. Get off at the fourth robot, turn right, and the third door beyond the bioscope is the entrance to my flat!"

Quite simple, my dear Watson, *if* you're a Johannesburger. You'd get on one of those large double-decked streetcars, pay the conductor threepence, go to the fourth stop light, turn down past the motion-picture theater, and before you knew it you'd get to the right apartment. Or would you? I didn't.

Even the numerous robots (a name given by a cub reporter to Johannesburg's first stop light) at times seem inadequate. Before war rationed gas there were 62,000 automobiles on the streets. There are also countless bicycles to keep an eye on: natives riding them may be carrying anything from a bundle to a dining-room table on their heads.

Natives Recall Swift Growth

Native sidelights often reveal how young the development of Africa really is (page 740). In front of a huge department store with moving escalators, I saw a night guard

one cold evening sitting hunched up in a bright blanket as if he were in his native kraal. Another, running a newspaper stand, wore large bright plugs through his ear lobes.

Going to one of Johannesburg's new movie houses to see one of the latest Hollywood pictures, I once passed a group of bead-decorated women whose ankles clanked with metal rings and whose hair formed a pile more than a foot high on the back of their heads. The bush and wattle fences seemed not far away.

Of the city's total population of 592,000, only 290,000 are white. Even so, that represents more than one-tenth of the white settlers in South Africa.

In Johannesburg's infant days the first general store became the local "pub" (hotel), post office, and stock exchange. Mail that came by coach or rider was dumped in a packing box.

Instead of Shouting, Newsboys Display the Daily Headlines

American news is often featured in Johannesburg papers. The Star is the city's afternoon publication. The morning Rand Daily Mail was once edited by Edgar Wallace before he gained fame as a mystery-story writer.

Today, the Central Post Office is a five-story building that covers an entire block. Letters and packages are shot around to the sorting rooms on belts or conveyors that automatically drop the bags at their proper places.

Stamp-canceling machines buzz through letters at the rate of 800 a minute. There's even a periscope to enable men to look down into the post boxes fronting the street and see when they need clearing. Incoming and outgoing mails are shuttled across to the railway station a half mile away on moving belts through an understreet tunnel. Altogether, an average of three million pieces of mail are handled here every week.

And the Stock Exchange? That, too, has long since grown into its own quarters, and all the exchanges throughout the Union are controlled from this center. In boom days seats on the Exchange have cost more than those in London.

The Exchange's coat of arms appropriately bears three gold ore-crushing stamps, as does that of the city. There is also a gold bar, representing the reef. See the Exchange on a day during "High Change" and you wonder why an old law still exists: "Members are not allowed to play cards and dominoes on the floor of the Exchange"!

Mining and Medical Schools

The University of the Witwatersrand owes its growth to the impetus given it by the mines. As the South African School of Mines, it was transferred here in 1904 from

Kimberley. Today it offers courses in arts, medicine, dentistry, commerce, science, engineering, law, and architecture to nearly 3,000 students.

Because of the mines, too, Johannesburg has the largest medical research center in Africa. The Institute of Medical Research is supported by mining interests and Government grant. Here early research work was done on the ascorbic acid and salt tablets which are so widely used now by persons engaged in work where heat causes excessive perspiration.

"Our activities are many," explained its director. "We conduct investigations in direct mining problems, especially miner's phthisis—silicosis with added tubercular infection—and its prevention. Also any other diseases, and the proper nutrition of the natives.

"On the Government side, we study diseases of the country and give advice for their control. We also maintain a general laboratory service and prepare vaccines, toxoids, serums, and antivenins."

Now, with the country at war, the Institute's work has doubled. I saw men working on a new serum against scorpions, as many of the soldiers in the north were being stung (page 746). Blood plasma is being dried, and doctors trained to administer it, as the liquid plasma deteriorates in the heat of the Middle East.

Compressed Sunshine from Oranges

Synthetic and concentrated vitamin preparations have also been made. I tasted a toffee-sized sweet made from six oranges which contained a three-day supply of vitamins. Soldiers who miss their spinach in the desert still are well cared for!

Johannesburg is headquarters of the main offices of the South African Railways, which normally operates more than 13,000 miles of railroad and 16,300 miles of bus routes, carrying both passengers and goods.

Now, though thousands of the organization's men have volunteered for war service, the railway workshops everywhere are making bombs, mortars, gun carriages, electrical units, and fuses, and an engineer has even invented a highly specialized gun director.

The mine workshops along the Rand likewise make bombs, gun parts, and bridge pontoons. Factories making explosives for use in mine blasting now produce munitions.

Johannesburg's climb to prominence as the largest industrial city in the Union—and all Africa south of Cairo—has not been without its ups and downs.

Back in the 1890's tension grew between the old burghers and Uitlanders (aliens). Staunch, Bible-loving, Voortrekker-born Paul Kruger and his fellow men found little use for those outsiders who came to make money and destroy the independence that the Voortrekkers had won when they marched courageously into the blue spaces of the Transvaal.

But the "outlanders" felt that they, too, had just cause on their side. After all, it was they who were contributing much to the country's treasury.

Open hostilities flared when Dr. Leander Starr Jameson, friend of Cecil Rhodes, carried his abortive raid in 1895 across the western border of the Transvaal and headed toward Johannesburg to assist in a rebellion that never fully materialized.

Then, after four strained years, the war drums sounded in earnest; the Boer War of 1899-1902 was begun.

More Gold Than Ever Before

Strikes, labor shortage, World War I, and slumps in gold prices have marked jagged dips on Johannesburg's production charts. Once the introduction of cyanide treatment of ores gave new impetus for deep mining. And again, in 1932, when the gold standard was abolished, the Rand saw bigger and better boom days return.

Despite war, the mines along the reef are producing more gold than ever before in their history. Supplying one-third of the world's output, they are aiding South Africa to pay her war bills.

But what of the Witwatersrand—this fantastic El Dorado that has produced eight *billion* dollars' worth of gold?

First, the imagination races back through geological ages when the sea water lapped here and a vast river washed down pebbles and particles of gold to drop in its sediments. Then came cataclysmic upheavals, more deposits of earth layers, and still further contortions until a plateau of nearly 6,000 feet was formed here.

This gold-bearing reef had been tilted up like a saucer, with one edge lying exposed along the Witwatersrand, and awaited only the toe of George Walker, who strolled there on a Sunday morning in 1886, to make its presence known.

Gold miners hewing at the reef edge, which varies from an inch to 12 feet in thickness and tilts at an angle of 35 degrees, soon had to probe deeper and deeper into the earth. Today they have followed the vein down more than 8,500 feet, or more than half a mile below sea level!

 Kodachrome by W. Robert Moore

High on a Hill above Pretoria Stand South Africa's Union Buildings

Symbol of the country's unification in 1910, this imposing unit houses the administrative offices. The figures guiding the horse on the National War Memorial represent the British and Afrikanders of South Africa. The Belgian flag on the left of the Union's banner flies for the visiting Governor General of the Belgian Congo.

Kodachrome by W. Robert Moore

In October Springtime Broad Banners of Flowers Cover the Terraces in Front of Pretoria's Union Buildings

The business section of the city lies in the valley in the distance. Now administrative capital of the Union of South Africa, Pretoria once was the center of the Transvaal Republic under President "Oom Paul" Kruger. Parliament meets in Capetown; the Judiciary is located at Bloemfontein, in the Orange Free State.

Kodachrome by W. Robert Moore

To the Beat of Tom-toms Johannesburg Mine "Boys" Chant and Stomp in an Old Tribal Dance

It's Sunday recreation after working deep down in the gold mines. Most of the big weekly dances, in which several tribal groups participate, have been stopped for the duration. About 327,000 natives, from all South Africa and Portuguese East Africa, work along the golden Witwatersrand.

Kodachrome by W. Robert Moore

A Smiling "Queen" and Her Attendants Aid in South Africa's War Work

At the Rand mining town of Boksburg eleven such queens, representing different organizations, entered a popularity contest. The "Queen of Queens" was selected by ballots bought at a *tickey* (five cents) a vote. Setting out to raise $3,000 for a mobile canteen, the town collected $20,000.

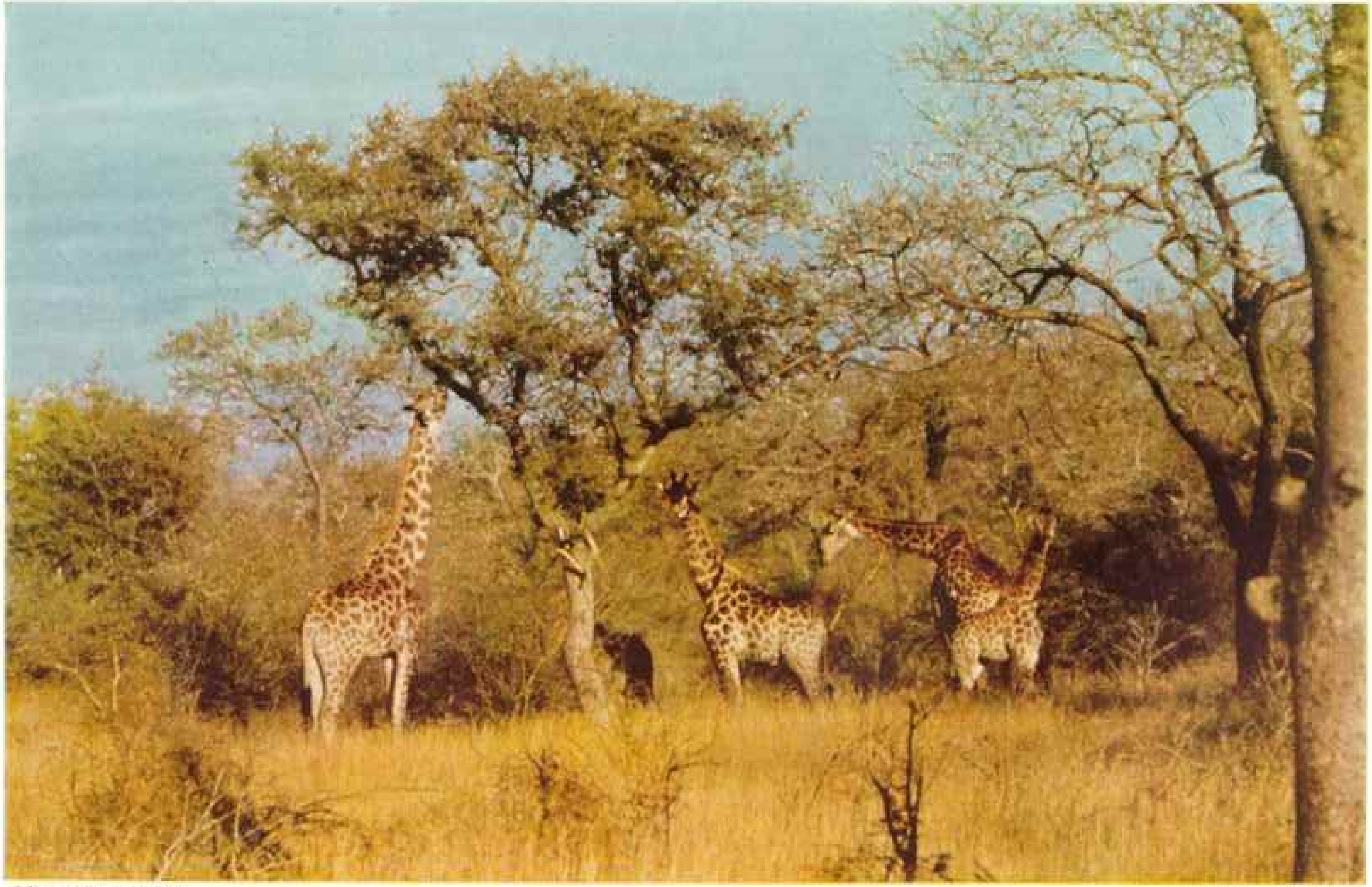
Each a Bright Decoration for the Other

The young lady sits in a Kaffir boom tree (*Erythrina caffra*), which flames scarlet against the blue skies and green foliage of subtropical Durban. Jacarandas, flamboyants, and bougainvillea add vivid splashes of color to the city.

Kodachrome by W. Robert Moore

It Pays to Be Conspicuous, Think Durban Rickshа Pullers

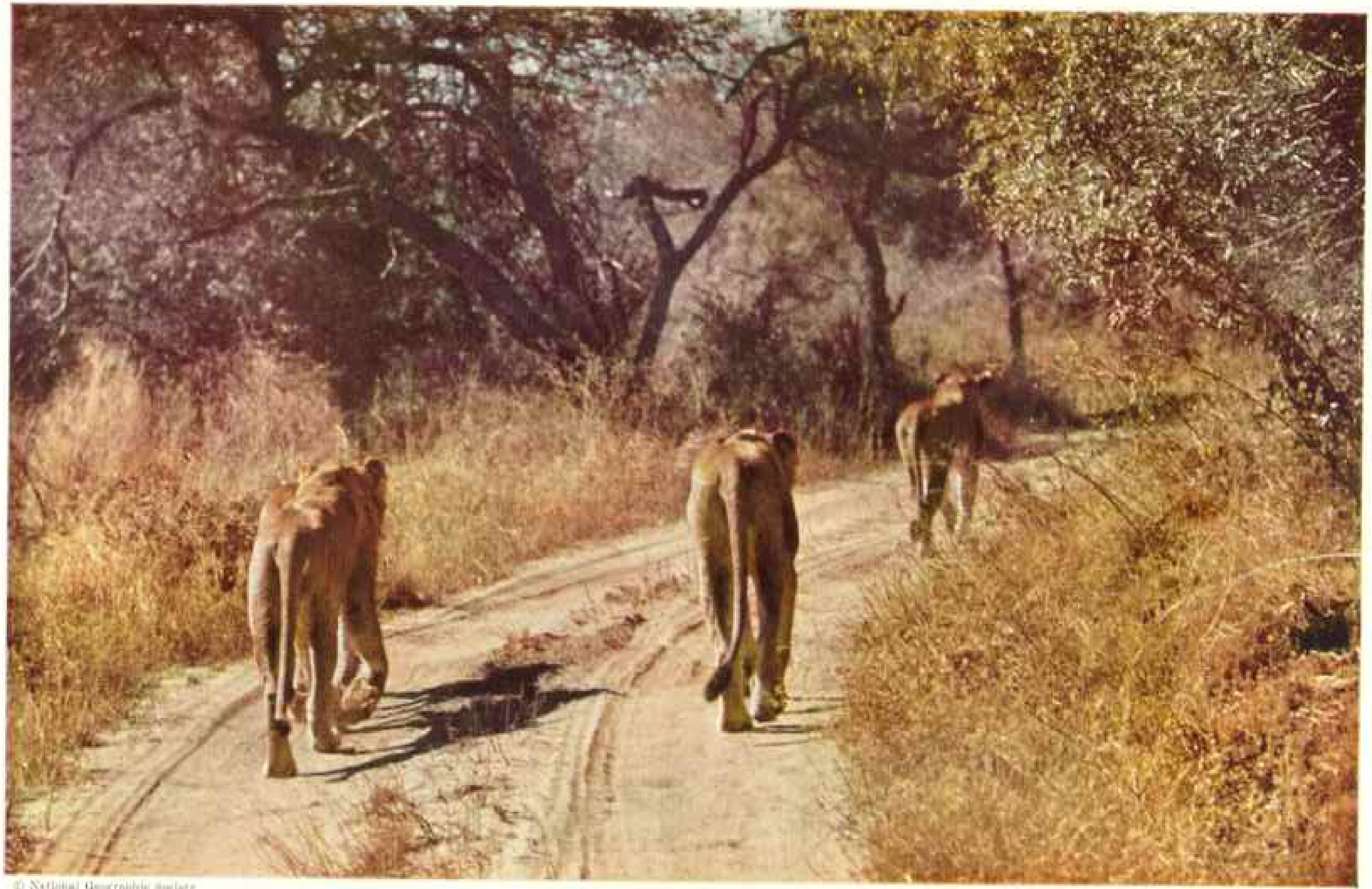
Perhaps now with war rations on gasoline they may be so busy hauling passengers that they can discard oversize headdresses of horns, feathers, paper rosettes, and even Empire flags (New Zealand, right; Canadian, left).



Kodachrome by W. Robert Moore

Giraffes Use Their Two-story Necks to Stretch for Appetizing Leaves

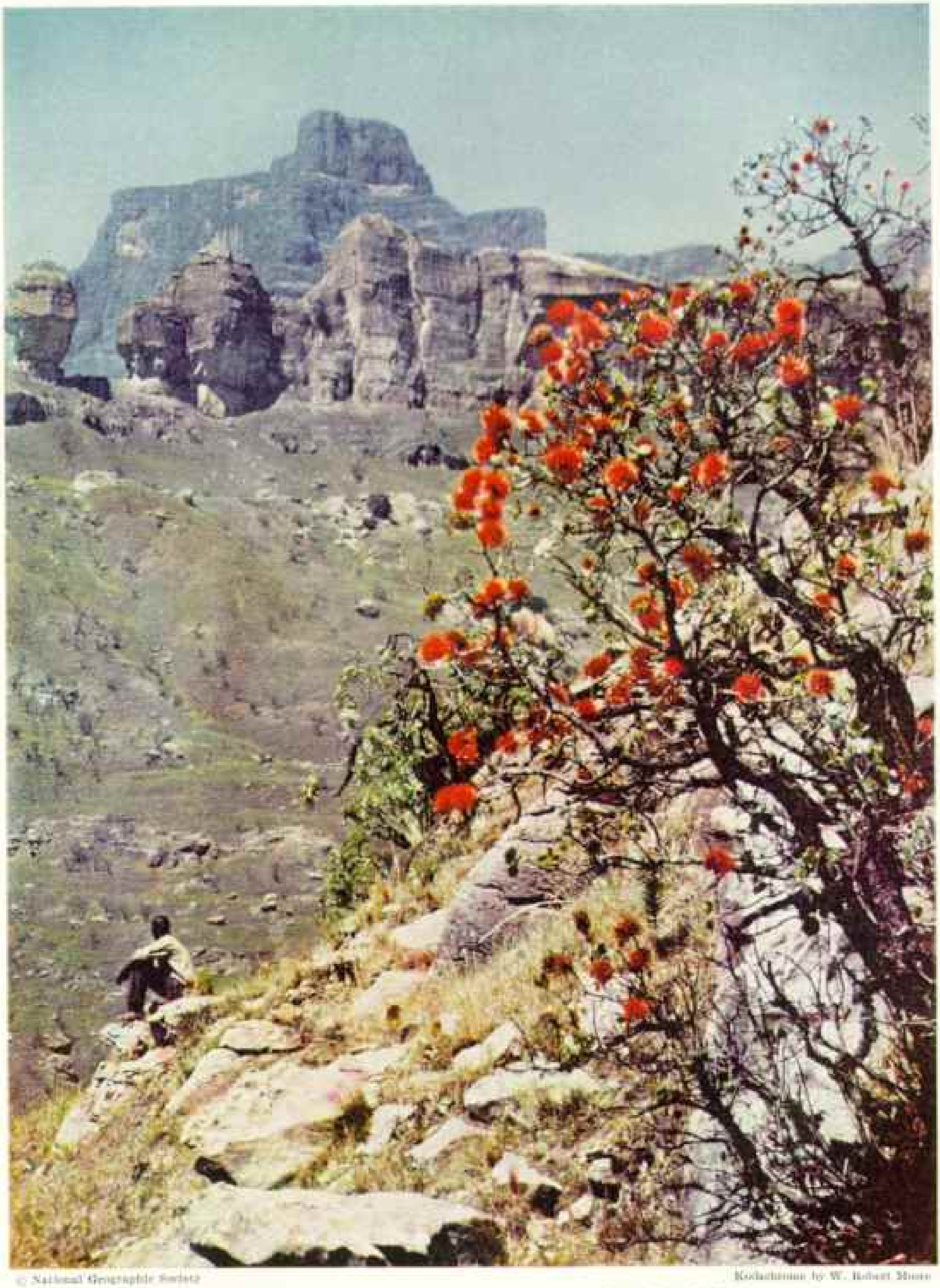
Tallest of mammals, these well-camouflaged beasts often reach the height of 18 feet. To get their heads down to the ground to drink they spread their long front legs. They are swift of foot, but appear ungainly as they move with pacing gait. Hundreds roam in Kruger National Park; lions are their only enemies.



Kodachrome by W. Robert Moore

Four Young Lions Trot down a Trail in Kruger Reserve, Hopefully Looking for Lunch

One almost conceals its companion at left. Two others have skulked away and are stalking a herd of impalas. They later failed in the attempt, as they were yet unskilled in making a kill. This pride (or group) of lions is less than two years old and has just begun to hunt.



 Kodachrome by W. Robert Moore

The Drakensberg Mountains Are Fragments of an Eroded Plateau

The Policeman's Helmet, at the left on the hill, is a colossal boulder freakishly carved by erosion. South Africans say it reminds them of a London "bobby." This range separates Natal from Basutoland and the Orange Free State. Bottle brush trees have just put forth their tuftlike blooms in the early October sunshine.

Let's go down. No, don't be frightened. This shaft is only 6,200 feet straight down, but the skip, or lift, has a safety factor of six times for an 8-ton load of ore. If we were ore carts we'd be down in a couple of minutes; for our lungs' sake, however, we'll go a bit more slowly.

Once at the bottom of the shaft, we enter tunnels and passageways, cross along an incline, and drop down farther.

Eventually we are standing at the deepest spot of the earth that men have explored. Here dusty, sweating miners, white and black, are drilling and breaking up the dirty gray ore and shuttling it off on its way to the surface mills.

Disappointing? There isn't a flake of gold in sight. We don't envy the miners a bit.

And it's hot, despite the fact that big air-conditioning machines both above and below ground are pouring what amounts to thousands of tons of ice into the workings every day. Rock temperature here at 8,500 feet is 105° Fahrenheit.

Above again, and into sunlight that seems more beautiful than we ever before realized, we ask questions.

"How many miles of tunnels and passages are there on the Rand?"

The mine director holds up his hands in despair. "Let me see. We have 500 miles on our own mine, and—well, say somewhere between 20,000 and 25,000 miles as a very rough guess."

Nearly enough to reach around the earth!

"How much deeper will you keep digging?"

Again he doubtfully shakes his head. "It all depends on the heat, adequate ventilation, perfection of mining equipment, and gold prices. Some talk of 10,000 feet."

Above ground are the stamp batteries and the ball grinders for pulverizing the ore, huge cyanide tanks, reduction furnaces, and other equipment necessary for redeeming only about $7 worth of gold from each ton of ore hauled to the surface. Another 50 cents' worth of metal escapes and goes to the dumps.

A Chinese Wall of Gold Dirt

Since their beginning, the mines on the Rand have milled approximately 1,200,000,000 tons of ore. Build an imaginative wall with this astronomical amount of rock and you'd have an embankment 68 feet high, 68 feet wide, 1,000 miles long—from Johannesburg to Capetown!

Beside that mighty rampart, the gold taken from it would make a solid cube measuring less than 28 feet on a side.

If your fancy carries you far enough to stretch that cube out, you might fashion two heavy wires the length of your barrier, over which to telephone some unbiased Capetown mathematician to see if your figures were really correct!

From such grandiose facts and fancy, let us turn to the fun on the mines.

One Sunday morning out at Rose Deep Mine I saw a dozen native tribal groups enact their old war dances, beat drums made out of kegs and oil casks, and play pipes cut from curtain rods or brass tubing.

The throbbing, haunting rhythm these mine "boys" can get out of a xylophonic creation made from an assortment of differently sized boards, tin cans, and oil drums is beyond words.

Even if one did not see the dancers with their assegais (spears) and hide shields, watch them surge back and forth with ox-tail leg ornaments flying, and hear their chants rising in dramatic crescendo, the pulsating beat of the music still would paint a graphic picture of days but recently gone in kraal and bush when Bachopis, Zulus, Basutos, Swazis, Shangaans, and all the rest lived by their wits and their weapons (Plate III).

Over this sweeping pageant of savage magnificence "police boys" in trim khaki uniforms watch with calm to see that under the intoxication of the moment no one goes beyond the bounds of play acting.

About 327,000 natives, drawn from wide districts in South Africa and from Mozambique, work along the Witwatersrand. Besides this large native contingent, there are nearly 40,000 white employees.

Drive along this chain of mines east or west of Johannesburg and soon you are impressed by one significant fact. Mining camps here have grown into sturdy, well-planned towns. Germiston, Benoni, Springs, and Krugersdorp have larger populations than many of the long established centers of the Union.

Ever Hear of Germiston?

Germiston, on the East Rand only nine miles from Johannesburg, is the sixth largest municipal center in the Union. Gold, too, is its magic—and what fabulous quantities! Here, in recent years, refineries were established for purifying the unrefined bullion that comes from all the mines along the Rand.

When you watch the gold being poured, and see the yellow metal being trucked about in whole cartloads, you feel that the stories of King Solomon's treasures from Ophir and of Pizarro's roomful of ransom exacted from the Incas in Peru are really petty tales after all. Men in the refineries talk in terms of

Director General of War Supplies

General Smuts Examines Dies at the Union Mint, Pretoria

Keenly he oversees every phase of the Union's war work, and even flies north frequently to visit his "boys" facing Rommel in Egypt. With him (right) is American-trained Dr. H. J. van der Bijl, Director General of War Supplies. Though made a Field Marshal in 1941, Prime Minister Smuts likes to be called "General."

fine ounces, yet they are dealing in tons!

At Boksburg, a few miles beyond Germiston, I saw the full flavor of the civic spirit in these towns on the Rand. As a climax to a competition for raising funds to provide a mobile canteen for the soldiers "up north," Boksburg was crowning its "Queen of Queens" (Plate IV).

Several "queens," selected by different organizations, had wholeheartedly staked their popularity upon the votes of their constituents, at a tickey (five cents) a vote!

Instead of raising about $3,000 as the community had expected to do, enthusiasm in voting had carried the amount collected to $20,000!

Though mining is easily the Rand's outstanding industry, it is not by any means the only one. Boots, shoes, clothing, and many other products are made locally.

Even should gold working cease, the Transvaal and the rest of the Union can unlock more of its treasures for new enterprise, for here is coal, iron, platinum, copper, chrome, manganese, asbestos. Then, too, men apparently can always scratch up a few *tons* of diamonds!

In the Land of Diamond Rushes

Diamonds built the town of Kimberley in Cape Province, just south of the west tip of the Transvaal. Diamonds have caused scurried rushes to the mouth of the Orange River and to Lichtenburg in western Transvaal, and have created the vast yawning hole of the Premier Mine near Pretoria.

For the present, Premier has closed up shop so far as digging is concerned. About this hole, where the world's largest diamond in the rough—the Cullinan—was found, armored cars and tanks now growl and roar in practice tests. Here men armed with assegais and machine guns also guard Italian prisoners.

Ever See $2,240,000 Worth of Gold at One Time?

That is the value of the bars of shining refined gold on these six trucks in the Rand Refineries at Germiston. Approximately 70,000 fine ounces are handled here each working day, or about 20,000,000 a year. Mines send their unrefined gold and are given credit on its weight and assay. The bars are dispatched to the bank after this final weighing.

There are more diamonds in the blue dirt that fills the ancient crater, which sooner or later may be unearthed to bring more money to the country's treasury. South African diamonds today have vital use. They are being flown over the world to United Nations' factories for machine cutting tools.

A Capital at Five Years

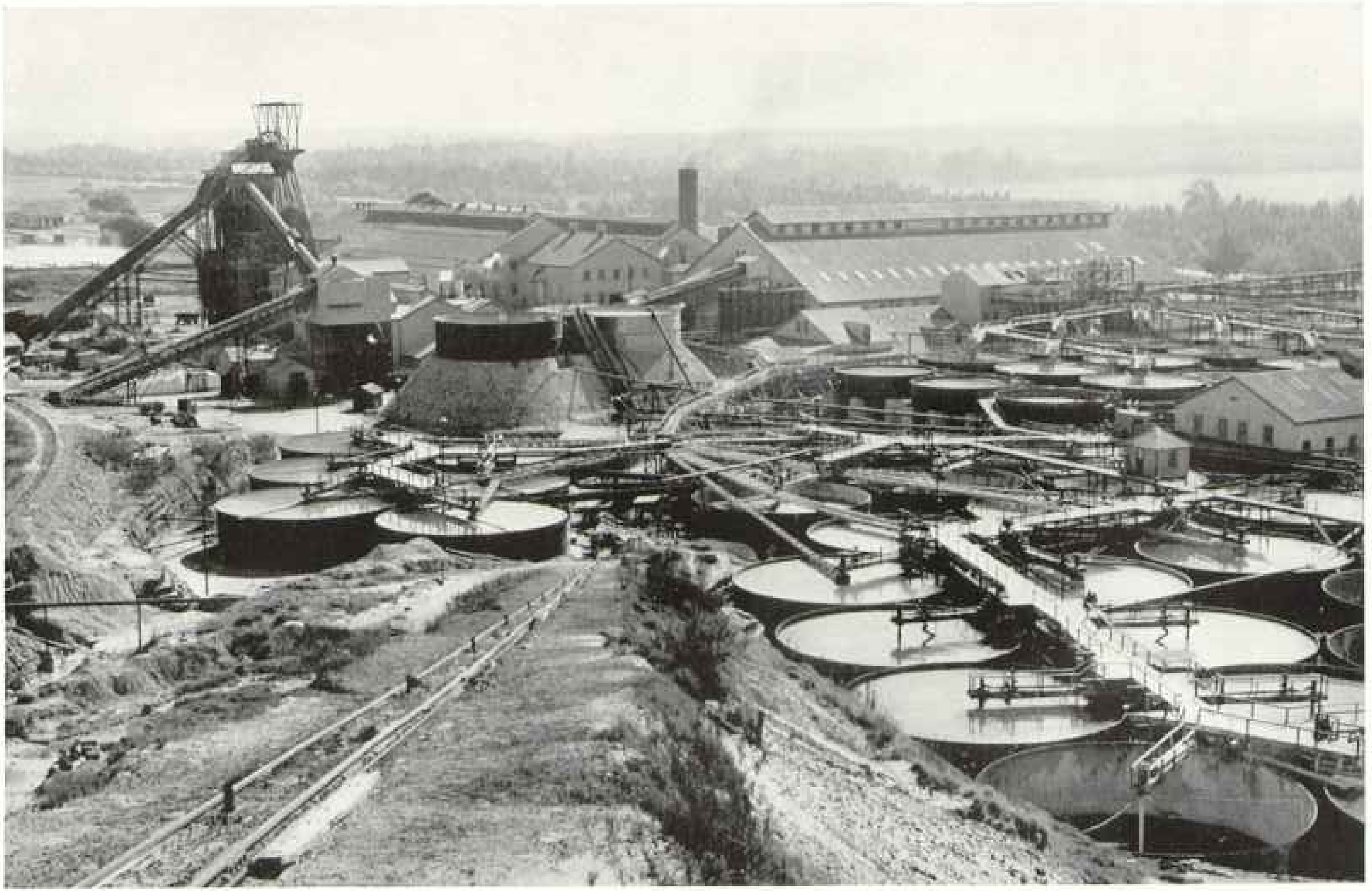
Pretoria owes its birth neither to gold nor to diamonds, but was founded by the son of the Voortrekker leader, Andries Pretorius, of Blood River fame, whose name it commemorates. Had it not been nurtured on gold discovered at Barberton and the Witwatersrand and by diamonds in its own back yard, however, it is doubtful if this administrative capital of the Union would be more than a pleasant Arcadian village.

In 1860, when still a gangling infant five years of age, Pretoria was proclaimed the capital of the South African Republic. It thus acquired the honors that might have belonged to Potchefstroom, first permanent white town to be created in the Transvaal wilderness when the Voortrekkers outspanned their ox teams and settled down.

If Johannesburg has two monuments—its mine dumps and its trees—Pretoria also has two. One is to Stephanus Johannes Paulus Kruger, whose patriarchal power as President of this Boer Republic so long endured here.

As you step from the railway station, there is "Oom Paul" standing in bronze, dressed in his familiar top hat and long coat and gazing toward the town. His mighty shoulders are stooped, bent by his Atlaslike task of carrying on them the weight of his Boer world (page 762).

And here in the monument, as in life, he is a man above men—and what men! Look



A Maze of Cyanide and Settling Tanks, Crushers, and Furnaces Clusters Around the Headgear (Left) of a Gold Mine

Skips, or lifts, bring up ore from 8,500 feet down in the bowels of the earth, where rock temperatures are 105° F. Ventilators and refrigerators constantly condition the air. Third or fourth in size, this mine alone has some 500 miles of tunnels. From one ton of ore comes an average of $7 worth of gold.

In a Private Garden, Field Marshal Smuts Dedicates a Large Home as an Auxiliary Hospital for the Duration

Staunch President Kruger Gazes over Pretoria, Which He Helped Build

Below him crouch four lean keen-eyed burghers who fought with him to preserve the old Boer Republic. When ten years old, Kruger accompanied his parents on the Great Trek northward from the Cape. He became President of the Transvaal in 1883. The Boer War ended the Republic and forced him into exile (page 759).

carefully at those bearded figures beneath him; they knew both plowshare and weapon.

But there is more of Paul Kruger to Pretoria than this piece of bronze. You feel his ruggedness still in many of its people, and every time you meet one of the long ox spans along the outlying roads, you are reminded that this was a life that Kruger best knew.

A few blocks west of wide Church Square is President Kruger's old home. A single-story, tin-roofed house it is, which has now been converted into a museum.

Here, in glass cases, you see many of Kruger's personal effects and souvenirs. Here are his glasses, his razors, shaving brushes, and coffee cups. Here, too, is his pocketknife with which he amputated his own thumb when he injured it while hunting.

"I had no means of deadening the pain, so I tried to persuade myself that the hand on which I was performing this surgical operation belonged to somebody else," he wrote long afterward. Kruger would!

Here you see his pipes, his two-foot high cuspidor, one of his dress shirts (with size 19 collar!), and the top hat that was so much a part of him.

And his Bibles. They were even more a part of him than anything else. Indeed, so thoroughly had he schooled himself by his Bible reading that in his writings and speech it was often difficult to tell whether his powerful statements were Kruger or the Bible speaking.

Oom Paul "Solomon" Kruger

Certainly one feels as if Solomon as well as Kruger were sitting on the judgment given to two brothers who had disagreed about their property shares.

"Which is the elder?" Kruger asked, as they stood at his *stoep* before him.

"I am," said Piet.

"Good," replied Kruger. "Go now back to your farm. And you, Piet, as the elder, make the division, and give your brother first choice of the portion he will take."

Another story told of Kruger is illustrative of the man. Through him churches were given land upon which to build. The Jewish community also came to ask for a grant for the erection of a synagogue. Later, when they discovered that they had received but half as much as the churches, they asked Kruger the reason.

"But you believe in only half of the Bible, don't you?" was his terse reply.

The South African Republic ended with the Boer War. The guns in the hill forts with which the Boers had encircled Pretoria were never used. Kruger spent his last days in exile in Switzerland and died in 1904.

In 1910 Pretoria's second monument was begun—the Union Buildings, which now stand as a symbol of the bringing together of all South Africa under one administration.

Pretoria's Monumental Buildings

The administrative buildings are more than a block of mere offices, or even a symbol. They are an architectural achievement.

Two massive wings are linked together by a sweeping colonnaded amphitheater, and attain added impressiveness by being perched high in the side of a sharp hill. Terrace after terrace drops away below, and over them seem to cascade rivulets of roses, aloes, and other flowering plants, and wide streams of velvety greensward (Plates I and II).

Upon this greensward and among the trees Pretoria goes for a stroll or sits and relaxes. There isn't a single sign "Keep off the grass."

A peaceful, friendly place is Pretoria. Even the near-by steel mills, puffing smoke on war work, haven't seemed to bother a bit. Despite its growth, it still retains much of the community charm that it had in earlier days when everyone used to pack up lunches and have a picnic under the colossal wild fig tree, called the Wonderboom, a few miles out of town.

Each year, in October and November, springtime stages a miracle flower pageant here. Misty blue clouds first form in small scattered patches and then spread to cover the valley and billow up the sides of the opalescent hills; it is jacaranda-blossom time. Until the last petals have carpeted the streets and gardens, it is a picture-book town.

Pretoria in part is still linked with the land. I spent a day traveling the countryside with a professor of the University of Pretoria while he was making a survey of grasses, edible bushes, and types of soil.

The whole of the Transvaal is to be mapped in this manner. From this work farmers will be better fitted to solve their grazing and cultivation problems.

Breeding Better Livestock

Out at the University's agricultural experiment farm I saw also Afrikander cattle, sheep, horses, and hogs which research men are breeding to better the livestock of the country.

At present, they are also carrying on extensive experiments in cross-breeding sheep of Persian and European strains to produce a fast-fattening animal for slaughter. These animals fruit growers and other agriculturists can raise to avert pinched times.

To Tsetse Flies This Trap Looks Like a Cow

Lured by the light-colored burlap, flies crawl underneath. Finding no blood, they fly up to the light only to be trapped in the cage. Thousands of traps placed in infected areas, especially in Natal, have greatly reduced the tsetse-fly disease (nagana) among livestock. Wild game in the bush are also victims (page 766).

Say Ah, Little Sheep, and Take Your Medicine

Nearly 22 million doses of worm compound are prepared yearly at this veterinary center at Onderstepoort.

A few miles north of Pretoria is the Onderstepoort Veterinary Research Institute, known throughout the veterinary world. The vision for it and much of its development was due to Sir Arnold Theiler (opposite page).

As a young veterinary graduate in Switzerland, he came out to South Africa in 1891 to find elbowroom. And for a while those elbows were bare. But when a smallpox epidemic broke out, he turned his hand to manufacturing vaccine in Johannesburg, and thus caught the attention of President Kruger.

Thereafter, he was appointed veterinarian to the Republic and did signal work in stemming the cattle plague, rinderpest, which had swept down Africa from Somaliland. This present efficient research center for the study of animal diseases is the outcome of his scientific work.

"Today we are a good-sized factory just in preparing vaccines, serums, and other remedies. That alone pays half of the cost of the Institute," said Dr. P. J. du Toit, its director.

"We also examine more than half a million blood smears a year. In Natal, for instance, we examine a smear from every animal that dies or is killed. We can thus catch any disease at its source."

To the laboratory and research work has been grafted the teaching of a limited number of veterinary students. The center likewise is carrying on extensive work in the care of meats for war use.

As we walked among the pens and barns, I was amazed at the work being done on nutrition and disease problems. Elsewhere I saw parcels of serums being packed and posted at the rate of 200 to 300 a day.

Milly the Oof Bird Does Her Bit for the National War Fund

Every time a coin is dropped in the box at the side, Milly rises from her huge egg. Barnyard noises and calls from a phonograph accompany her risings and sittings here in front of the Johannesburg City Hall.

In another building men were working on the refrigeration of meats. Close by, machines were extracting plant poisons. More than 200 poisonous plants in South Africa have been studied, and the problems are strikingly similar to those in Texas.

The Family Tree of Ticks

The laboratories also maintain a "Sing Sing" for ticks which carry the dread East Coast fever. Multiple-screen cages and even a moat of disinfectant keep them from escaping. The door is locked.

Incidentally, the ancestry of these creatures has been carefully recorded for more generations than have most lines of thoroughbred and pedigreed livestock.

Director General of War Supplies

An All-South African Howitzer Passes Its Tests with a Bang!

These soldiers have their mouths open to neutralize concussion when the gun is fired. At the beginning of the war the Union had no heavy guns, no armament factories. Within six months, however, this howitzer, armored cars, and other war equipment had been devised by South African engineers. From a white population of only 2,000,000, the Union has raised a volunteer army of some 200,000 men and women (page 733).

Over in the wool research center I watched machines testing the springiness of wool; other machines bend strands back and forth until they break.

If you think that your trousers soon get baggy in the knees or your coat frays too quickly at the cuffs, the research men may remind you that merino wool may stand *seven million* bendings before it breaks, whereas some other goods may snap at a mere 2,000!

Building a Better Flytrap

In an exhibition corridor I examined a trap designed to catch tsetse flies (page 764). Knowing that the fly attacks the underside of an animal, the scientists constructed this trap with a burlap belly.

In the cloth is a wide slot through which the insect wanders. Then, finding no blood, it flies up to the light, only to be caught in a net trap at the top.

The tsetse has thus been reduced to a minimum in the infected Zululand area.

While we talked, the director was interrupted by the arrival of field men just down from Tanganyika and Northern Rhodesia, where they had been investigating rinderpest and its disquieting movement southward.

During World War I a wide band of territory had to be immunized to prevent the plague's southward course. The same may have to be done again soon.

As I rode back again to Pretoria and on to light-spangled Johannesburg in the gathering dusk, I thought again of the last message of Oom Paul Kruger to his people which I had seen hanging on the wall in his home. It was penned in Switzerland shortly before he died.

In it was one line wherein he expressed perhaps the most beautiful Biblical thought of his life: "Take the best from your past and build your future on it."

The Union of South Africa is building.

New Map Shows Asia's Role in Global Warfare

TIMELY addition to the National Geographic Society's series of wartime maps is the new Map of Asia, distributed to 1,165,000 member-families as a supplement to this issue of their NATIONAL GEOGRAPHIC MAGAZINE.*

With this notable map of Asia, National Geographic Society members have received in 1942 five map supplements. Others were: Theater of War in the Pacific; North America; Theater of War in Europe, Africa, and Western Asia; South America.

In all, the National Geographic Society has printed in a single year nearly six million wall maps in color—a world-area mapping program unprecedented anywhere, any time, in all the history of map-making.

Map-making constituted one of your Society's important contributions to the war effort, as attested by requests for some 125,000 maps by the Army, Navy, Marine Corps, State Department, and other Government agencies.

"The Continent of Superlatives"

Printed in 10 colors, on a sheet 40 by 26½ inches, the Map of Asia reveals by a wealth of cartographic detail how global war has enmeshed the "Continent of Superlatives."

Asia is the world's largest land mass, approximately 16,000,000 square miles or 5½ times as big as the United States. If adjoining Europe, which really is a peninsula of Asia, be included, the entire Eurasia area is nearly 20,000,000 square miles.

In the Himalayas rises our planet's tallest peak, 29,002-foot Mount Everest; off the Philippine coast the ocean floor plunges to its greatest known depth, 35,400 feet below the surface of the Pacific.

Lowest sheet of water on the earth's crust is the Dead Sea in Palestine, 1,286 feet below sea level. Biggest depressed continental area is the Caspian Basin and Sea, a territory larger than the State of California, and for the most part 85 feet below ocean level.

Coldest place in the world—colder than the North Pole—is Verkhoyansk, Siberia, where the thermometer drops to more than 90 degrees below zero in winter.

On this huge continent dwell half the earth's people—most diversified group of races and creeds on the globe.

On this one chart your Society's cartographers have mapped an expanse of some 65,000,000 square miles, about three times the area of all Eurasia, to reveal the strategic relationship of widely separated campaigns.

The map's extreme longitudinal spread is 240 degrees. In latitude, the map reaches from the North Pole to Brisbane, Australia, some 8,120 miles.

Two-thirds of the northern expanse of the sphere is represented, from Ireland and the Faeroes to the Aleutians. In the south, the map covers the vital area from Fort Lamy, Free French outpost in Equatorial Africa, through Portuguese Mozambique, British-held Madagascar, Japanese-occupied Netherlands Indies, embattled northern Australia, and the beleaguered Solomon Islands.†

Japanese Mandated Islands in the Marshall and Caroline groups come within the eastern border.

Sealed on a New Projection

This is the first general map to be based on the transverse polyconic projection system.

To map any part of a globe on a flat surface requires a compromise called a "projection," or a grid of lines, representing latitude and longitude. Conventional projection systems would seriously distort distances over so vast a stretch of territory from east to west.

Your chief cartographer, James M. Darley, turned to the projection system devised in 1900 by C. H. Deetz, of the United States Coast and Geodetic Survey. Basic principle of this system is to select on the globe a great circle which cuts across the center of the map. From this circle and its relation to the usual lines of latitude and longitude, Wellman Chamberlin, of The Society's Cartographic Department, made exacting calculations necessary to establish the new grid.

On the flat map of Asia this selected circle around the spherical earth appears as a straight line, running directly across the map in its center. From east to west it passes near the Hawaiian Islands, the Japanese Mandated Islands, and southern Japan. The Chinese supply lines from India, Russia, and

*The National Geographic Society maps of the continents and oceans, with the accompanying indexes, make a magnificent atlas and gazetteer of the world. The Society provides a handy map file, bound like a book, 10¾ x 7¾ inches, with Manila pockets which accommodate 20 folded maps or 10 maps with their respective indexes. Members wishing additional copies of the new Map of Asia may obtain them by writing the National Geographic Society, Washington, D. C. Prices, in United States and Possessions, 50¢ on paper (unfolded); $1 on linen; Index, 25¢; Map File, $2.50. Outside of United States and Possessions, 75¢ on paper; $1.25 on linen; Index, 50¢; Map File, $2.75. All remittances payable in U. S. funds. Postage prepaid.

†See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Madagascar: Mystery Island," by Paul Almasy, June, 1942; "Java Assignment," by Dee Bredin, January, 1942; and "Life in Dauntless Darwin," by Howell Walker, July, 1942.

the Middle East all lie close to its course. In the west it coincides with the wartime aerial ferry across Free French Africa to Khartoum, Karachi, and the Persian Gulf ports.

If you could look down on the actual area pictured here, you would see planes, ships, trains, trucks, snow-shod tractors in Arctic Siberia, plodding camels in the deserts, sweating coolies, slogging elephants in Asiatic jungles, all carrying tools of war over supply routes from "the arsenal of democracy" in the Western Hemisphere.

Solid red lines show railways, of which thousands of miles are newly constructed.

Coolies Replace Burma Road

In China some half a million coolies are picking and chiseling a truck route through some of the world's toughest terrain. This road cuts across 10,000-foot heights, and bridges three of Asia's largest rivers which flow directly across the builders' path in deep chasms.

The map also shows the so-called Red Route, connecting Alma Ata and Ayaguz (Sergiopol) in Soviet Russia with Lanchow and Chungking, over which supplies have been trickling for several years to help the Chinese.

Important caravan trails, including the old Silk Route of Marco Polo's day, are shown.

In the far north Murmansk, Archangel, and new ports such as Igarka (whose population has grown to more than 15,000 since the war began), Salegard, Dudinka, Tiksi, and Ambarchik punctuate the Arctic route.

Snowshod tractors and propeller-driven sleds haul supplies from these ports in winter. River steamers and barges laden with sinews of war, ply the Ob, Yenisei, Lena, and other large north-south rivers in summer.

British, Russian, and American engineers and technicians are helping plot a whole new transportation system for Iran (Persia). They have built modern ports and increased the capacity of the trans-Iranian railroad many fold to pour supplies into the Soviet Union by the southern route.

The Free French are pushing other "lifelines" through the equatorial jungles of Africa, to move goods overland from Atlantic ports to the fighting fronts of the East.

All Asia reverberates to war. Afghan and Ainu, Baluchi and Battak, Cambodian and Chinese, Druze and Dravidian, Jap and Jat, Kurd and Kirghiz, Malay and Mongol, Rajput and Russian, Sart and Sikh, Tamil and Turkoman, Yakut and Yezidi—their very names make one's mind jump from the tundra to the tropics, from sultry Syria to bleak Sakhalin.

Men and munitions pour westward from the United States into lands which once sent to our shores a host of peacetime commodities. Malayan rubber trees, Asiatic silkworms, Indian lac insects, Manila hemp, Bengal jute, Singapore tin, and many more products contributed to the normal American way of life.

Today the United States turns to synthetic rubber, synthetic silks, plastics, native fibers, and alloys. In Asia the disruption in trade has been calamitous.

Vast rubber plantations in Malaya and Sumatra, with their thousands of workers and expensive, imported machinery, have been robbed of their main customers—American automobile tire manufacturers. Philippine hemp, coconut oil, and sugar no longer have a ready market.

Burmese rice is rotting, while millions of Asiatics, facing unemployment, hunger for their staple food. Teeming millions live along coast and river in Burma, in China, in the Philippines, and elsewhere close to paddy fields.

Rice is the staff of life in vast Asiatic areas. To answer the demand of generation after generation for rice and more rice, growers have climbed from plain to hillside, extending their fields over spectacular terraces, now coffee-colored under the feet of buffaloes, now golden with sheaf and stubble.

Climate is a life and death affair in Asia, and people are doing something about it, or because of it, all the time. North American cities lie within a relatively narrow zone running around the earth. The bulk of Asia's population lies south of that zone, where a loin cloth or a sarong may be a complete costume. Asiatics work more for food than for clothes and shelter.

Even in food Asia is a land of contrasts. Chinese love pork, Moslems do not. Look on your map from northern Africa to Dacca and note the long trail of Islam where never a porcine grunt is heard.

Poverty-stricken India, almost without a meat or dairy industry, feeds more than twice as many cattle as does the United States. Millions of superannuated oxen and cows linger on, for they are sacred and not to be killed. When they die, their hides, handled by low-caste Chamars, turn long loss into scant profit.

The Asia map contains a table of 561 great circle distances, showing the length of bomber or air-ferry flights between important points on the globe. Similar tables appear on The Society's other war series maps, including the Atlantic Ocean, the Pacific Theater of War, the Western Theater of War, and South America.

Riddle of the Aleutians

A Botanist Explores the Origin of Plants on Ever-misty Islands Now Enshrouded in the Fog of War

By Isobel Wylie Hutchison

IN a peacetime summer I made a trip to the Aleutian Islands to collect plants for the British Museum. I well remember the view from a volcanic peak on Kiska. As I sat on the crest I could look down on Kiska Harbor and see, far beyond, the pale-blue cone of Chugul Island. Above me two eagles soared. (See New Map of Asia, page 767.)

Little did I think, as I watched them, that planes of the United States Army would soon hover over those serene waters and use every rift in the cloud mantle to rain bombs on Japanese ships.*

My trip began in Scotland. I traveled to Seattle, where I sailed for Seward, on the Kenai Peninsula, and Kodiak Island.

At Kodiak I was picked up by the small mail boat *Starr*, and in mid-July I arrived at Dutch Harbor. I had set my heart on extending my botanical quest to Attu, westernmost of the islands. My wish was happily realized through permission to take passage on the United States Coast Guard cutter *Chelan*.

The Aleutians had scarcely been explored botanically before 1932. In that year Dr. Eric Hultén, of Lund University, Sweden, ranged over the region and in 1937 published his work, "Flora of the Aleutian Islands," which includes the names of 481 local species.

Since my journey in 1936, events have stirred the interest of the strategist as well as the curiosity of the botanist. Regarded as the key to the back doors of two continents, the Aleutians are fog-bound, their waters storm-swept, their atmosphere compounded of the chill of the Bering Sea and the warmth of the Japan Current.

Stepping Stones between Two Continents

The islands are the tops of a submerged mountain range which is a westward extension, for 1,100 miles, of the high volcanic mountains of the Alaska Peninsula. The Russian Komandorskies are a further continuation of this range.

For convenience, the International Date Line, which technically would pass through the center of the islands along the 180th meridian, has been twisted here to include Attu's 96 inhabitants in the Western Hemisphere.

This vast under-water range rises in places more than four miles from the ocean bed. The Aleutian Trough is one of the deepest ocean pits. Protruding above sea level, the rugged crests may have provided stepping stones on which some of America's prehistoric inhabitants slowly crossed from Asia to the New World.† Flowers are traveling even more slowly between the continents.

The stormy voyage of the *Starr*, which used to ply monthly from Seward to Unalaska, and sometimes even as far as Umnak Island under its Norse captain was an adventure in itself.

On each run the ship logged about 2,500 miles and stopped at 50 lonely villages and canneries. If a passenger could weather a trip aboard the *Starr*, anything else was easy, I was told, but I recall with pleasure the seven days I spent with interesting fellow-passengers.

The boat's first call in the Aleutians was the salmon cannery at False Pass on Unimak Island. Unimak is the largest of the Aleutians and the nearest to the Alaska Peninsula, from which it is separated by a narrow channel unsuitable for ocean-going vessels.

The gateway to the Bering Sea is at the next gap, between Unimak and Akun, where the wild waters were lighted by beacons at Scotch Cap on the south and Cape Sarichef to the north.

Unimak Island is of interest to zoologists because it is the only island of the chain where the Alaska brown bear and caribou are still found. Its flora also is unique, for the other islands are treeless. On Unimak flourishing alder thickets, similar to those found in Kamchatka, reappear after a gap of 1,560 miles, as Dr. Hultén noted.

A warning from our captain that I must not explore the groves alone because they were crossed by two bear trails confined my researches on Unimak to the shore and the village.

Colonies of tall blue monkshood (*Aconitum*

* See "Bizarre Battleground—the Lonely Aleutians," by Lonnelle Davison, National Geographic Magazine, September, 1942.

† See "Exploring Frozen Fragments of American History," by Henry B. Collins, Jr., National Geographic Magazine, May, 1939, and "Discovering Alaska's Oldest Arctic Town," by Froelich G. Rainey, September, 1942.

Official Photograph U. S. Navy

Does That Fog Hide a Jap Plane or Ship?—A Navy Flying Boat Seeks the Answer

While billowing mist may hamper sky patrols, it gives good cover for American sea and land operations. At Dutch Harbor extreme temperatures range from 80° Fahrenheit in August to 8° in February. Summers are characterized by much cloudiness and frequent fogs. Average rainfall is 57 inches, snowfall 71 inches.

maximum) grew around the houses. The Ainus of Japan and the ancient Aleuts are reported to have used the deadly poison from the roots of this plant to tip their arrows. It is generally found in the neighborhood of old island villages.

Before crossing to the whaling station on Akutan, we paused at Scotch Cap, a headland so named from a fancied resemblance to a Glengarry bonnet.

My cabin mate was the wife of one of the lighthouse keepers there. She had traveled from Ketchikan, taking the risk of being swept past her husband's station, for it was often too stormy to land. She faced being marooned for months at the lighthouse. Her husband had told her terrifying tales of bears that came down from the headland in winter to knock at his back door.

Fortunately, the sea was kind, and she was put ashore in the ship's lifeboat. Remnants of two wrecks on the wild beach were grim reminders that sailors call this region the "Graveyard of the North Pacific."

We docked at Unalaska on July 15, a later date than I had intended when leaving Scotland, but in Alaska one had to take sailings where and when they came. The flowers on the islands were about three weeks behind those of the mainland.

My headquarters were in the deserted Methodist orphanage, the Jessie Lee Home, since removed to Seward. It stood at the end of the long straggling street of Unalaska, the largest village in the Aleutians. In 1936 the town's inhabitants included 250 of the vanishing Aleut race. Their chief was kindly old Alexei Yachmenev. He was born in 1866, when the islands were still under the dominion of the Tsars, and died in 1937.

In the Unalaska Wilderness

Unalaska, second largest of the Aleutians, is 77 miles long. A narrow strip of water

Official Photograph U. S. Navy

All Hands Rally round a Letter from Home—Best Tonic for Morale

Hollywood art is another "pick-me-up" for sagging spirits. Mail from the States cheers these Marines manning a pillbox at vital Dutch Harbor, jumping-off-place for United States attacks against Japan.

separates it from Amaknak Island. Here Dutch Harbor, with the U. S. naval air station, is located. In my month's stay I gathered two or three hundred specimens of Aleutian flora, making my way over the mountainous country, sometimes through vegetation breast-high.

Mountains surround the little village, distinguished for its big white Russian church. There are few trails and no roads. The island was almost as much an unexplored wilderness as when Father John Veniaminov, one of the first Russian missionaries, wandered on its heights, teaching Nature lore to his children.

The Russian regime of more than a century ended in 1867, when Alaska was sold to the United States. The valuable furs of the seal and the sea otter originally attracted Russian traders, and later settlers brought Christianity.

In Bering's time the number of Aleuts was less than 20,000. There are fewer than 1,400 of them now. Beyond Unalaska, except for some islands utilized as fox farms, there are only three inhabited islands, Umnak, Atka, and Attu, but each has its little Russian church, visited from time to time by the Russian priest who has his principal station on Unalaska. There services are held in a big church which has replaced one Father John built in 1824 with his own hands.

This remarkable man came from Irkutsk in 1823 with his wife, his year-old son, an aged mother, and a brother. After traveling more than 600 miles across the wilds of Siberia on horseback, the party set sail for Unalaska.

There Father John, who was a skillful carpenter, began building his church. He also translated the liturgy of the Greek Church and the Gospels into Aleutian.

"Of all the good qualities of the Aleuts," he records, "nothing gave me more pleasure and satisfied my heart than the diligence they had for listening, or more properly the thirst they had for hearing the Word of God, for a most untiring preacher could become weary sooner than their diligence become lessened."

Nature's Bounty Headed for Liquidation. The Whaler *Aberdeen* Tows Its Floating Catch to Akutan for Processing

Wide World

With Collars Turned Up against the Cold and White Hats Neatly Rolled and Flared, Bluejackets Head for Liberty at Dutch Harbor

These salty sailors will not find much amusement in the town, but at least they can stretch their legs and feel land under their feet after months at sea. A community of 52 people in normal times, Dutch Harbor has expanded rapidly in the past year to a mighty base from which the United States operates in the Aleutians.

Aleš Hrdlička

Prehistoric Aleutian Life Comes to Light as a Burial Cave Gives Up Its Dead

Village sites on Amaknak Island were excavated in 1936 by Dr. Aleš Hrdlička and members of a U. S. National Museum Expedition which he headed. In a volcanic cove on Kagamil Island the expedition discovered several mummies. The Aleutians embalmed their dead, wrapping the bodies in grass mats or skins and hid them in caves.

The origin of the Aleuts seems as fog-wrapped as their home. Whatever their origin, they readily adapted themselves to their rain-washed surrounding.

Their waterproof coat, made from the gut of sea mammals, is one of the first waterproofs in the world.

Like the Eskimos, their hunters were expert seamen, going far from shore in their two-seated skin *bidarkas* to hunt fish and sea mammals. They are related to the Eskimo, to whom they are somewhat akin in feature and language. Alexei Yachmenev told me that even in the small inhabited circle of the Aleutians there were distinct differences in dialect. He could not understand the Eskimo tongue.

The Aleuts mummified their dead and suspended the bodies in carefully hidden island caverns. After removing the intestines and stuffing the body with dry scented grasses, they dressed it in its best clothes, they seated it in a squatting position with knees drawn up to the chin. Then they wrapped it in closely plaited grass mats or skins. Finally it was lashed into a compact bundle and hung in the burial cave. There it was supposed to come to life at night, and to cook and feast.

Mummies at a Tea Party

The Eskimo is inclined to regard the dead as malicious, but the Aleut had no fear of them and regarded them with affection, carefully preserving the bodies of important persons.

I learned more about Aleutian mummies at a tea party at one of a small row of houses

Official Photograph U. S. Navy

Mighty Heart of a Jap "Zero" that Crashed in a Lonely Unalaska Marsh

Forced down in the mountains near Dutch Harbor, the carrier-based fighter pancaked, pinning its pilot, a lieutenant commander, at the controls. Its motor and propeller assembly, recovered practically undamaged, is guarded here by a United States Marine pending study by aeronautical experts. This engine is patterned after the American Pratt-Whitney, which Japan was licensed to build before the war. Japan also copied the plans outright for the Hamilton propeller.

just built behind the wharf at Dutch Harbor.

This row is shadowed by Ballyhoo, Amaknak's 2,000-foot mountain, named by the U. S. Coast Guard. On its cone-shaped summit is an iron box containing a visitor's book, in which all good Coast Guardsmen are expected to inscribe their names.

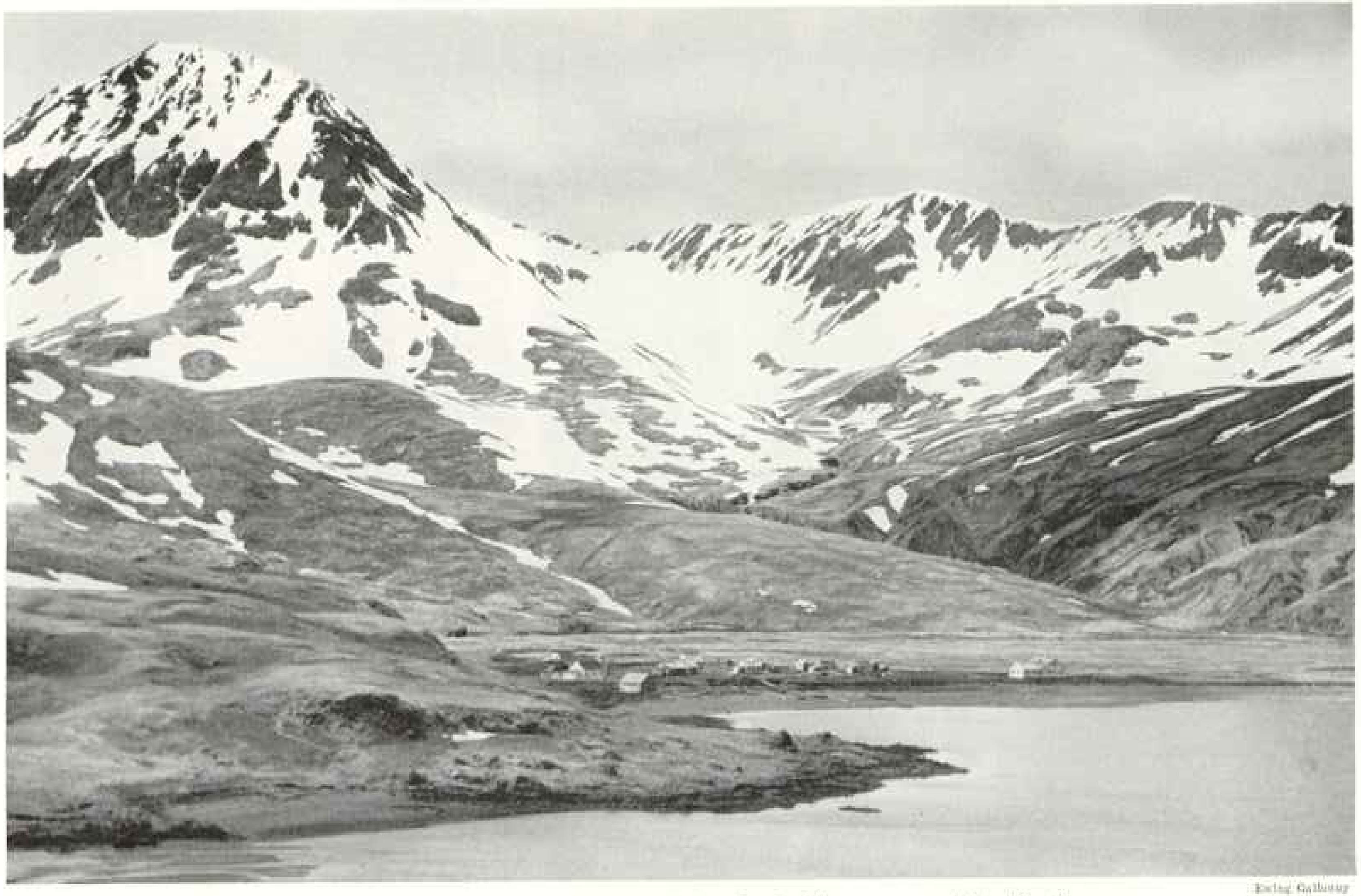
Dr. Aleš Hrdlička of the U. S. National Museum, with his young assistants, was excavating prehistoric village sites on Amaknak Island. On the Coast Guard cutter the party had visited the island of Kagamil, farther westward, where they found mummies in a volcanic cave. The tea table consisted of two boxes of mummies. A collection of 68 boxes and barrels containing these "skeletons at the feast" awaited shipment.

Like the mummies, I was something of an intruder at this party. I had met Dr. Hrdlička by chance while at Dutch Harbor, where I was making color pictures of the beautiful wild garden—blue monkshood, crimson fireweed, lupine, and white cow parsley—which flourished on the site of the old village.

The Westernmost Trees of America

I wished also to inspect "the westernmost trees in America," the famous grove of Sitka spruce (*Picea sitchensis*), the only trees in the Aleutians. They grow in a sheltered hollow beside a small lake, behind the radio station.

According to Dr. Hultén, 24 small trees were sent from Sitka and planted at Unalaska about 1805. Thirty years later they were



Irving Galloway

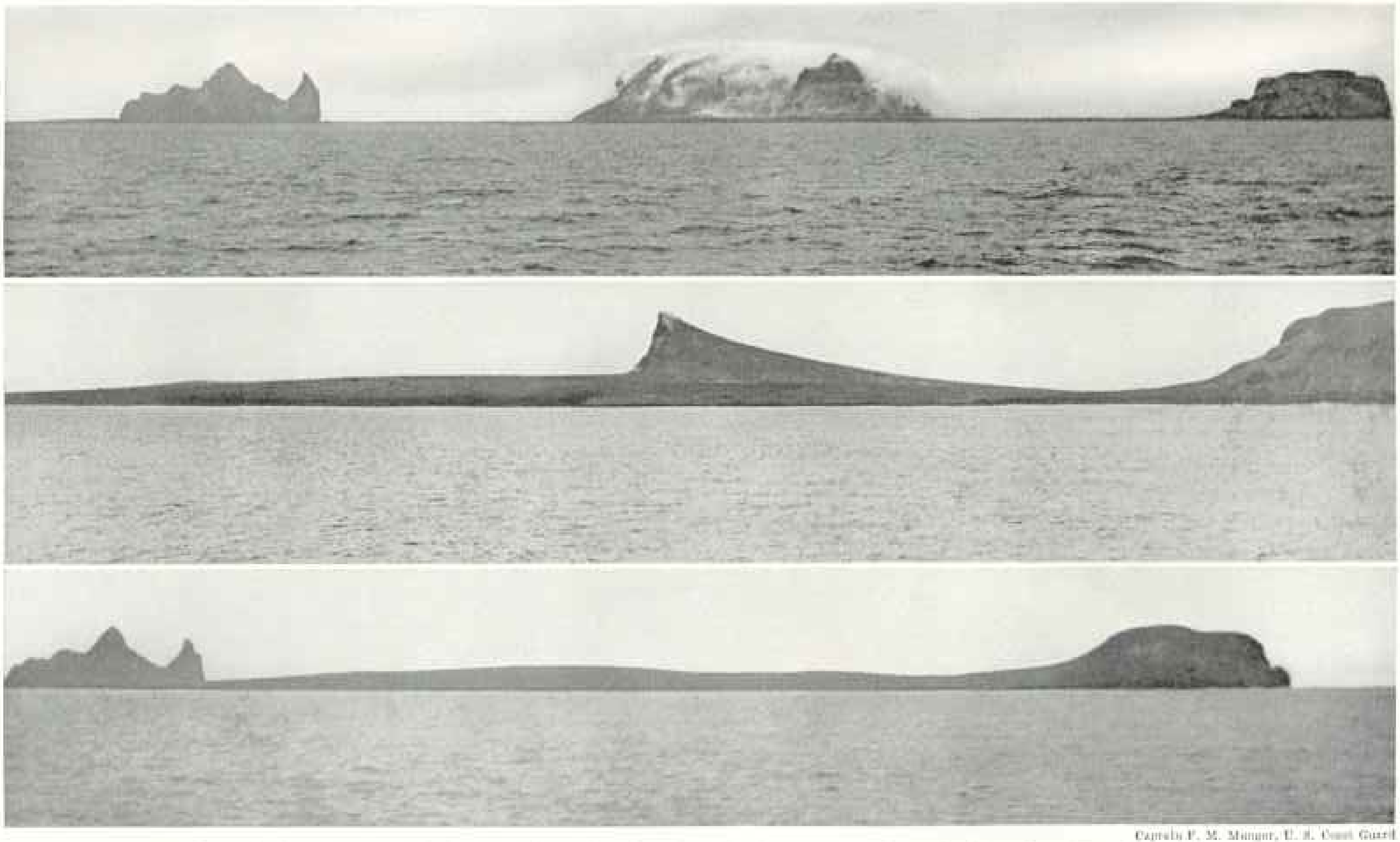
First Foothold of the Jap Invaders, Bleak Attu Is the Westernmost of the Aleutians

Forty miles long and 20 wide, Attu was dubbed by an American traveler "the loneliest spot this side of hell." In 1940 the island had a population of 96, many of whom lived in this village of wooden homes. The Japanese occupied Attu in June, 1942, but after constant bombing by United States planes they were forced out in September.

(Official Photograph U. S. Navy.

Cold Spray Flying, a Navy Whaleboat Comes in through the Surf to Transfer Officers and Men to Shore

Our soldiers, sailors, and pilots must all be good seamen to operate in Aleutian waters which are subject to violent storms without notice.



Captain F. M. Munger, U. S. Coast Guard

Bogoslof Volcano, Vulcan's Jack-in-the-box! Three Peaks Pop Up from the Sea, then Two Subside

The three extraordinary pictures above record the rapid ups and downs of an Aleutian volcano (page 781).

Upper photograph taken July 4, 1907—Bogoslof, discovered in 1790, once included only jagged Castle Island (upper left). In the late Eighties a new formation, Fire Island, appeared to the far right. Between 1903 and 1907 two other peaks, McCulloch and Perry (center), poked their heads up between the two older islands.

Center, October 15, 1907—Within three months after the taking of the upper photograph, McCulloch Peak had vanished in a volcanic explosion, leaving Perry Peak standing alone. Castle Island is out of the scene to the left and a ridge of land stretches across.

Lower, July, 1908—A year later Perry Peak had disappeared entirely, leaving only a black ridge 1,300 feet high between Castle and Fire Islands.

Captain F. M. Munger, U. S. Coast Guard

Coast Guard Officers Go Ashore to Survey the Strangest Island in the World—Bogoslof Volcano

Here, in June, 1906, they stand before Perry Peak (named for their revenue cutter), which had popped up from the submerged crater several months before. During the following winter another rock, McCulloch, 495 feet high, appeared close to Perry. About September 1, 1907, McCulloch suddenly vanished, probably causing the dense black cloud which floated over Unaluska Island 40 miles away, covering the land with ashes. Later Perry Peak, too, disappeared.

Official Photograph U. S. Navy

The Chief of the Aleuts, Attu's Head Man, Comes aboard a U. S. Warship

For the big event Mike Hodinkoff wears his "Sunday best," a Coast Guard officer's old jacket laced with tarnished gold braid, a pilot cap, and Navy trousers with top boots. As the island lacked a priest, the Chief conducted church services. His aunt, Maggie Prokopoff, known to the Coast Guardsmen as "Rock of Ages," was Attu's best basket weaver (pages 784 and 792).

seven feet high and 18 inches in circumference. They produced cones for the first time in 1833.

The few now remaining are thick in girth, but no young trees have grown up around them. In 1936 the *Chelan* carried several thousand young pines to the islands for an attempt to establish them in sheltered areas. Successful afforestation in such wind-swept territory is doubtful. Gales of high velocity may be expected at any season.

We strolled back from the party through flowery meadows, where Aleut children were gathering delicious bush blueberries and red salmonberries for preserving.

Captain Ralph W. Dempwolf of the Bering Sea Coast Guard Patrol, one of the guests, said casually, "I suppose you know that permission came for you today from Washington to travel with the cutter to Attu, and she will bring you back again, too."

I was delighted at the news. I had set my heart on reaching Attu, for I knew that some Asiatic species grew there, which were not to be found on the islands nearer America. Only Washington could grant permission for me to make the voyage on the *Chelan*, and the cutter was due to depart in two days on her annual voyage through the islands. For days my chief worry had been that the radiogram would arrive too late.

When I reached my comfortable quarters in Unalaska that evening, I was hailed by my fellow-boarder, a Government nurse, and our mutual friend, Dr. Bingman, of the *Chelan*.

They were leaning out of the window, hilariously waving an American flag, for these kind people were as much pleased with my good fortune as I.

As soon as I had crossed the *Chelan's* white gangplank at Dutch Harbor, I unpacked the British Museum's presses and drying paper, putting them into the drawers of the commodious cabin reserved for me. This was next door to the gyrocompass, and just at the officers' mess. I never missed a meal, despite the doctor's gloomy forecasts, for I had found my sea legs on the *Starr*.

Though Attu was less than 900 miles and about two days' direct sailing from Dutch Harbor, I was destined to spend 14 days on board and to travel 1,700 miles before I actually set foot on it. In 1936 the *Chelan's* main job was the charting of some unplumbed

parts of the Aleutian Trough to the south and west of Attu and Agattu.

The year before, Captain Lloyd V. Kielhorn, the *Chelan's* commander, and his navigators had charted a submarine range north of the islands, which inclined in a direction contrary to the coastal ranges enclosing the shallow Bering Sea. The Captain was now anxious to discover whether this range also extended south of the islands.

We Find a New Reef

Though actually no trace of it was found, the *Chelan's* navigators charted a new reef between Attu and the Komandorskies, a region formerly thought to be very deep.

Despite my longing to see the flora of all the peaks which rose to greet our graceful vessel, I soon found this ringing up of Neptune by the echo-sounder, or Fathometer, almost as fascinating as the discovery of a new flower.

I was grateful to the Captain for letting me share this unusual activity.

When we tapped the new reef, the Fathometer without warning recorded shoal soundings of only 49 fathoms. It was not long after the "Lady Guest" (as my place-card at the dinner table politely called me) had with her own ears listened in to the deepest sounding made on the voyage, 4,199 fathoms.

"Trust a woman to be at the bottom of everything," said my good friend the doctor, when he heard about it.

One night I had just turned in and lay watching through my porthole a white wisp of moon chased by a dark cloud.

We were close to the Soviet shore. More than once we had sighted the peaks of mountainous Attu. Suddenly I heard a commotion. The engines slowed and stopped.

The officer of the deck had pressed the oscillator to give old Father Neptune a night call. He got a startling surprise, for Neptune had answered almost instantaneously. There was scarcely a gap between the sound of the bell in the ship's bottom and its echo in the earphones of the operator.

We were riding the crest of some submarine Everest and had to retreat hurriedly and "mind our toes," as Captain Kielhorn put it, for the rest of that night.

The navigators had a million-dollar ship in their charge and had no wish for it to share the fate of a sister cutter, the *Tahoma*. In 1914, while that cutter was steaming south of Buldir Island, between Agattu and Kiska, she suddenly piled up and became a total wreck on a reef now charted as Tahoma Reef. We spent the next day defining our new discovery.

A brief digression is in order here for a word about the island of Bogoslof, which I was summoned to inspect from the bridge on our first morning out from Unalaska.

Bogoslof is a submarine volcano about the size of Vesuvius situated 25 miles north of Umnak Island. Only its splintered crests rise for a few hundred feet above the ocean. First sighted by the Russians in 1796, the island is constantly changing position and appearance by unexpected flare-ups (pages 778-9).

The U. S. Fish Commission steamer *Albatross* in 1906 came upon the island at a moment when she was "shooting her mouth off," and made valuable observations; so did U. S. revenue cutters at various times thereafter. But as we approached over the gray and silver sea, lighted by a fitful sun, the only sound from the strange shores was the wild and melancholy roaring of a herd of pale-coated sea lions using her sulphurous beach as a haul-out place.

Dr. Hultén, who landed in 1932, found some vegetation despite the active volcanic conditions, for there the blue-gray flower of lonely beaches, *Mertensia maritima*, had her home along with the beach pea (*Lathyrus maritimus*) and the sea grass (*Elymus arenarius*).

Aleutian women still weave sea-grass baskets for which their islands are famous. Next day, when we landed at the inhabited island of Atka in the Andreanof group, I saw one of these elegant baskets, but I was told that the finest and best were to be obtained only at Attu.*

The inhabitants of Atka were a small and rather miserable remnant, about 50 in all, who lived on the shore of Nazan Bay's inner harbor. An American teacher and his wife lived on the island, where there was a good school.

On our return journey this couple accompanied us to Dutch Harbor, for they had to act as witnesses at an unusual trial for murder, the defendant being an Atka native who had killed a trader on the island in a fit of marital jealousy.

Aleutian Wildlife Refuges

From Atka we sailed to Amchitka, in the Rat Islands group, and close to the 52d parallel. The *Brown Bear*, a small vessel belonging to the Alaska Game Commission, had preceded us, bringing the Game Warden, Mr. Homer W. Jewell, and his staff of the U. S. Biological Survey.

* Occupation of bases in the Andreanof group by American armed forces was announced on October 3 by the United States Navy. American bombers operated from these new vantage points against Japanese-held Kiska in the Rat Islands group, and Agattu and Attu in the Near Islands—Editor.

Luis R. Huber

Wake of a Wounded Submarine? International Date Line?

Both wrong! This foamy streak is the joint autograph of the merging waters of the dark Pacific Ocean (left) and the lighter Bering Sea. The spectacle was visible from the boat deck of the United States Coast and Geodetic Survey Ship *Discoverer*, then steaming in the vicinity of Unimak Island.

Alan G. Mac from Three Lions

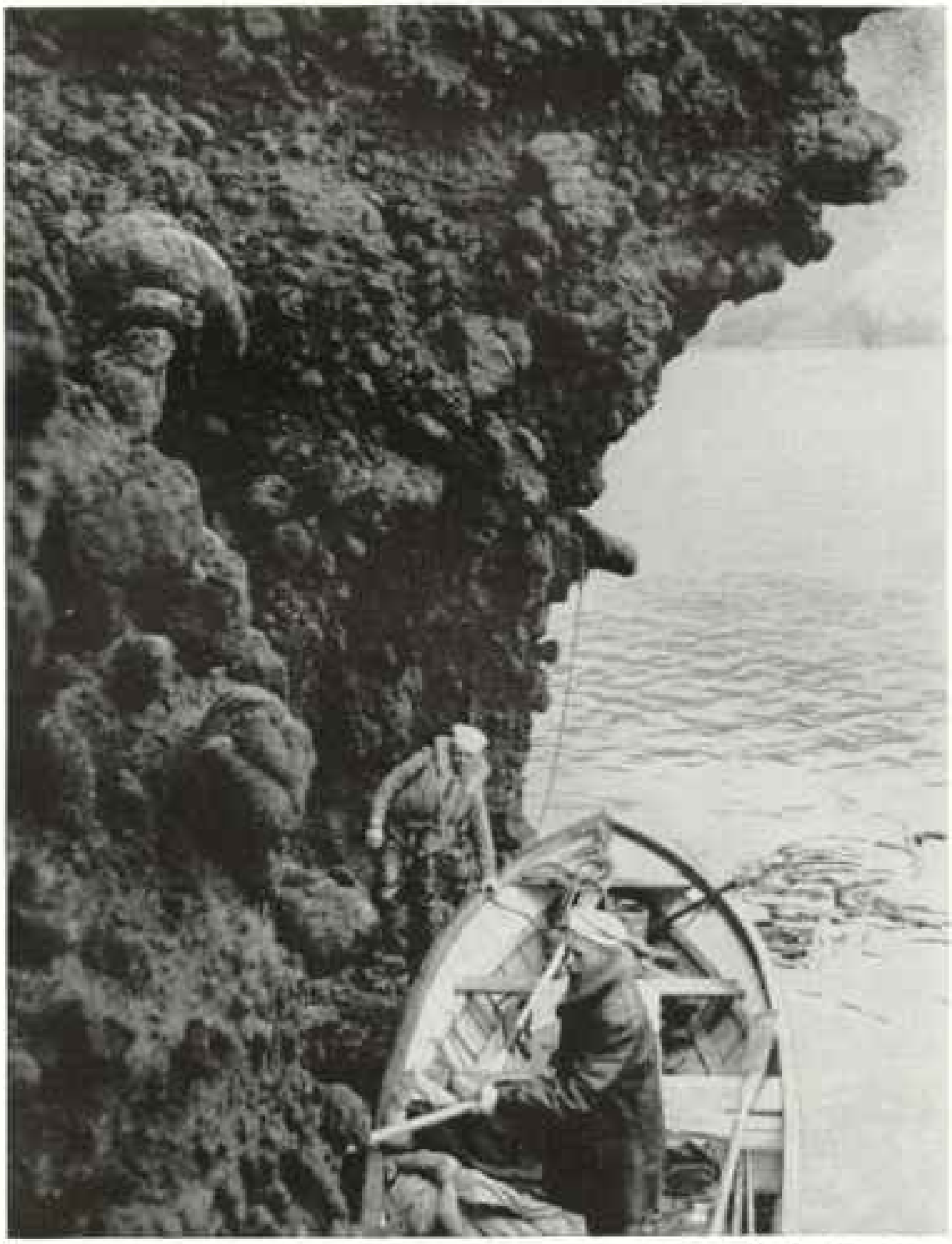
In Proud Remembrance, Memorial Day Is Observed at Unalaska

Among the largest of the Aleutians, the island of Unalaska includes a native village of the same name, and Dutch Harbor, a rapidly developing center of American military strength. Unalaska's population in 1940 was 296.

These naturalists had put notices on some of the larger islands, proclaiming them "Wildlife Refuges." On those islands visitors were not allowed to carry firearms or to molest the animals.

At Amchitka such a notice was specially apt, for the remnant of the once extensive sea otter here was breeding again. We picked up our chief officer and two companions. They had been camping on the island to observe and count this herd, while keeping an eye open for Japanese poachers whose presence was suspected.

A few skins of this beautiful fur, which once charmed the Empress Catherine of Russia and her ladies-in-waiting, had unaccountably found their way into the market at Seattle. Some footprints, too small to be made by white men, had been noticed, but their makers, who had hidden on the arrival of the Coast Guard, had slipped away in the mists, for no other trace of them was found.



Allan G. May from Three Lions

Such Difficult Landings Are Common in the Aleutians

Visiting steep-sided Wislow Island depends on the whim of wind and tide. A landmark for entering Unalaska Bay from Bering Sea, it is a small, rounded mass about two miles from Cape Cheerful.

Perhaps because of the suspected presence of the poachers, the captain kindly lent me an assistant when I went plant-hunting on Amchitka. We remained two days in the pretty harbor of Constantine.

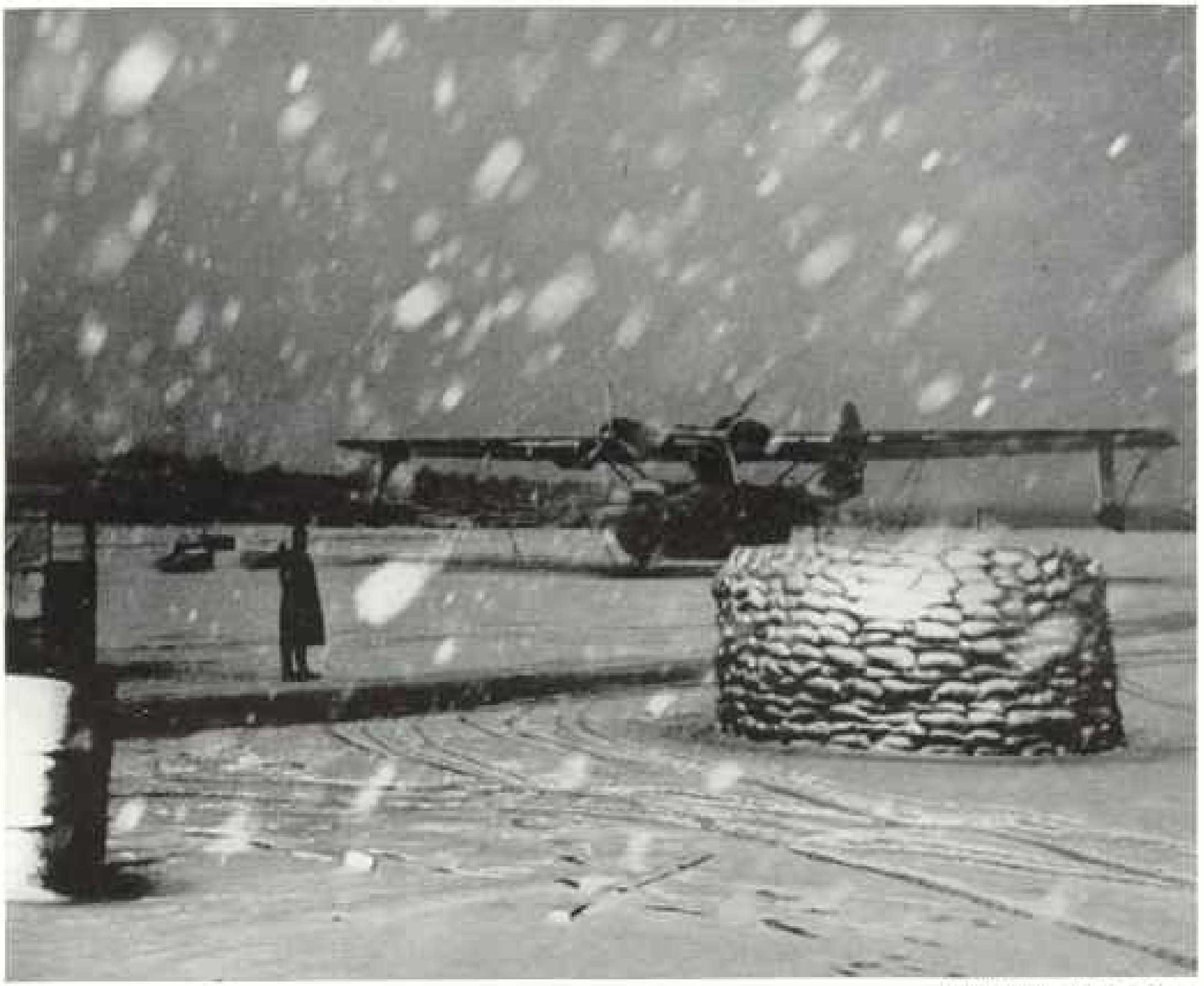
My helper was an interesting companion, his mind stored with unusual lore. Though botany was new to him, his jobs in the Coast Guard, he said, had ranged from gravedigger to nursemaid.

Amchitka is one of the flattest of the Aleutians, with a rich vegetation. I added about 50 species to my list. The weather was ideal; the finest two days the captain said he had ever seen in all his Aleutian experience.

While he and the doctor, who were ardent fishermen, explored a small lake teeming with Dolly Vardens and other trout, I set out with my assistant. He had offered to show me the sea otters, and we found the little rocky cove which they were said to frequent. I filmed its blue waters when my companion insisted he saw the black head of one of these rare creatures, but for my part I could see nothing but golden seaweed.

"There's a plant in Unalaska," said the sailor, "that the natives make into a drink for coughs and colds. I've drunk pints of it myself and it's real good."

"You don't mean the potato, do you?" I asked, for I had read some strange stories of the use to which the natives put the



Official Photograph U. S. Navy

An Aleutian "Whiteout" Grounds a Navy Patrol Plane

"Cradle of the Storms," they call the islands because of the wild weather. Visibility is reduced to zero by Nature's flaky blindfold. Winds blow frequently with hurricane force; the seas are seamed with tide rips, shoals, and swift currents. Sandbag "pillboxes" are new features of the landscape.

fermented potato in the manufacture of the illicit native drink called "peevy."

But my friend assured me that the Eskimo potato was a different thing, though also eaten by the Aleuts.

"These islanders," said the Coast Guardsman seriously, "didn't need a doctor till the white man came along. The Aleuts on Attu are the happiest of the lot, and the best. I hope they'll land you there. You'd like to visit with Rock of Ages; there's a nice old woman!"

I had heard of this interesting personage, Maggie Prokopoff, aunt of the Chief of Attu. She is the daughter of a native chief. She claims to have been married to a Russian officer of high rank, and to be the best dancer in the Aleutians. She is still the most skillful basket weaver.

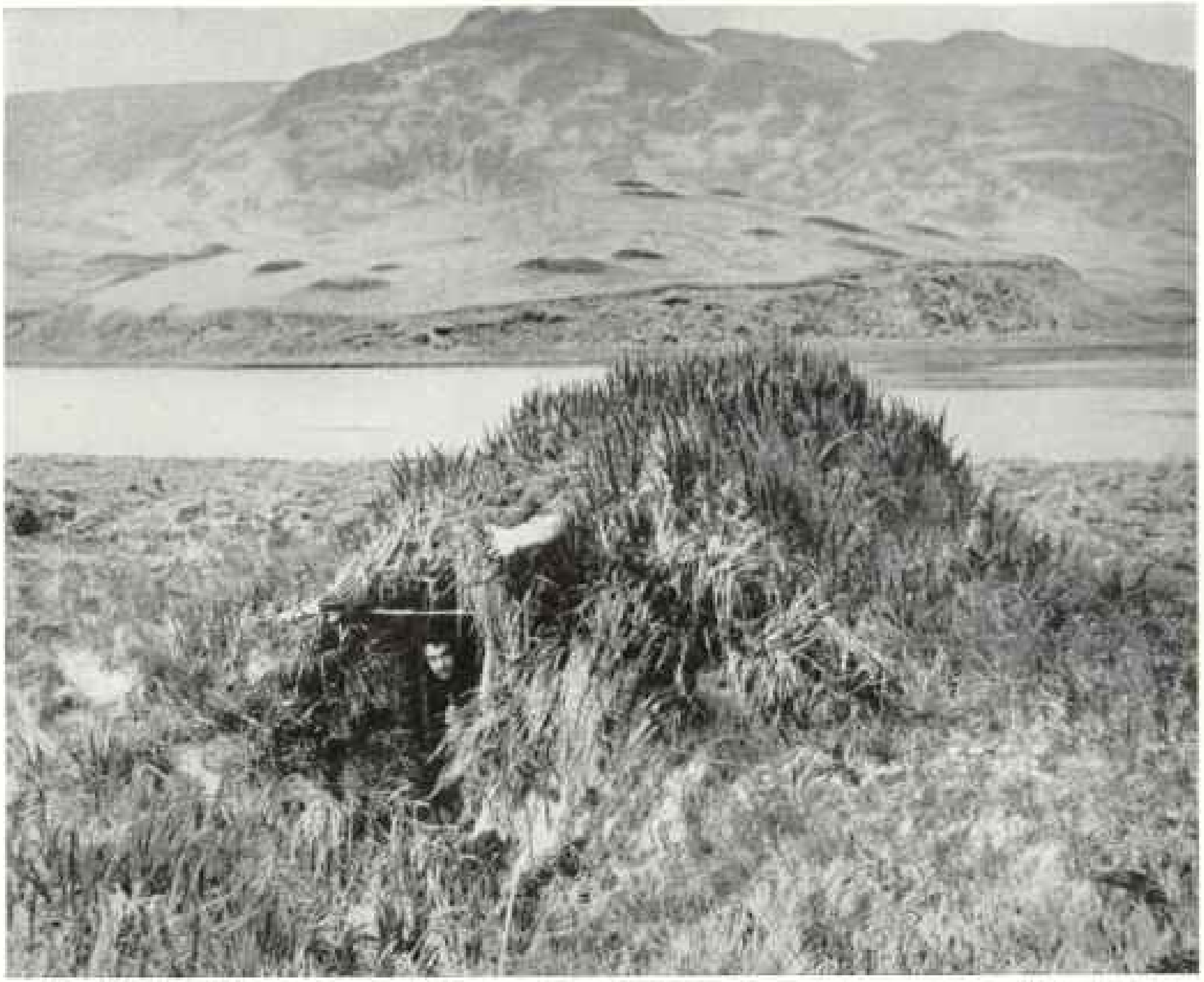
"Why do you call her 'Rock of Ages'?"

"Because she never changes from what she was years ago, white teeth and grin and all," was the answer. "Maggie's a fine old girl. But they do say that she's begun to hanker after Unalaska again—she used to live there. Thinks of the cinema, and the dancehall, and all that. I guess Unalaska seems like little old New York to poor Maggie. She's mighty fond of tobacco. You'll want plenty if they land you, but landing's none too easy there.

"Chichagof's a very bad harbor. I remember once the captain of one of the cutters telling me he thought they were at Chichagof, and the mist was so thick they found they were right at the other side of the island. I wouldn't bank on landing, if I were you."

Difficult Landing at Attu

He was right. Landing at Attu was a touch-and-go affair, for the spell of good weather, unprecedented for this area, chose the very moment of our arrival at Attu to break. Once this happens, it is likely to keep on blowing for the rest of the year.



AP from Press Assn.

Native Dugouts Provide Ready-made Fox Holes for the Japanese Occupying Kiska

Sod huts, known as "barabaras," were the original dwellings of the Aleuts. Driftwood timber and whalebone hold up the roof. Entrance to the single room is by tunnel and ladder. This type of shelter was favored by fox trappers. As military cover the grassy camouflage is ideal.

Curiously enough, we finally approached Attu from the Asiatic side, fresh from charting our new reef in the waters near the International Date Line. Landing is possible only in moderate seas.

For two days we rolled around on the heaving waters within sight of the cluster of houses behind the beach. At last, on Sunday, August 30, the winds moderated enough to allow landing.

The Chief, Mike Hodiakoff, an intelligent young native, met us with outstretched hand on the shore of his little Eden. He was dark-skinned, with rather bluish eyes, a wide mouth and nostrils, and good teeth. His brown-faced ten-year-old son accompanied him.

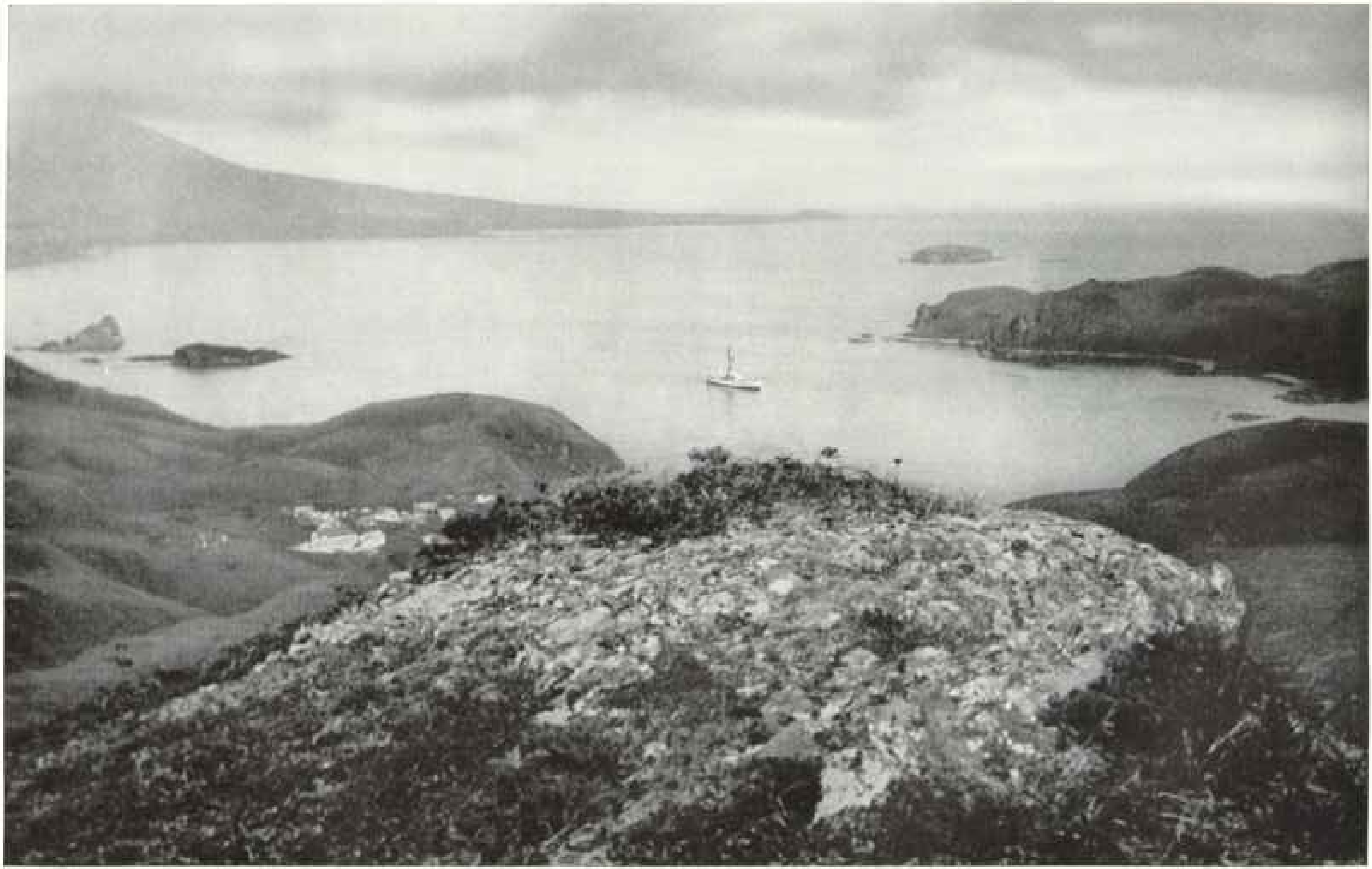
All the natives were dressed in their Sunday best, which in Mike's case consisted of a Coast Guard officer's discarded jacket laced with tarnished gold braid. A pilot cap with glazed peak, and navy trousers with top boots, added another nautical touch (page 780).

I went to the Chief's house before setting out plant-hunting. There I met Maggie and Anaisie, Mike's comely wife. Maggie was a lively, friendly creature with a highly Mongolian cast of feature. She drew me into the pleasant living room with its stove, mirror, and pictures, talking volubly in fairly good English.

I learned later that the chief's house also sheltered an old blind man whose relatives would not keep him. Mike was a chief in more than name.

The old man was reputed to have been born in 1833. That would make him 103 years old at the time of our visit. When I last heard of him in 1937, he was still living.

As there was no priest on Attu, service was conducted by Chief Mike. It was attended by the resident community. The island was a children's Paradise, for there were only 11 upon the island, and until there were 12, I was told, no teacher would be sent there.



Isobel Wylie Hutchison

Coast Guard Cutter *Chelan* Anchors in Nazan Bay on Atka, Largest of the Andreanofs

When Cape Kudugnak, marking the entrance in the distance, is fogbound, this snug inner harbor may be clear of mist. The outer bay, facing Amlia Island, is open to the sea to the eastward. Fewer than a hundred islanders normally lived in the frame houses nestling at the foot of the mountain (left center). United States forces have occupied bases in the Andreanof group, from which planes now operate to bomb the Jap stronghold at Kiska.

Wide World

Old Russian Tools of War Interest Three Sailors Giving Unalaska the Nautical Oncecover

Biggest town in the Aleutians, Unalaska was headquarters for the Coast Guard's Bering Sea Patrol. A cable ferry connects Unalaska with Dutch Harbor across Iliuliuk Bay.

Official Photograph U. S. Navy

Bomb Geysers Carry Death in Their Spray—a Wartime Spectacle with Japanese Sound Effects

Dutch Harbor gets its baptism of fire on June 3 and 4, 1942. The water took much of the punishment, reacting with a cluster of Old Faithful geysers. Ship in background beat off attack with machine gun fire.

©Official Photograph U. S. Navy

"U. S. Bombs Kiska Continually," Headlines Report. Here a Jap Transport, Ablaze and Sinking, Meets Her Doom in the Harbor

Ever since the U. S. Navy and Army occupied their new bases in the Andreanof Islands, mountainous Kiska has been constantly raided, our bombers destroying enemy seaplanes, cargo ships, transports, destroyers, munition dumps, and troop concentrations. All of these were once a threat against Alaska and the United States. Kiska's harbor, one of the best in the Aleutians, provides ideal anchorage for ships. This island was uninhabited at the time of the Jap invasion.

U. S. Army Signal Corps

Fighting Ever Westward, American Army and Navy Forces Established New Bases in the Andreanofs

Swiftly and efficiently they land men, guns, and supplies from barges on the pebbly beach. Obviously this westward advance is part of the methodical plan to oust the Japanese from United States territory and then strike at Japan's own insular appendage, the Kuriles.

U. S. Army Signal Corps

Packed Tightly in a Transport, Soldiers Check Their Guns and Equipment

In the morning they expect to see action when they land in motor launches through the surf of Andreanof beaches. Fortunately occupation of the islands and the setting up of new bases met with no interference from Japanese ships or planes.

I could not attend the church service, for my time was short. With my assistants I set off hurriedly to explore the valley and hills which promised the quickest results.

Attu is 40 miles long and about 20 wide. Its snowy peaks, the highest more than 3,000 feet, were sighted by Vitus Bering's sailors in 1741. Behind the village of Chichagof a small stream empties the waters of a lake into the harbor. The hills are clothed in verdure.

The vegetation immediately showed itself to be different from that of the other islands we had visited. We had gone scarcely a step from the chief's door when I was rewarded by the sight of one of the Asiatic species I had hoped to find here. This was a drooping purple thistle (*Cirsium kamtschaticum*). Presently I met another migrant from Asia in the large-leaved *Cacalia auriculata*.

On we went up the hills, gathering plants and flowers in feverish haste, while the church bell tinkled in the vale below.

Even at this eleventh hour, Attu repaid me richly for my long-deferred visit. Still in full bloom, hanging her lovely rose-pink tassels and crimson-tinted leaves over a little mountain gorge, was a beautiful spiraea-like plant not seen elsewhere on the Aleutians, *Aruncus sylvester*. Beside it, with berries already scarlet, stood a stunted rowan of an Asiatic species, *Sorbus sambucifolia*, which has rather large, orange-red fruit.

In less than two hours we had collected about 70 species, despite the fact that the flowering season on the islands was nearly ended and seed was being set. All too soon our brief morning on this solitary ocean Paradise was over.

In a cloud of spray afloat, and tobacco smoke ashore, for we had left behind us nearly half the contents of the *Chelan's* canteen, Attu faded into the mists. We had anchored just in time, for the gale was blowing up again.

From the bridge I took my farewell glimpse

U. S. Army Signal Corps

Soldiers Search for Their Duffle Bags on an Andreanof Beach

To a soldier, his barrack bag means everything. It contains all his worldly belongings, such as dry uniforms and personal gear. He dreads losing it in these cold lonely islands almost more than meeting the enemy. Contrast the worried looks of the men still searching with the contented expressions of the others.

of the island I had traveled around the world to see. The mountains were draped in fleecy clouds from which the sun struck fire. It was a noble sight.

On to Kiska

Our voyage was nearly over, but a call at Kiska remained. This lonely, at that time uninhabited island (the Japanese are there now) lies 180 miles to the southeast of Attu, between the large mountainous island of Agattu and Amchitka. It is 25 miles long and about five wide, with an indented coastline and high volcanic peaks.

"Kiska," said the *Chelan's* captain, "has the only good harbor in the Aleutians west of Dutch Harbor."

The wide, landlocked bay, sheltered to the east by Little Kiska, has a curving stretch of sand which extends for two miles. Forty ships, it is said, could anchor in the bay and be safe in all weathers.

We remained three days in this haven to calibrate the compasses. Though the island was a closed shore to aliens, and the harbor reserved for the sole use of the United States Navy, there were no buildings there—not even a jetty. As we splashed ashore through the surf, two sea eagles hovered near to inspect us, and a surprised fox paused on the sands to stare.

Botanically, Kiska was very interesting. One morning I clambered to one of the high summits. On this top, wind-swept and barren, I found a plant new to the flora of the Aleutians, the silvery-leaved *Artemisia borealis*.

On the lower slopes there also grew a white dwarf poppy. I was able to gather seed, and it is now established in Scotland, along with a beautiful deep-blue veronica (*V. grandiflora*) which grew near it on the mountain slope.

Kiska's highest peak is more than 4,000 feet.

Isobel Wylie Hutchison

Unfortunately, This Happy Aleut Family Was Captured when the Japs Took Attu

No word has been received from the 96 native Aleuts or from Mr. C. Foster Jones of the Office of Indian Affairs and his wife, the schoolteacher, since the occupation of the island. Presumably they are prisoners of war. United States aviators reported no signs of life on Attu in September, 1942.

It was first climbed by Dr. Hobart Egbert of the United States Coast Guard, in 1905, when it was still a slightly active volcano.

On the third morning the compasses were calibrated. In the early afternoon we sailed past the two Haycock Rocks which guard the entrance.

Away to the right another cone, wrapped in cloud like a half-iced cake, rose to meet us as lofty Kiska faded from view. In my presses I carried some 50 species of the island's flowers, and several packets of seed, a satisfying bouquet for a September morning in the Aleutians.

Two days later, after a second call at Atka to pick up the schoolmaster and his wife, the dim outline of Unalaska rose slowly out of the gray seas.

There came a knock at my cabin door. It was the captain. Into my hand he put a small, tightly rolled package, with the injunction not to open it till I got ashore. But discipline was beginning to slacken. I opened the package then and there. Inside was a small navy-blue flag which proclaimed me, in black letters down a white canvas margin, "Admiral of the Bering!"

In place of an admiral's stars and crossed swords were four yellow flowers skillfully made by the quartermaster on his sewing machine, and two peculiar designs which I was told represented crossed hairpins.

This little flag is now one of my most valued possessions, a souvenir of happy days spent with the United States Coast Guard in charting the untraveled waters of the Aleutian Trough.

As for the *Chelan*, her recent history is best related in the words of Captain Kielhorn, for she is the *Chelan* no longer. Last year he wrote from Washington:

"A couple of weeks ago I went on board the *Chelan* for a last cruise and with my own hands I compensated her compasses, and saw, too, that she was in good shape and fit for a duty far different and under different auspices than any of us could have dreamed five years ago.

"She is now called after a coastguard station in England and her captain, so I am told, is a fine young Scot. I am sure she will give a good account of herself, for she was always a lucky ship."

[On September 27, 1942, the British Admiralty announced that the former United States Coast Guard cutter *Chelan*, renamed H. M. S. *Lulworth*, had rammed and sunk an Italian submarine, and possibly had sunk a second, in a spectacular encounter in the Atlantic Ocean.—Editor.]

Mother Volga Defends Her Own

By Maynard Owen Williams

With Illustrations from Photographs by the Author

FIFTY feet below the level of the Seven Seas, one of the great battles of our time began in mid-August at Stalingrad, beside the Volga. Fall rains have gummed up the north Russian swamps, and winter has moved south to slow the sluggish brown river into a 2,300-mile strip of ice.

Most of Stalingrad's machinery has been evacuated. The Soviet army, assisted by the women workers who bring ammunition in and carry the wounded out, fights on, while the Volga flotilla pounds at the German batteries. Russians are fighting with their backs to "Matushka Volga," the largest and today the most fateful river in warring Europe.

When I first knew "Little Mother Volga," she crept peacefully past Byzantine domes which look like upturned beets. She swirled around rickety landing stages where women in spotless head-shawls sold baked fish and breadstuffs to uncouth muzhiks with matted beards.

Like our "Old Man River," the Mississippi, which she resembles in crawling length, in wide delta, shifting channels, and treacherous sandbars, Mother Volga knows what it is to "tote dat barge." The somber "Song of the Volga Boatmen" evokes a picture of peasants digging their bark sandals into the slippery mud and swaying their bodies against towlines which furrow their heaving chests.

Then came the modern steamers of the century-old Volga Steam Navigation Company and shallow-draft oil barges, bringing up fuel from the Baku refineries (pages 795-6). On broad decks, passengers sat at ease or dined on sterlet or beef Stroganov. Through wide windows they watched the sunset behind the relatively high west bank (page 800).

The lower river at times spreads wider than the English Channel between Dover and Calais. Low, dark masses, each with its cabin, seemed like islands. Then crude sweeps in motion showed them to be log rafts, ponderously floating down from dark forests toward the barren, treeless steppe, there to be broken up on the river bank at journey's end.

Peacetime Volga was becoming a power source and thirst quencher for earth and man. In 1937 an elaborate system of dams, canals, generating and pumping stations was completed between Russia's thirsty metropolis and the river. Moscow began to drink its fill of Volga water and to enjoy more baths.

Snow-white, streamlined pleasure boats moved through artificial lakes. Outboard motorboats skipped past the new port building at Khimki. To white-bloused tea drinkers and muffled skaters, reclamation was fun.

For the first time, two chief objects of Russian devotion—Little Mother Volga and the Kremlin at Moscow—were joined. When the crowded capital needed electricity, hydroelectric stations generated power. When "juice" was not in demand, electric motors pumped water over the rise between Volga and capital. That is a long way from barge-hauling by the thigh-power of Volga boatmen.

Other plans were afoot. Across the now blood-drenched, savagely contested neck of land between the Don and the Volga, another canal system was to turn Europe into an island, bounded on the east by an all-Russian waterway from the White Sea to the Black.

Around the Samara's "Horseshoe Bend"

Near the Samara Bend, the largest hydroelectric station in the world was to stretch its two-mile dam and force the mud-heavy Volga to do the quick, clean work of turbine and dynamo. It was planned to generate more power than Grand Coulee wrings from the steeper Columbia.

Then, as at Chicago, streams were to flow backward, and northbound rivers, now wasting their waters in the Arctic Ocean, would refresh the thirsty wastes around the Caspian. From rain-soaked forest swamp, Volga water flows into the Caspian Depression, where pitiless sun and parched land drink it up.

East of Moscow, where the Volga joins the Oka, Nizhni Novgorod has become Gorki and the famous Fair has been eclipsed by the Gorki Motor Works (page 808).

From Gorki's kremlin, whose walls occupy the site of a 13th-century palisade, one can look down on the low-lying fairgrounds to which tea came overland from China, iron goods from the Urals, fish from the Caspian, and furs from Siberia.

I still remember the fur-lined, fur-collared coat of heavy broadcloth which I stroked there at the Nizhni Fair. Alexander Kerensky had made his last speech in Moscow's Grand Opera, and October 25, 1917, Soviet Independence Day (November 7, New Style) was close at hand. But the afternoon sun was warm, my baggage was heavy, and so was the

coat. How often, during that bitter winter in Transcaucasia, I regretted my indecision at the Nizhni Novgorod Fair!

As I passed the stalls of accordions and icons, looked at the goldwork in Brazilian Passage, or fingered Persian carpets in the Caravanserai, the Fair was slowly dying. War had kept some dealers home. Private trading was on the decline.

Even the ornate cathedrals seemed monuments of the past. But in the little mosque, beside a canal near the back of the fairgrounds, Moslems from Asia touched their foreheads to soft-colored rugs as they bowed toward Mecca, far to the south.

Tatar Kazan Smells of Russian Leather

The Asiatic aspect of Volga life becomes even more pronounced in Kazan, which smells of Russian leather. It has many humble mosques, although church domes and steeples dominate the skyline. Their presence symbolizes the triumph of Slavic Christians over Mohammedan Turko-Mongols. But for Slavic success and Yermak's conquest of Siberian lands, the Volga, not the Urals, would be the edge of Asia.

Since Kazan's name never smacked of tsardom, it was kept as that of the capital of the Tatar Autonomous Soviet Socialist Republic. This Tatar Republic is one of several such autonomous regions along the Volga. In each of them, loyalty to the Soviet Republic has developed without interference with local cultures. The Maris, Chuvashes, Tatars, Volga Germans, and Kalmyks speak their own languages and retain many of their own customs and costumes.

Although Kazan manufactures typewriters and movie film and has become a center for scientific factory production and agriculture, its Asiatic cast of countenance dates back to the Golden Horde. Led by descendants of Genghiz Khan, these Tatars swept across Europe to Hungary. They retreated to pitch their magnificent camp across the Volga from the site of Stalingrad and were crushed, after a century and a half of nomadic warfare, by Timur the Lame.

High above the little Kazanka River is a Tatar tower which bears the name of a legendary Princess Syuyumbeka, who threw herself from the 250-foot height when, after a long siege, Ivan the Terrible took Kazan in 1552.

Below Kazan the clear waters of the Kama, sweeping in from the Urals to mix with the muddy Volga, brought passengers to the rail. From here on the Volga's course is to the south, and a high bank, cut by ravines down which passengers pour to the steamer, lies to the west. The low east bank is the western edge of steppe lands where Kirghiz and Mongol roam between the Volga and China's Yellow River.

Always on Volga River trips I would visit the crowded quarters below. Men, women, and children lolled about, resting wherever they could, drinking boiled milk or kvass from upturned bottles, tearing the crinkly skin of freshly baked fish or eating the heavy black Russian bread.

In the Days of "Wall Newspapers"

All around were the "wall newspapers" which were long prominent in Soviet life. They were highly colored, and often embellished with original cartoons. Combination poster and gossip sheet, these periodicals had a high ratio of readers per issue. When I tried to get one as a souvenir of awaking Russia, I was told the demand was so great that they were distributed by lottery to become decorations of the home.

Volga steamers burn *mazut*, a by-product of oil refining, and the throb of huge filling pipes to the thrust of the pumps is always a source of wonder as the steamers wait at landing stages. These may rise or fall as much as 50 feet between high water and low, depending on seasonal swelling.

The Volga voyage in other days was as peaceful as it now is stark drama, when every available bottom is on war duty. Passengers slept late and spent long hours at table, but in one stretch paying attention to the scenery was a "must." Below Stavropol the steamer enters as much of a gorge as the landscape allows and circles the 100-mile Samara Bend to arrive at a spot only 13 miles away, across the neck.

This is to become the greatest hydroelectric center in Soviet Russia, and a vast area on the east bank, from Kuibyshev to Stalingrad ultimately is to be brought under irrigation. Since water diverted to irrigation will not reach the already shrinking Caspian, Russian scientists planned to tap a whole succession of rivers, reaching as far as the Dnieper.

By making the Crimea an island and diverting fresh water into the Sea of Azov, this might be done without killing the Don-fed fish. As in America, reclamation engineers have to consider many problems.

Samara Bend is the key to vast changes which will facilitate irrigation and river traffic and rob the Arctic of iceberg material in order to give thirsty central Asia a drink. The hydroelectric works at both ends of Samara Bend are major factors in this vast scheme.

Volga Passengers on the *Karl Marx* Enter the Caspian through a Man-made Channel

Where Russia's life line enters the Caspian, dredges continually clear a deepwater passage through encroaching silt. Up this longest river in Europe flow vital Baku oil and United States lend-lease supplies, sent to Russia through Iran. The Caspian, 85 feet below sea level and with no outlet, is ever becoming shallower.

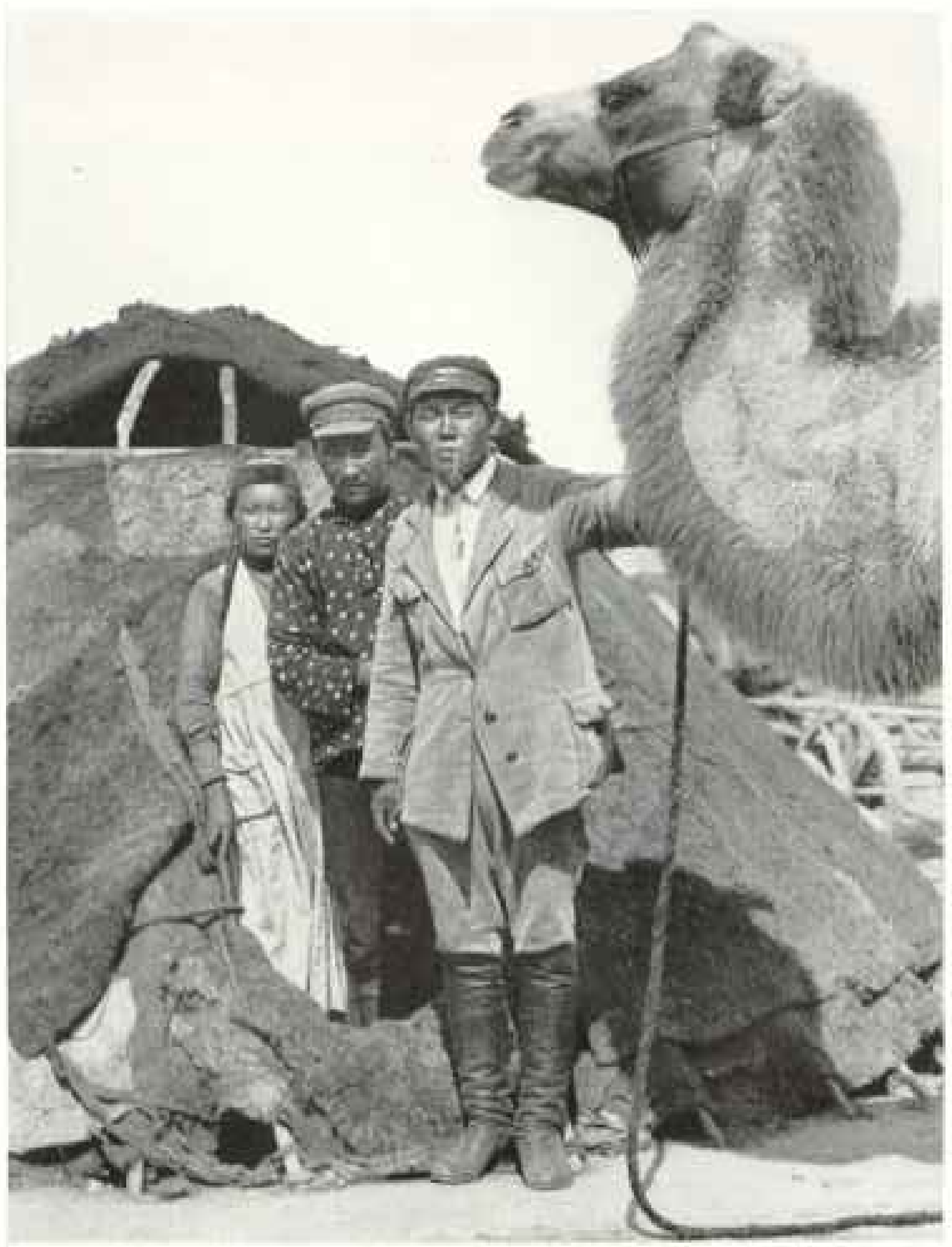
To Hungry Peasants in Peacetime, Eating or Sleeping, the Volga Voyage Means One Big Loaf

Before embarking at Nikolskoe, deck passengers buy fruit and an armful of bread. Hot water for tea is always available and many travelers carry their own teakettles wherever they go. Because the river trip was considered a rest cure, first- and second-class quarters on the upper deck were maintained in relative luxury with single cabins and excellent restaurant service.

Hattie B. Wood

Assistant Captain Brietzovskaya Gives Orders by Trumpet

Women, such as this officer of the steamer *Goncharov*, have long played a part in Soviet life. Housewives and industrial workers, even children, assisted in the defense of Stalingrad.

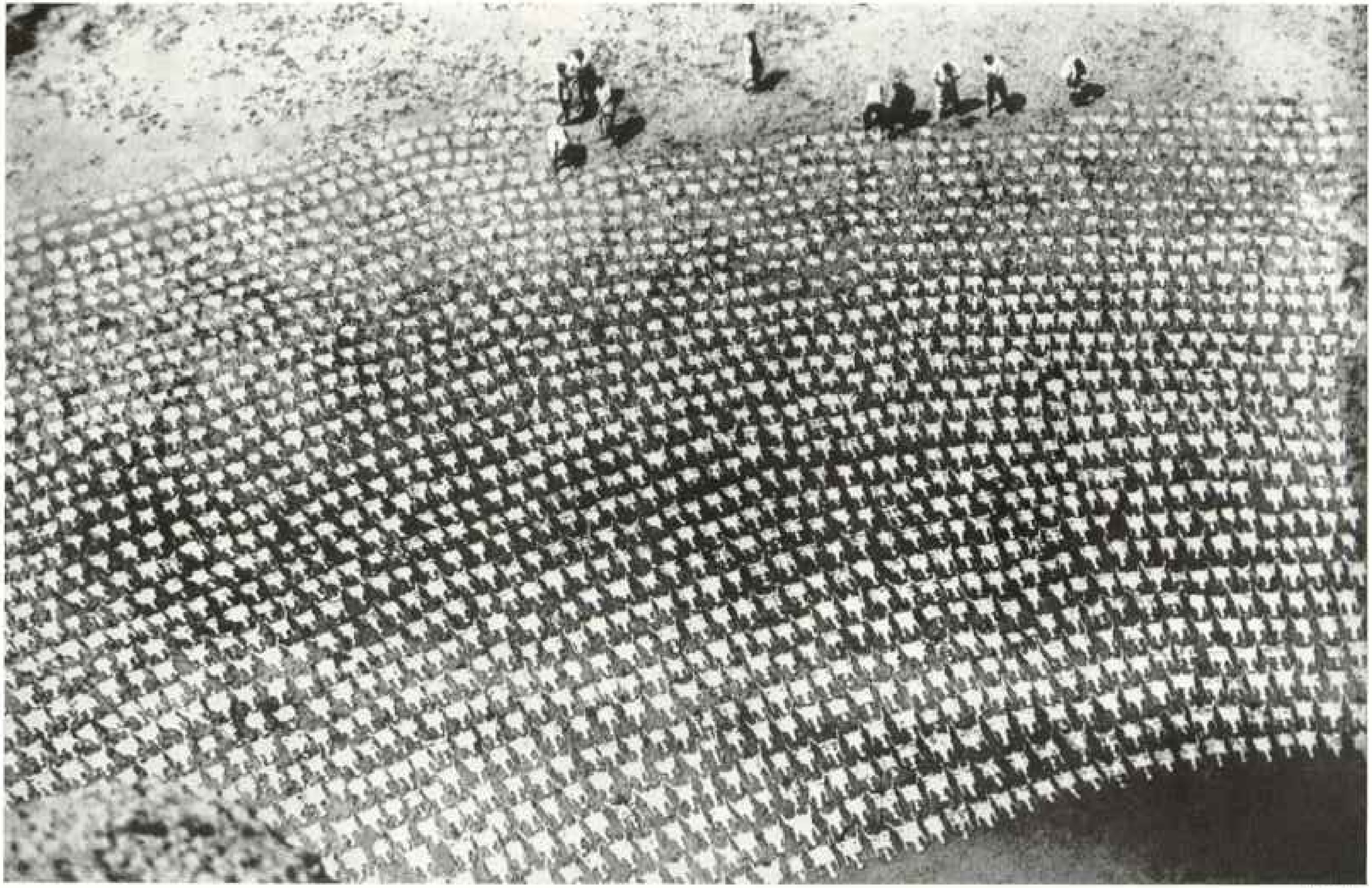


Herodotus Described Such Kalmyk Dwellings 2,400 Years Ago

Though these Mongol nomads are being encouraged to settle and farm along the lower Volga, they still cling to felt tents, their traditional homes on the Asiatic steppe (page 809).

Astrakhan Fisher Folk Gather about the Samovar, Shiny Symbol of Slavic Hospitality

When a connoisseur shows hospitality, he orders expensive caviar, served in a block of ice. In Astrakhan, near the mouth of the Volga, bread and tea are relished by the peasant who could have the choicest caviar, if he preferred it. When the sturgeon roe is prepared for export the eggs are separated from the membrane and fatty substance by whipping with twigs and sifting.



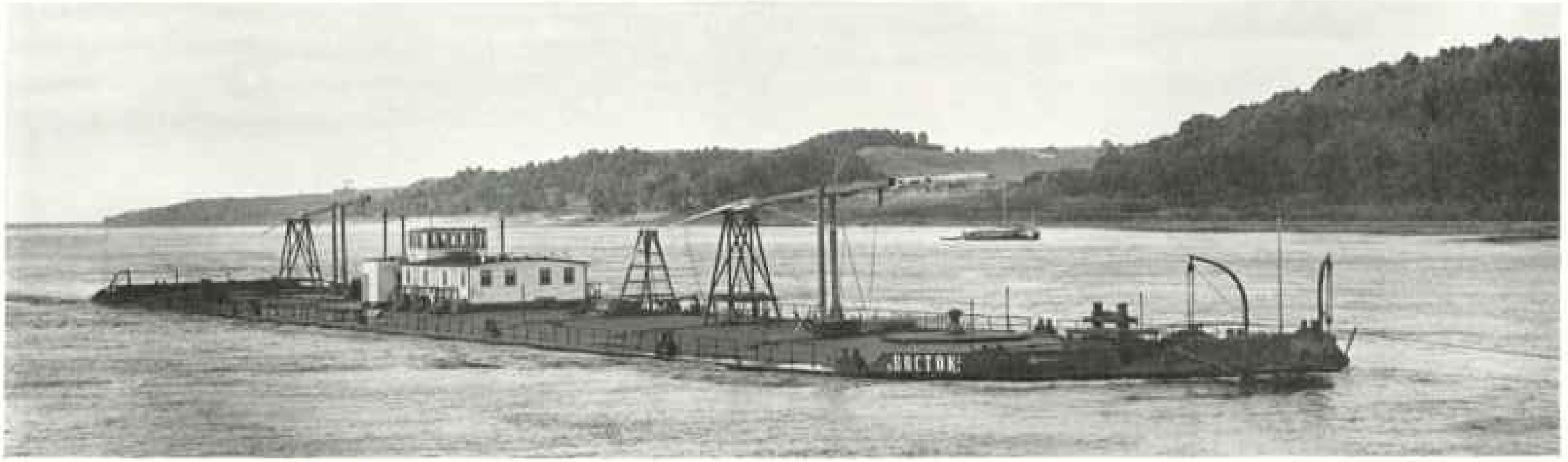
Keystone

Karakul Pelts, before Tickling Feminine Fancy and Chins, Are Regimented on Astrakhan's Sun-baked Steppe

When grandmother wore the tightly curled fur of young or stillborn lamb, she called it "Astrakhan." Now the trade name for that fine fur is Caracul Lamb, which includes the choice but perishable Broadtail, the tightly curled Persian and Krimmer Lamb. The best skins come from Afghan and Russian Turkistan.

Wartime Soviet Capital of Kuibyshev Presents an Imposing Facade to the Volga

In mid-October, 1941, when the Germans were advancing, Kuibyshev became temporary capital of the U.S.S.R., although Stalin remained at Moscow.

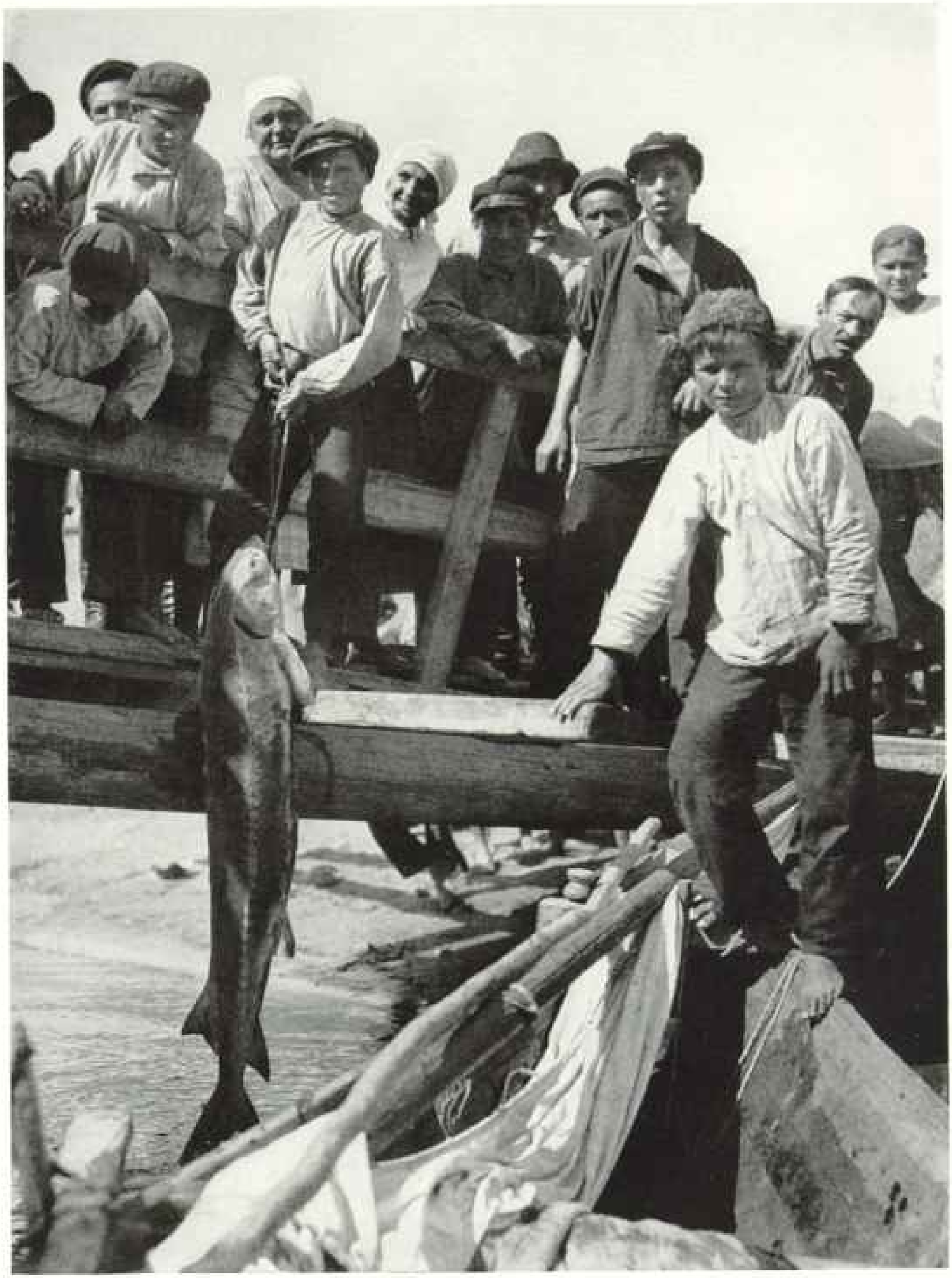


The *Vostok* Must Be Up-river Bound—She Is Chock Full of Oil and the Volga's High West Bank Is to Port

To gain the Volga and sever this vital artery for oil from Baku, the Germans launched their costly Stalingrad drive.

Such Smiling Women of Stalingrad Are Helping in Its Stubborn Defense

Behind the fruit sellers is a spur line beside the Volga, whence trains formerly ran to the Don. A year ago Stalingrad was a long, riverside industrial city of nearly half a million. Today most of the machinery is gone, the city a shambles, and its name famous for its stubborn stand against Nazi attack.



He Keeps His Live Sturgeon on a Leash until a Buyer Comes

Along the lower Volga, a lad pulls up a sturgeon for inspection even though he knows it is "no sale." In Astrakhan there are large tanks in which the live sturgeon are kept. From one large roe sturgeon may come caviar worth $480 in Washington, D. C., retail stores. Little caviar is being imported into the United States today.

Asia's Burden Bearer, Turned Draught Animal, Rests beside the Volga

In the hot Kalmyk steppe a ship of the desert grounds his bony keel close to Russia's chief highway for river boats.

Apple Seller and Old-clothes Man Count the Cost at Stalingrad

That was in peacetime. Now the whole world counts the cost of inching forward and back through the war-torn streets, perhaps paying as many lives for an apartment house as it would hold in tenants.

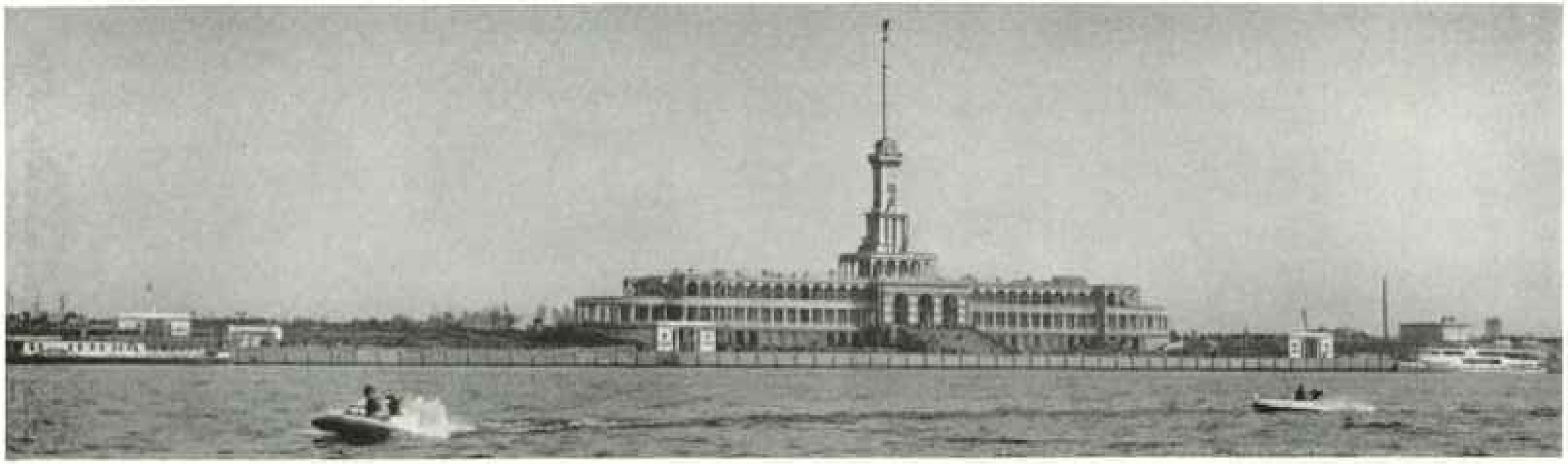
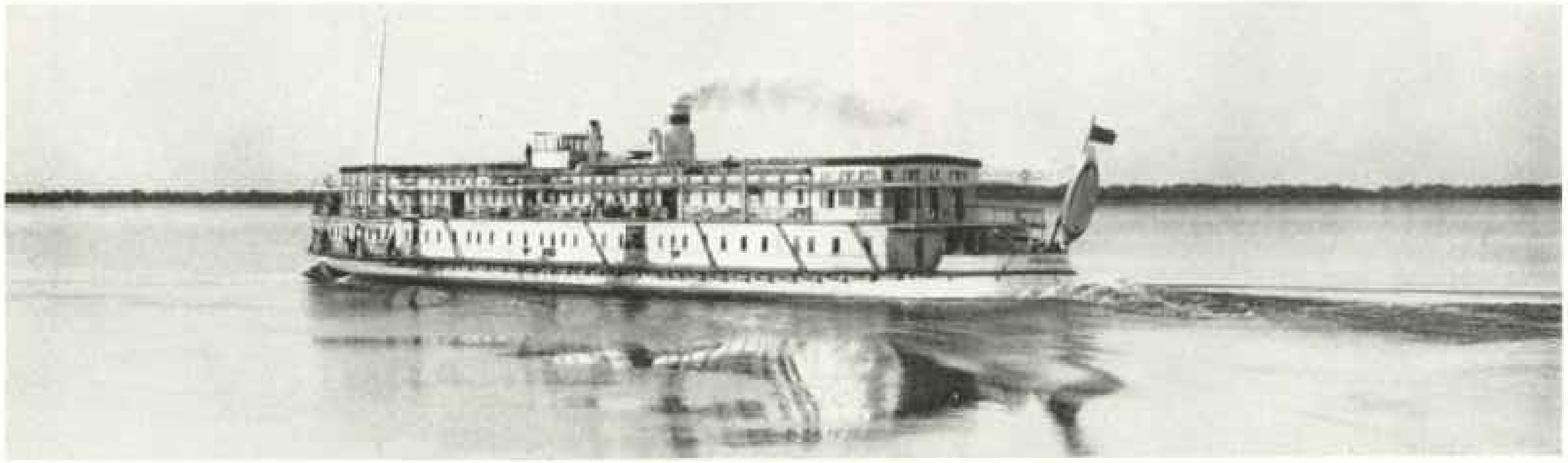


Photo U.S.S.R. Embassy

Outboard Motors Race Past the New Port at Khimki, on the Moscow-Volga Canal

Formerly this was a neglected, narrow ravine. Now tea drinkers crowd the colonnades, and in winter the port becomes a skating rink.



With Its Tender Hung Like a Fishing Trophy, a River Steamer Shatters the Volga Mirror

Brain Food Paves a Street at Kuibyshev, Wartime Capital of One-seventh of the Earth

One corner of an outdoor market is devoted to books, some of them dating from before the revolution. Since October 25, 1917, thirst for knowledge has been a noticeable feature of Soviet life. In 1939, newspapers in the U.S.S.R. had a circulation of 37,500,000 and nearly 45,000 books were published in 99 languages.

Lenin, Standing on a Mechanistic Monument, Symbolizes the Turn toward Machines

Since the early days of Soviet Russia, emphasis has been on bolts, nuts, and mechanical processes. From this spot in Stalingrad, factories spread up and down the Volga for miles. After seven weeks of bombardment, some of these shops still repaired Soviet tanks and trucks while under fire.

A Sunday Market at Kuibyshev Spreads Its Stalls beside a Bright-domed Church

The breath of winter has already touched this outdoor market, though it is only mid-October. The women have added a petticoat and the men donned warmer coats. Anything is sold here from fruit to large-horned phonographs. Now Kuibyshev's hotels are crowded with diplomats and refugees from the war to the west.

Ritts Photo from Wide World

A Massive Cathedral Dominates the Flat Site of the Annual Market at Gorki, Granddaddy of Fairs

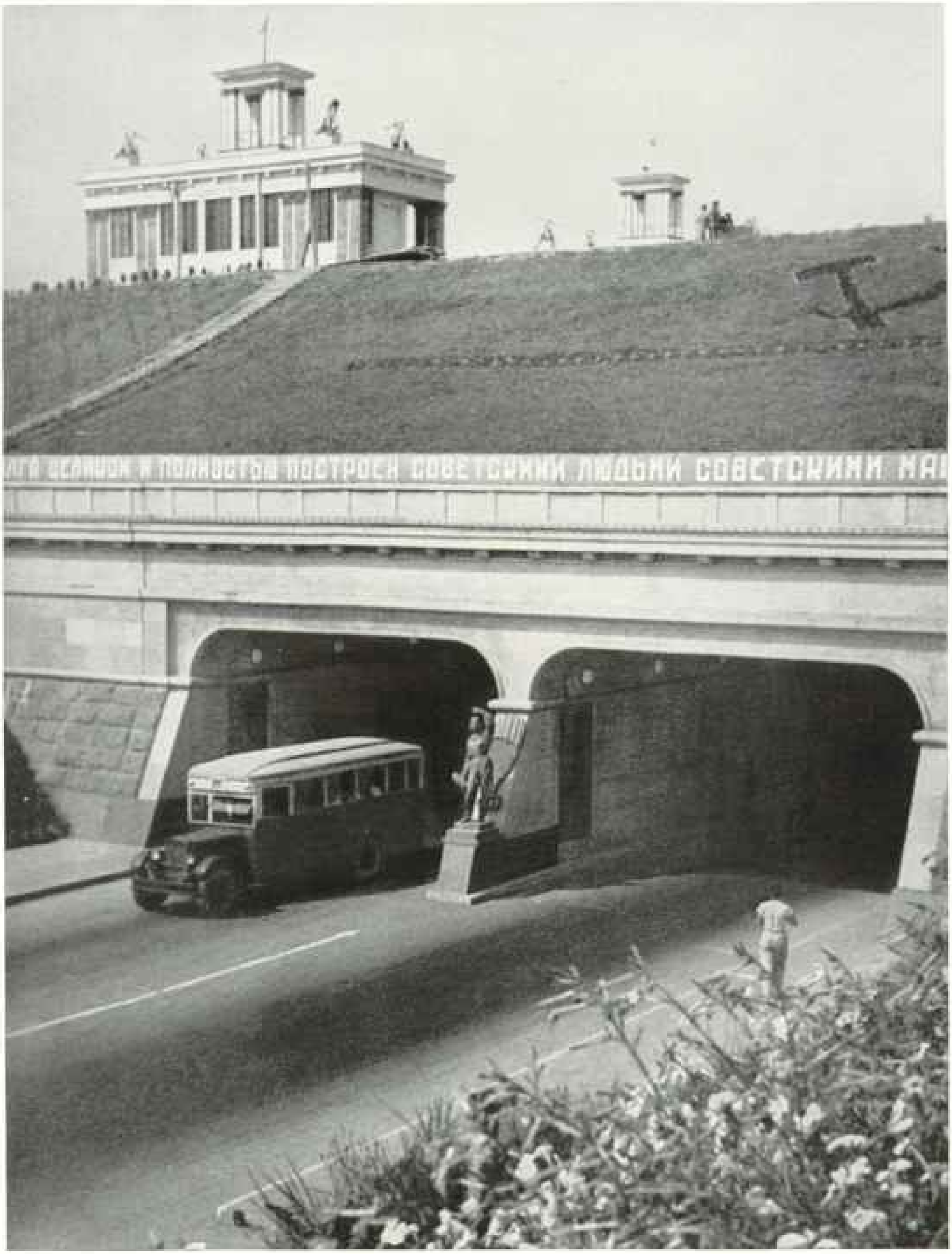
Rivers, flowing in from east and west, long since made the middle Volga region a center of barter. In 1817, this trade was fixed at Nizhni Novgorod, which now bears the pen name of Alexey Maximovich Peshkov, Maxim Gorki. Two great cathedrals bless this place of merchandise, patriarch of annual fairs. Buyers and sellers from China to Great Britain met here each summer. In 1880, goods worth $100,000,000 changed hands. World War I and state trade brought a setback, but in 1927 more than 2,500 firms were again doing business at the old stand between the Oka, left, and the Volga, right.

In Their Dissimilar Faces Read the Story of Kazan

Hers suggests the Tatars who founded Kazan, his the Slavs who won it. Now the Tatars have their own autonomous republic of which Kazan is the capital.

Mother and Child Typify the Racial Complexity of the U.S.S.R.

Georgians, Armenians, Uzbeks, Kazaks, Kirghiz, Tatars, Germans, Chuvashes, Kalmyks, and many others are joined with Russians in the Soviet State.



Motor Bus and Drinking Water Speed toward Moscow—with the Water on Top

Against the skyline are two control towers along the Moscow-Volga Canal which crosses above the highway. It supplies the crowded capital with water and allows floating restaurants to dock outside the Kremlin walls. In four years, 1933-37, the Soviet carried out the dreams of Peter the Great to connect Russia's chief traffic artery, the Volga, with its heart, the Kremlin at Moscow.

Kuibyshev used to be Samara, where city folk drank fermented mare's milk in kumiss establishments, famous wherever indigestion was known. Kirghiz still use this combination of lactic acid, carbonic acid gas, and alcohol to get drunk. Invalids, using it to soothe, rather than inflame their stomachs, drink quarts of mare's milk wine in its milder stages.

End of Caravans' Trail

Before Kuibyshev became an auxiliary war capital, it was the gateway to the steppe, to Tashkent, Samarkand, Bukhara, and beyond (pages 800 and 807).

Here caravans of double-humped camels dumped their cargoes at the end of the sandy trail. Soon after I first passed through Samara with the Vladivostok-bound Czechoslovak legions in 1918, other trainloads of Czechs took over Samara. Meanwhile Kuibyshev, who later won Samara from the Czechs, was inspiring the "creative energy of the proletariat" or "waking the workers" and the transformed city which now bears his name is concrete evidence of his success. Kuibyshev, like Washington and New Delhi, is "enjoying" a war boom.

Opposite Saratov, whose sale of books is extraordinary, is the town of Engels, named after Friedrich Engels, who once said, "How beautiful the Russian langunge is: all the advantages of German without its terrible coarseness." But in Engels, German is spoken freely and has been since Catherine the Great colonized this region with German settlers about 1764.

Originally from Bavaria, Alsace-Lorraine, and Switzerland, they are now loyal Russians. The Volga German Autonomous Republic is highly advanced in agriculture, industry, and education. Below Saratov, some of whose modern buildings suggest Düsseldorf, is a new bridge across the Volga, one of Russia's largest and a much-sought prize of war.

Tsaritsyn, whose new name, Stalingrad, may live far longer than its old one, owed its importance to the fact that Volga and Don were here close neighbors, with a railway between. In World War I it made guns for Vickers. Then it turned not to plowshares and pruning hooks but to tractors to cultivate Russia's famous black earth.

Now, as Stalingrad—for Stalin's name replaced that of the tsars—it has held the eyes of the world for weeks of living hell and immortal glory. As Tsaritsyn, it held 100,000 souls. Later its factories spread high and low along the Volga front and its population reached nearly half a million in 20 years. What is population in Stalingrad today, when death falls from the sky on friend or foe? One measures Stalingrad not in souls but in soul.

Down to Stalingrad the Volga is a river, even though it flows below sea level from Saratov on. But from Stalingrad to the Caspian the Volga is an ever-changing mosaic of land and water, now lined with tiny canals, now spreading wide in one solid expanse of water or ice.

Sturgeon migrate up to Sarepta, 15 miles below Stalingrad, and on their way upstream are caught and give up their roe not to their own kind but to *bon vivants* as black caviar (page 802). Twice delayed in Astrakhan, when butter and sugar could not be had, I ate choice caviar until I no longer have the appetite to wipe out a fish colony with one swallow. The Caspian's fish are estimated to equal 400,000 cattle in food value. But the fish value lost through eating caviar has not been computed.

In the dry plain above Astrakhan, hot in summer, cold in winter, live the Kalmyks, related to the Torhuts of Dzungaria, far to the east. Their capital, Elista, is in German hands.

Tending their Bactrian camels and supporting many Buddhist priests, they are settled remnants of a nomadic Mongol horde which went back to Mongolia to escape the government of Catherine and the conquering plows of her German colonists (pages 797 and 803).

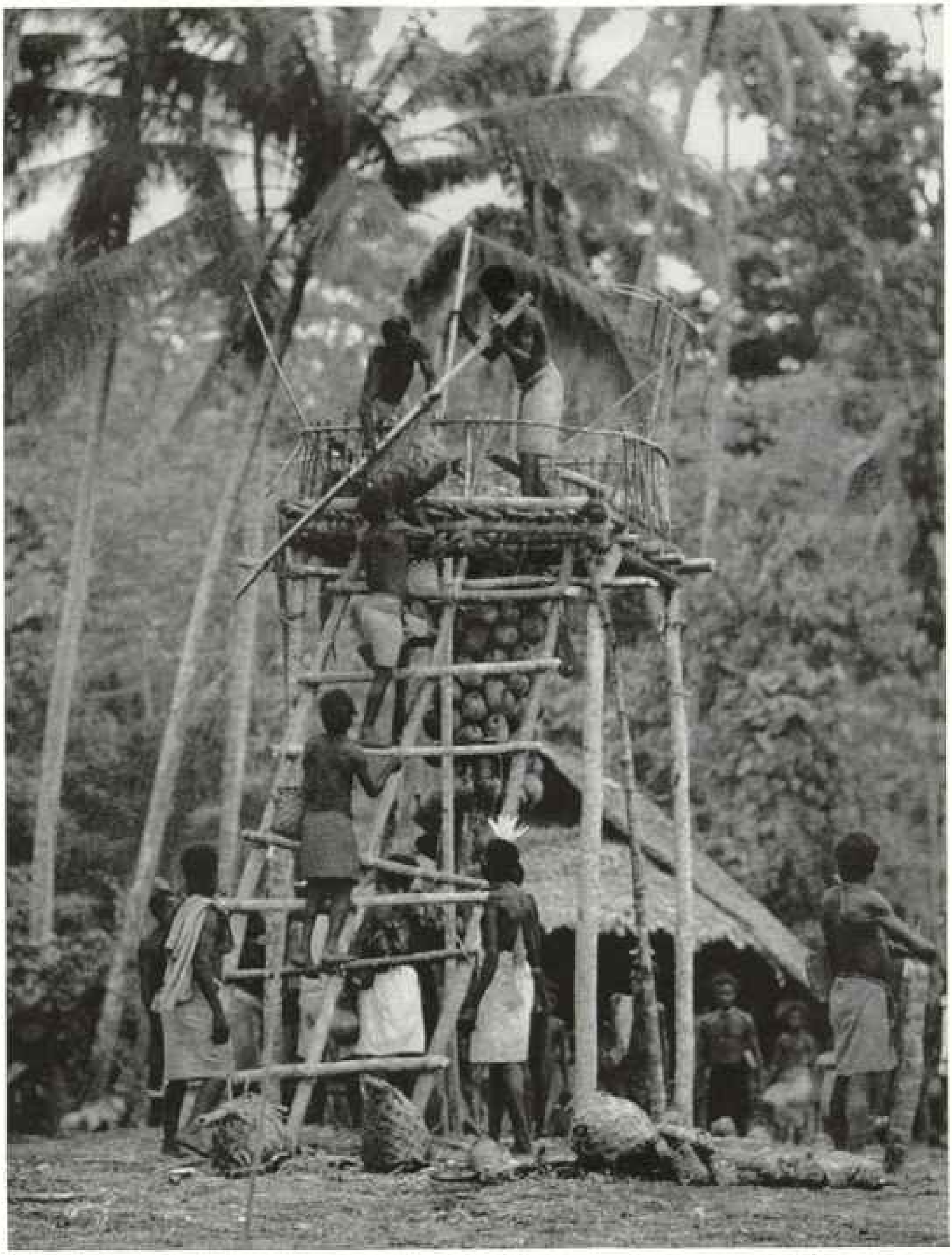
The Kalmyks, who greeted me kindly, added much to the racial medley. As I saw them riding their high-reaching camels across the floor-level steppe, the Russia of thick beards, sunflower-seed diet, and voluminous blouses seemed far away indeed.

Returning to Astrakhan after visits to Bukhara and Merv, the lower Volga seemed a mere extension of central Asia, with pagoda-like temples replacing the bulbous church domes of the Russian scene.

There she flows, Russia's Mississippi, which unites the land from snowy pine forest to hot salt desert. For centuries she was a frontier, and may be again. Mother Volga nurtured her people, helped them eastward toward the vast expanse and mineral wealth of Siberia. All this summer she has been hard at work carrying machinery away, bringing up oil, or transporting lend-lease matériel from the Caspian to the battle front.

By December the softly flowing river will be a path of ice—more highway than barrier. But for precious months she has backed up her fighters and their fearless women against the Nazi foe, a life line in war as in peace.

From summer heat to winter chill, Little Mother Volga has played her part defending her own.



A Tower of Fruits and Vegetables Advertises a Free Feast in the Solomons

Before the folk of Turungom village go to a party, they can examine a display of what they will be given to eat (page 836). No worry here about a menu. If the host's offering is not inviting, guests will be few. Steps are provided by which the high "buffet" may be scaled, but strangely enough these natives of interior Bougainville Island never have thought of making portable ladders (page 822).

A Woman's Experiences among Stone Age Solomon Islanders

Primitive Life Remains Unchanged in Tropical Jungleland Where United States Forces Now Are Fighting

By Eleanor Schirmer Oliver

With Illustrations from Photographs by Douglas L. Oliver

THE native steersman of our little launch pointed triumphantly at a small hill which broke the monotony of the mangrove coast. "That's Kangu," he told us. "That's the no-good place."

Kangu is the natives' name for Buin on Bougainville Island, where fierce sea and air battles raged between Allied forces and Japanese invaders in recent months. A few miles to the south is Shortland Island, now a strongly fortified Jap stronghold. The island of Guadalcanal where U. S. Marines wrested an airbase from the Japanese is at the south end of the Solomon Archipelago, about 300 miles from Bougainville.

The night had been a terrible one of fog and rain. A squall blew up, the crew went to sleep, the engine died, and the dinghy broke loose. At one time we lost our course and saw land on the wrong side. At another time my husband roused the steersman into semiconsciousness just as we were headed for a ghostly curl of waves breaking on the reef.

It had been with real eagerness that we watched the coastline for our port, but a feeling of dismal anticlimax sobered us as we viewed this desolate green hill. After traveling more than 12,000 miles to the Solomon Islands from the other side of the world, we had expected something more thrilling.

Disappointment did not lessen as we approached the shore. The closer we came, the more isolated and unfriendly it seemed, with two miserable dwellings settled against the hill and a tremendous surf pounding on the beach.

Cold Welcome to an Uninviting Shore

It was little short of a miracle to me that all our worldly goods—including seven hens and three ducks—were successfully maneuvered to the beach in a small skiff. With an uncanny skill, the native crew guided the little boat through breakers time after time and settled everything safely on shore. I made sure of the safety of the food boxes, while my husband worried over cameras and film. These preoccupations ordained our division of labor throughout our stay.

Even landing on solid ground was an anticlimax, for the strip of black volcanic sand was alive with mosquitoes and midges, and where I had expected to see at least a few wild-eyed savages looking as if they wished head-hunting days were not a thing of the past, I saw instead a solitary native, clad in a calico and looking like a Melanesian replica of Kipling.

We prevailed upon "Rudyard" to lead us to the Government headquarters. There we were met by a native constable who informed us that his master, the officer in charge, was away on patrol. This news was even more dismal than the sunless day and the desolate beach. It meant that we would have to strike off into the interior without foreknowledge of paths and travel conditions.

One thing was certain: we could not move a yard off the beach without some means of transporting our cargo, and the only possible conveyances were the natives we had come to study. Accordingly, we sent messengers into the jungle to procure carriers, and settled down to consider our predicament and plan our next move.

Sixteen months previously when we were married—my husband, an anthropologist with Harvard University, had warned me of just such a predicament. At that time I had laughed at the idea that field work could be anything but a thrilling adventure among picturesque surroundings. I had formed a vivid picture of expedition life—of dozens of trained servants waiting on my pleasure, and myself smartly attired in tailored whipcord and shining leather, competently leading a long line of trucks across some exciting landscape.

Instead, I sat in a miserable little shack, clad in sopping wet trade-store dungarees and shirt, struggling to light a primus stove as my husband and our one servant dragged packing cases in out of the rain. Then there was the prospect of a year's isolation off in some primitive village, days away from any European settlement. We should be forced to lead completely independent lives, with no trade stores, no medical aid, no contact with the

Official Photograph U. S. Navy

U. S. Airmen Set Fire to a Japanese Base on Tanambogo Island

After the carrier-based air forces had hit and departed last August, the enemy's gun emplacements and antiaircraft batteries were in ruins. Gavutu Island, just across the causeway from the devastated stronghold, was also attacked and taken over by invading Marines supported by Pacific Fleet forces.

outer world save mail carried in now and then by a native constable.

Nevertheless, it was thrilling to guess what lay back of the towering wall of jungle which abutted directly upon the beach. We must first penetrate that wall and—somehow—move ourselves and our supplies through miles of swamp on to the foothills of the central mountain range in order to reach the tribe my husband planned to study.

Our destination was the country inhabited by the Siwai. We had chosen this tribe for various reasons. One of these had to do with their ethnic relations.

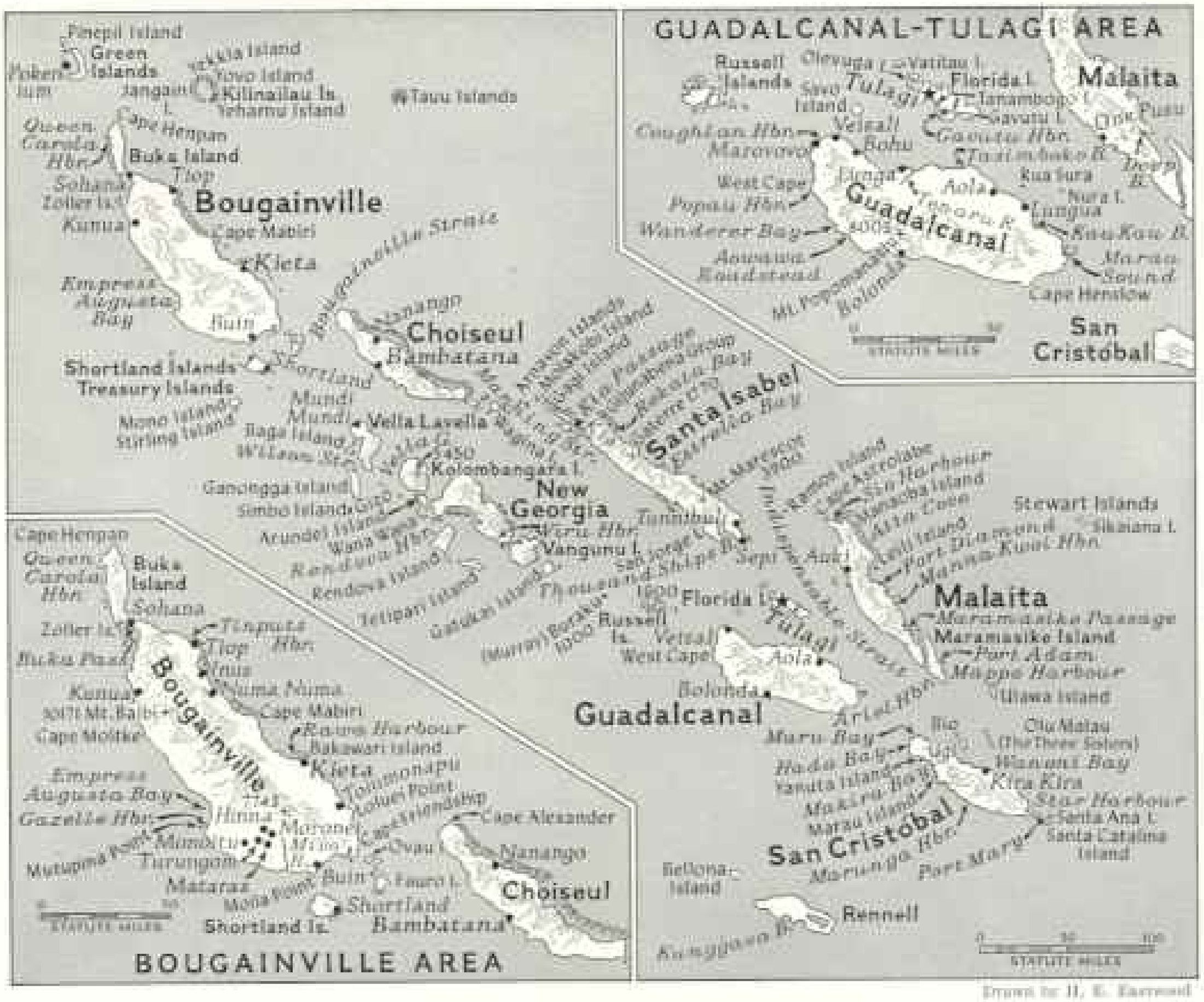
Anthropologists and laymen alike have long known of the lives and cultures of strong-limbed, brown-skinned Polynesians, who inhabit small volcanic islands and coral atolls in the eastern Pacific. Scientists are also familiar with the beach-dwelling Melanesians who—although darker skinned than their Polynesian neighbors—yet have much the same kinds of languages and means of living.

Polynesians and Melanesians are linked with Micronesians from the Marshall and Caroline Islands and with Indonesians from Java, the Philippines, and Borneo in one great language family.

More recently, however, there have come to the attention of anthropologists great hordes of people living far in the interior of the larger islands of Melanesia, such as New Guinea, New Britain, and Bougainville—people who are essentially unlike the lighter-skinned coast dwellers in physical features, language, and culture.

These Papuans—for so they are called—probably are the descendants of the oldest races to inhabit this part of the world. They are more negroid than the beach dwellers, speak more complex languages, and base their subsistence upon hunting and crude tillage.*

* See "Treasure Islands of Australasia," by D. L. Oliver, National Geographic Magazine, June 1942.



Drawn by H. E. Eastwood

The Solomon Islands, Field of Bitter Battle between Americans and Japs

In this 700-mile-long archipelago, which threatens air and sea routes between Australia and Hawaii, may be decided the fate of the entire southwest Pacific. Near Lunga on Guadalcanal (upper inset) is Henderson Field, captured by U. S. Marines and used as an air base against Japanese concentrations at Buin and Kieta on Bougainville, Rekata Bay on Santa Isabel, and Shortland Island (lower inset).

Driven back from the coast by seagoing Melanesians, they have taken refuge in dense jungles and within almost inaccessible swamps. There they have lived and clung to their Stone Age cultures.

One must not imagine that these Papuans are homogeneous. They might have been so in the beginning, but centuries of segregation and isolation have broken down similarities, so that now no one tribe can understand the language of its neighbors.

Bougainville Siwai True Aboriginals

Bougainville Island proved to be an ideal refuge for these Papuan aboriginals; its towering mountains, thick jungles, and pest-ridden swamps discouraged all attempts at penetration by the more civilized salt-water people. I certainly sympathized with salt-water natives, for I also was discouraged with the prospects.

Nevertheless, we had two things to do before we could return home: we had to make a broad survey of all the eight Papuan tribes, collecting physical and linguistic data, and we had to make an intensive study of the culture of one of these tribes. Prompted by hearsay reports from Colonial officials, we had chosen the Siwai tribe.

"It will be ideal," my husband enthusiastically explained to me. "Why, they've just given up head-hunting within the last 15 years!"

Every one to his own tastes, I suppose, but personally I should have preferred one of the picturesque little villages built on a lagoon near a European settlement, and said as much.

"Spoiled," I was scornfully told, "disgustingly civilized."

I was yearning for some of that "disgustingly civilized" life when a great crowd of

From Tropic Sea to Cloud-crowned Mountains Is But a Step at Bougainville

The native, paddling his outrigger canoe into a small harbor of the largest of the Solomons, looks up to peaks rising from 7,000 to 10,000 feet. Like New Guinea, this island has a climate graduated by altitude from steaming heat to bracing cold.

Official Photograph U. S. Navy

Enemy Golfers on Tulagi Had No Time to Yell "Fore" at American Dive Bombers

Besides fortifications, antiaircraft batteries, and a radio station, the confident Japanese had built a small golf course on the island, which was one of their principal strongholds in the southern part of the Solomons. Here, shortly before U. S. occupation, our Air Forces were bombing enemy installations. Near Savo Island, 20 miles away, the U. S. cruisers *Astoria, Quincy,* and *Vincennes* were lost.

Native Boys Carry the Author Across a River

On the paths through the forest her bicycle served her well, and there were always willing hands to help her over hard places. Training Siwai youths to do housework was a more difficult matter (page 821).

Siwai Women and Children Watch Wonderingly as the Author Types Her Notes for this Geographic Article

bush natives swarmed down to the beach a day later and began lashing our supplies to carrying poles.

Carried by Six Black Bushmen

Some of the glamour returned when, an hour later, my chair was lashed to a stout frame and I was borne along on the shoulders of six black-as-coal bushmen. I had only enough time to look around for a last sight of the sea before my chair-bearers swept through a narrow opening and into the jungle.

The transformation was amazing; it was as if a curtain had fallen behind us, completely muffling the sound of the roaring surf. We were enveloped in a heavy stillness which I learned to associate with the jungle, and which did not lift until months later when we returned to the coast.

The native carriers lapsed into an easy trotting motion, and in this monotony of rain and mud we traveled along the silent paths, stopping at night in makeshift palm-leaf shelters. It was not until the third day that another transformation occurred. The rain stopped, the skies cleared, and we saw for the first time the brilliant beauty of the jungle.

Sago for Cooking Comes Wrapped in Banana Leaves

Holding the package of food, the author's Siwai houseboys look confident, but even Mamao, the cook, could not make efficient servants of them (page 821).

Streaming through thick foliage, the sun warmed hordes of giant, bright-winged butterflies into easy, graceful flight among the flowering bushes and flashed sparks of color on the parrots that screamed in the trees. We marveled at the dazzling whiteness of cockatoos against a brilliant sky-blue background, and soon forgot the dismal, rainy days just passed through.

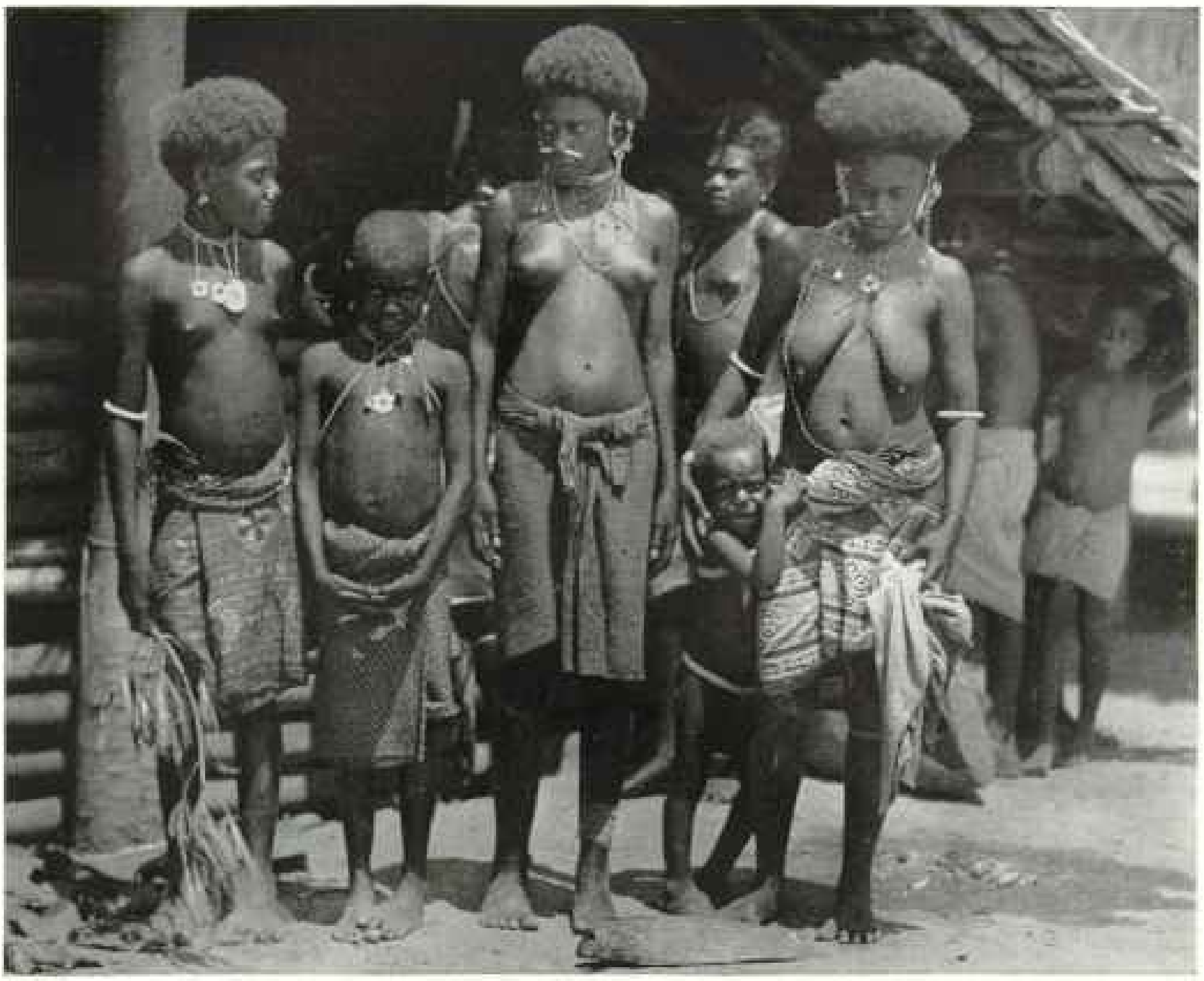
This day of sunshine brought us to the Mivo River, which marked the eastern boundary of Siwai.

I was in midstream, supported by carriers, and was about to make a trite remark about "our Rubicon" when I suddenly remembered the yeast. We had forgotten to bring along yeast! I clutched at the woolly heads of my carriers more firmly and shouted the tragic news across to my husband.

Homemaking in Mataras Village

His only reply was a laconic "Too bad"; but he lived to regret his indifference. It was actually some five months later, after many black and sodden failures, that I learned to substitute fermented coconut mold for yeast, and turned out what was probably the most beautiful loaf of bread ever baked in a jungle —at least in a Bougainville jungle!

We had decided to settle in the village of Mataras, which from our rude little map



Siwai Women's "Sunday Best" Is a Little on the Scant Side

Wearing in addition to their everyday *lap laps* (island skirts), strings of shell money, and earrings, necklaces, arm bands and anklets of shell, they come to Monoitu Mission. The ceremonial ornaments are perhaps donned in deference to the missionaries' request that they clothe themselves modestly. Their young children are always with them (page 835).

seemed centrally located. There the natives had built a new rest house for the patrol officer to use on his census-collecting visits; and it was with evident pride that the village headman invited us to stay there (for a short time, he thought).

Our carriers deposited our boxes outside. Before we were allowed to enter, however, two magicians swept through the house with leaves to chase away any evil spirit.

It was an airy, well-built house of three rooms enclosed by two verandas. Walls and roof were thatched with palm leaves; floors were made of split palm logs raised above the ground by four-foot piles. I favored leaving the gable ends open to frame a pleasant forest mural; but after the first tropical shower had soaked all our bedding, I consented to have them closed over.

We devoted the first two weeks to consolidating domestic affairs, this being the most tactful way to establish our identity among the villagers. One could sympathize with the natives' reticence at such a time. Whites they had seen before—government officers, missionaries, and an occasional labor recruiter, but how puzzling it must have been for them to see the two of us settling down in their midst for no apparent reason and smiling at them in lieu of more coherent means of communication.

One native who had some knowledge of pidgin English argued that we had "probably not had enough food in our homelands." "Otherwise," he asked, "why would you be buying food from us?"

Our house was built on a hilltop, and, looking down over the village, we could see curls of smoke rising from the houses. We could even hear the cries of babies and the shrill chatter of women.

We were sorely tempted to visit the homes and learn something about the life there. My husband, particularly, chafed at the delay

Baby Is Bathed with Cold Water Poured from a Hollowed Coconut

Children require little care unless they are tiny infants. The mother puts in the whole day suckling the child, playing with it, and showing it off to her neighbors.

caused by the necessity for caution; but since our hosts were still suspicious, we had to move slowly.

Despite our impatience, the delay proved to our advantage. It gave my husband an opportunity to surround himself with useful informants and begin work on the language; and it gave me a chance to put our household into running order.

Training Jungle Boys for Housework

We added two local youths to our "staff," and with their coming the domestic problems began. Manao, the one trained servant we had brought along (he might well be the hero of this account if it were a novel!) had already proved his value even to making a pie with fluted edges. It was he who supervised the first stages of training. He soaped and scrubbed the novices and cut off most of their hair; their screams merely led him on.

They were then presented with calico loincloths and told to begin work. Names and uses of utensils had to be taught them; constant care was needed to keep them from blowing crumbs off the table, and from using their loincloths for dish towels (page 819).

First we needed some one to do the laundry, and I set one boy to work at that. He proved a failure. Though he would start out for the river with plenty of soap and a bucket for boiling clothes, an hour or two later I should find him sitting at his ease, looking on while smaller and dirtier urchins played with clothes and soap in the water and gleefully watched the suds float down the stream.

Manao presided in the cook house and shot pigeons and wild ducks to supplement our tinned meats (page 829). Once when we were short of butter he proudly brought me some fat white sago grubs (a delicacy among natives) to be used "for greasing pans." I discouraged this economy immediately.

In two weeks our ménage settled into some semblance of order and comfort. Though our hens and ducks were shamefully unproductive,

To Gather Almonds, a Native Climbs a Palm

When this Turungom villager has shinned up the small tree, as high as the first crotch of the big Canarium, he tosses a home-made rope over the branches of the latter and swings himself across. Bougainville folk have never made portable ladders. After the nuts are shelled, they are smoked and thus preserved for flavoring the native taro or sago "pudding."

they preened themselves contentedly in a yard back of the house; our books were arranged on shelves; the storehouse looked like a small, bright shop; and our mosquito room had already proved to be a sanctuary in the early evenings. The natives had lost much of their reticence—and my husband was able to pass more time in the village and the men's house.

Death of the Headman Calamitous

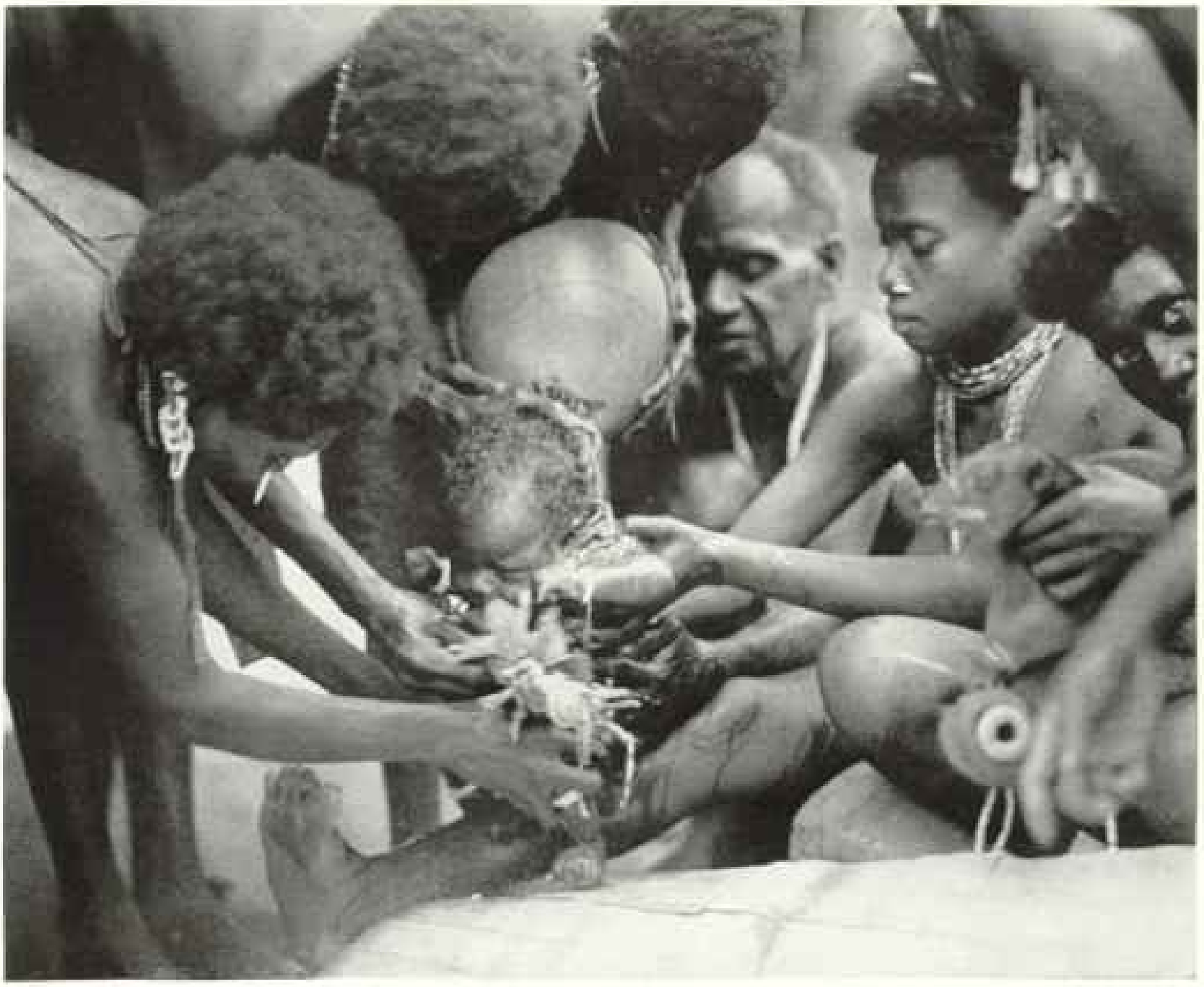
Late one night all this changed. We were startled from our sleep by the clamor of sudden shouting and wailing and the beating of drums. The village headman had died!

We received this news with mixed feelings. For my husband it was a spectacular event, a dramatic introduction into the lives of the natives; but on the other hand it might prove to have repercussions on our own lives. The death coincided too well with our arrival!

For two days and nights the sound of the mourning song rose and fell from the village in a continuous rhythm. No gardening or any other work was done, and all day long silent groups of people from other villages passed our house to join the mourners. We two aliens were discouraged from visiting the house of death.

The cremation was to take place the second night after the death, at the rising of the morning star. Some time before midnight we joined the villagers.

I could see only the faint outline of houses in the dark. The men were huddled near a dim fire, and all the women who could not find room in the mourn-



A Month-old Babe Is "Christened"

The mother is the woman with many strings of shell money around her neck. On the right a live possum is held like an infant so that the evil spirits will not notice the child, who at this time is considered highly susceptible to evil influence. After being anointed with magical potions, the baby is walked across a mat spread with the things believed to be of most benefit during life (page 835).

ing hut sat near the door and swayed in time to the wailing. In a cleared space outside the house stood the funeral pyre, revealing a cavity sufficiently large to hold a man's body.

When at last the morning star appeared, the corpse was brought from the hut, strings of shell money were wound around neck, wrists, and ankles, and the whole body was rubbed with coconut oil. It was then wrapped in a casing of split bark and placed in the pyre.

Amid increased wailing and shouting the fire was lighted with torches, and the men and women began a slow procession in a kind of dance around the burning mass. Many of the women prostrated themselves on the ground and rubbed their already white-painted faces with earth and ashes, while a few of the older people stood aside and watched the clouds of smoke and sparks for a sign of the deceased's spirit wafted to the mountain paradise.

After the fire had burned to the ground, the mourners retired to their houses so that there was comparative quiet in the village, but at sunrise the widow, her face still smeared with white clay, gathered the remains of the bones and ashes and took them for burial to sacred ground in a deep gully.

Invited to Visit a Rival Village

From that time on the attitude of the Mataras villagers changed toward us and for two months we endured their conspiracy of silence. My husband made excursions to other villages and mapped the countryside, while I made a collection of edible plants. But most of the days dragged by under this enforced silence and we were thoroughly discouraged. Though we never knew just how much of the headman's death was attributed

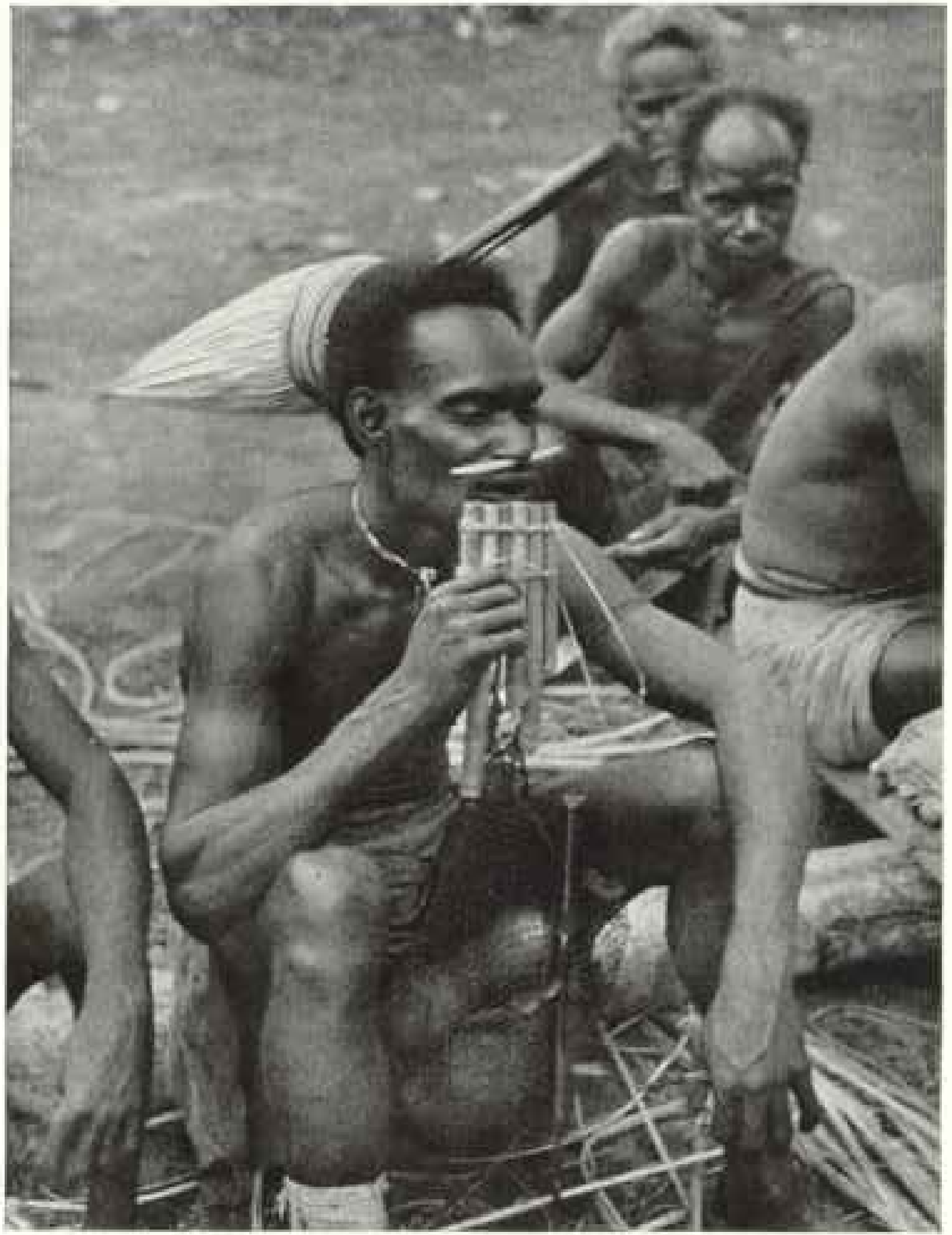
At a Turungom Feast Guests Honor the Host with a Prancing Grand March Around His House to Work Up an Appetite

Many Shoulders Get Under the Load When a New Hollowed-log Drum Goes to the Drum House

By the number of men required to carry it the importance of its donor is measured. The log framework on which it is placed is purposely made heavy to emphasize the size of the gift. As soon as the ceremonial drum is in place, it will be beaten to summon the Siwai to a feast provided by the "social climber" (page 836).

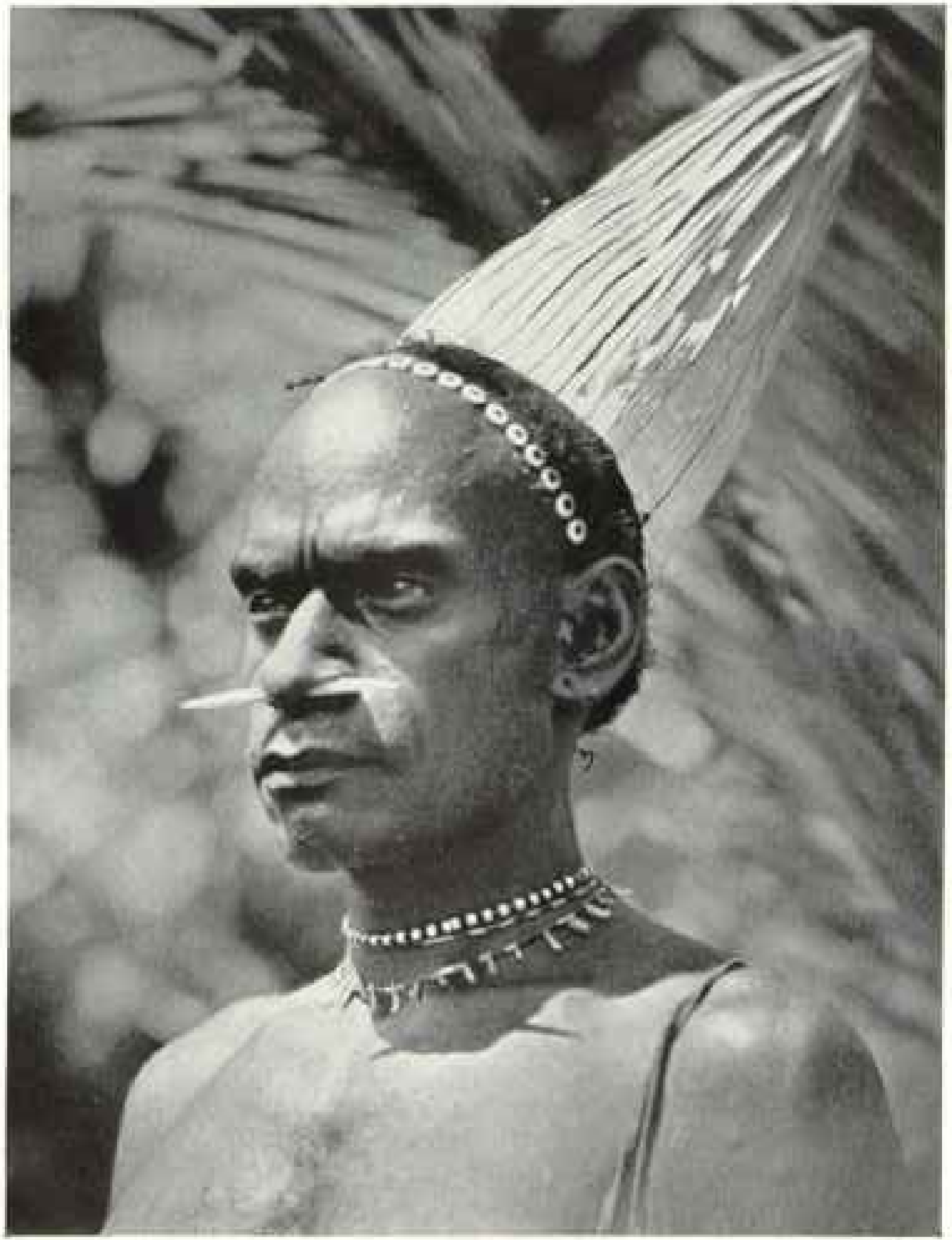
Bougainville Folk Fish with Nets and Bows and Arrows Instead of Hooks and Lines

Here near Hinna village, the Mivo River has been dammed in one of its tributaries so that the water is spread out in a shallow lake easily waded. Whole villages turn out for a day of sport, the women and children hunting eels and shrimp and the men a species of fresh-water perch.



"List to the Pipes of Pan"

Though the Siwai have not learned the trick of making bamboo flutes with finger holes, they coax notes from hollow twigs of varying length by blowing over the open ends as one would produce a whistle with an empty bottle.



Fully Tricked Out, the Siwai Looks Fierce

A pin of wood or bone is thrust through his nose; his head and neck ornaments are strings of shell beads. To white men's eyes his palm-leaf hat looks like a dunce cap, but he wears it proudly.

To the Women Falls the Task of Gardening

The husband has cleared and prepared the ground and built the fence, but the wife plants the taro shoots (page 851). With plenty of vegetables and pork available, the Siwai live well.

to us, we knew that we must leave Mataras if we wished to continue our work.

Suddenly our luck changed. A deputation of natives from the hill village of Turungom brought us an invitation to live among them.

This was too good to be true! Why should the hill villages befriend us when Mataras folk had been so inhospitable?

We suspected an ulterior motive, and, rightly enough, there was one. Turungom people were traditionally hostile toward Mataras; a feud had been going on for generations.

"So," the Turungom folk had reasoned, "anyone disliked by the Mataras 'gang' must be all right!"

Our Turungom hosts even went so far as to build a house for us, not in a public place on the outskirts of the community, but in the village itself. Over we moved, hens, ducks, and all.

The "house" was an open lean-to affair, built directly on the ground so that the rains washed through it, and pigs found their way inside despite any barrier we might put up. We were assured, however, that we would not be bothered with rats; "the snakes would keep them away!"

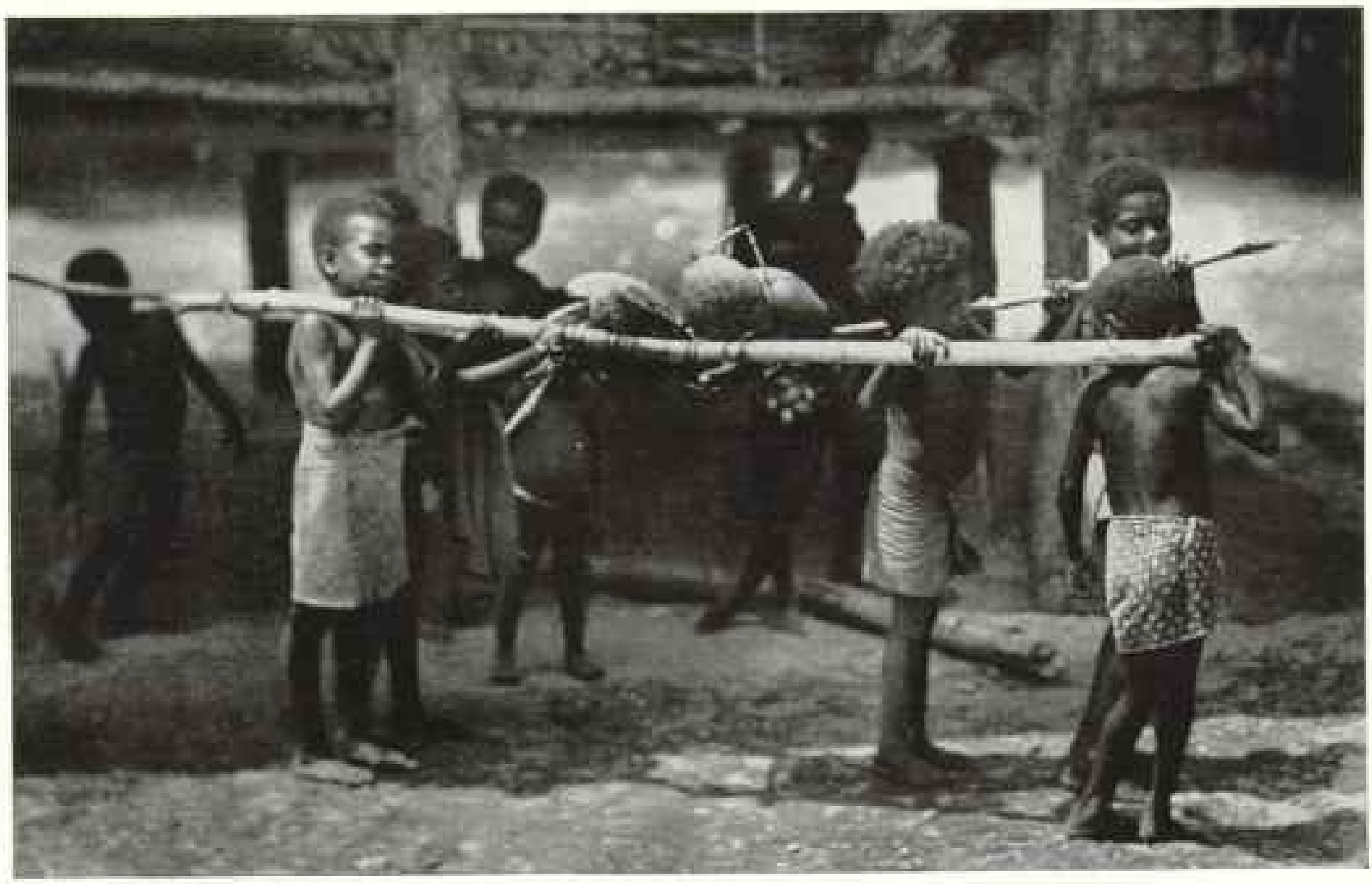
In this miserable little place, mosquito-ridden, damp, and dirty, we enjoyed our stay more than any other time on the island. There was no privacy, but we were given the hospitality of every house in the village. There was no comfort, but we were in the best possible situation for observing native life.

The weeks in Mataras had not been entirely useless, since we had used the opportunity to learn something of the language. An alphabet had to be formulated, myths reduced to writing, and rules of grammar discovered.

It was no easy task even for a trained anthropologist, and only after 10 months did my husband become fluent in the language. Even then he did not speak with grammatical precision, distinguishing among the 50 classes

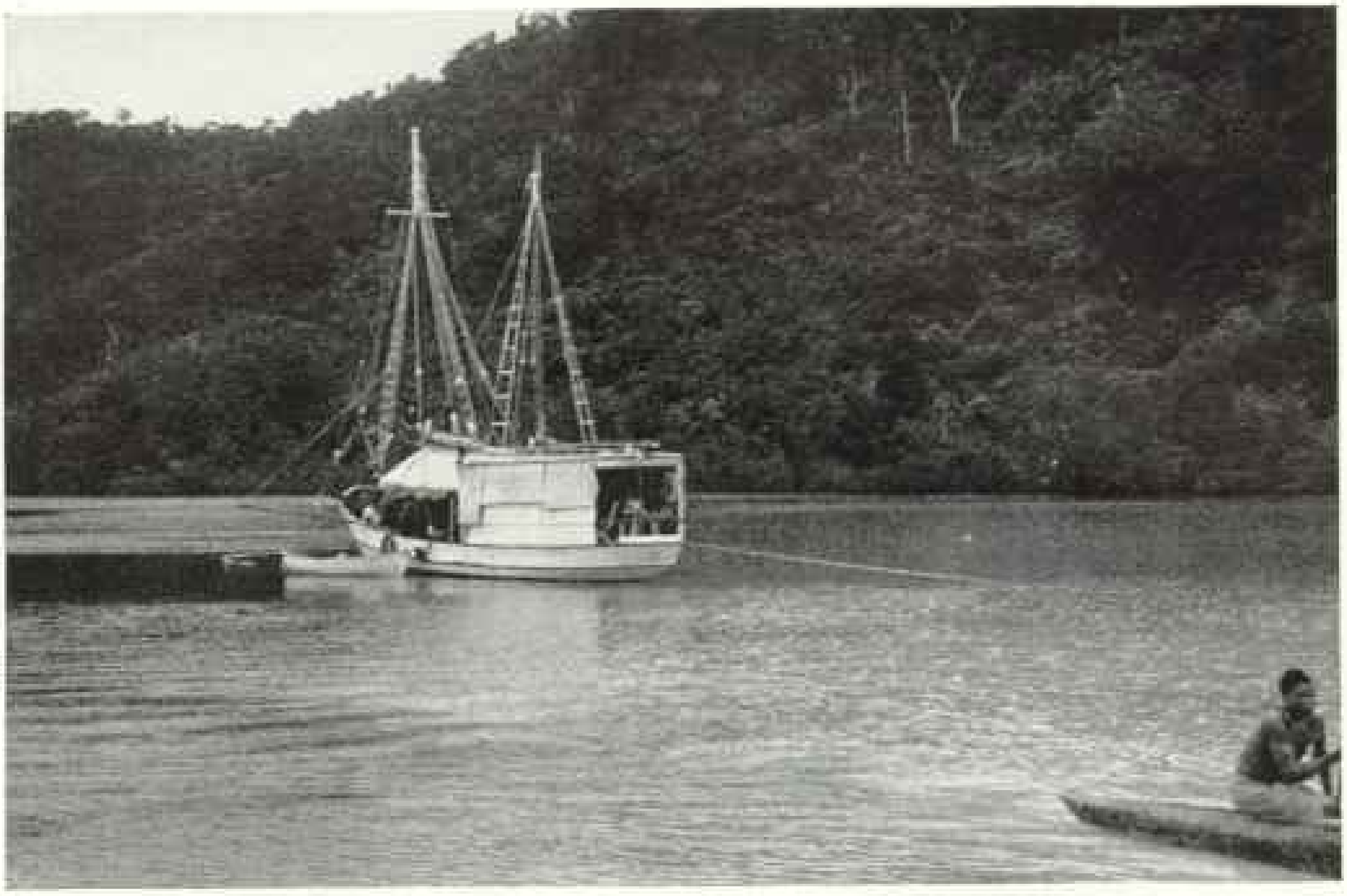
Mamao, the Cook Boy, Made Life Comfortable for His Employers

Here he stands before the kitchen of the author's shack in Turungom. Most houses are built on piles to protect them from sudden rain floods and roving pigs but this one rested on the ground (see opposite page). A covered bridge connects the dwelling with the cook house.



Carrying Coconuts for Pigs, Siwai Boys "Play Like" Their Fathers

When a large object such as a ceremonial drum is to be moved, it is placed on a scaffoldlike device with enough protruding ends to enable sometimes as many as a hundred men to get under the load.



An Australian Patrol Steamer Anchors in Kieta Harbor, Now A Jap Stronghold

Used by officials in their tours of inspection, the *Eroa* made regular rounds of the islands before the war. Japanese invaders have taken a large part of the Solomons, and United States Marines are now fighting to drive them out. There was a battle for this part of Bougainville late in September, 1942.

of nouns or using all of the 11 tenses. At any rate, we arrived in Turungom village ready to begin a serious study of primitive life.

Like any other human being, a Siwai native belongs to a number of institutions, and, just like his cousin in America, China, or Africa, the most important institution in his life is his family, composed of mother, father, and their offspring. These family members work together in a garden, eat together around a single pot, and sleep together in a single house. Several Siwai families are united in clans, whose numbers revere the same ancestors and abstain from eating the same totem. Membership in the clan is based on mother right, but there the woman's influence ends.

Men have their own clubhouse, which is strictly forbidden to females, and women are not allowed to go far from their village or garden or to walk along the main paths. It was fortunate that my husband could remain with the men and I with the women; a single field worker would have received a very one-sided picture of the culture.

The men pass most of their days making pottery, haggling over exchanges in pigs, visiting friends in distant villages, talking politics, and discussing litigation. So very proud were these superior creatures that their womenfolk were obliged to walk some yards behind them! It took considerable rationalizing on my part about "While in Rome," etc., before I agreed to do the same for my husband's prestige.

Everyday Life in a Siwai Village

The day of the Siwai begins when the sun tops the jungle trees and clears away the heavy night mist from the village. Men are huddled in a patch of sunlight to warm themselves, and children likewise try to warm their shivering little bodies. Most of the women prepare to leave for the gardens, while others settle down to their weaving and to watching over the children.

With the housekeepers I made my first contact by teaching them knitting. To see these women "knit and purl" was certainly amusing and almost ridiculous.

The children were free to come to our house, where I always had drawing materials ready for them. They were a pleasant little group. Nearly every morning by the time we were at breakfast, they were already blinking at us from our veranda railing, where they were sunning themselves like small birds. "Gooraray, Massita" and "Gooraray, Mis-

K. W. Bilston Kept Law on Bougainville with His Native Police

Once or twice a year this patrol officer of the New Guinea District Services went over the island taking census, collecting taxes, and settling disputes. His "courts" took the place of the raiding and head-hunting of 20 years ago.

sissi" (good day, master, and good day, missis) were their regular greetings.

Many of the women left their houses for the gardens about this time with their burden of babies and baskets strapped to their backs. Sometimes I would leave with them, my burden being notebook and pencil and a large umbrella. The women soon became used to my pencil and notebook, calling them my "work," not knowing that they themselves were the subjects!

The Siwai woman's life is as narrow as the little paths she walks to and from her garden. She is the real worker of the community, for it is she who is responsible for providing a good garden and plenty of food, besides doing the cooking and taking care of the children.

If a man is asked whether he has a good wife, he will say she "makes a good garden." That is the highest praise. For this reason most of the gardens are beautifully kept and well weeded and the rows of taro plants are neat and straight (page 828). Except for a brief rest and a drink from a coconut, the women are bent double all day long in their gardens, and at the end of the day they leave with a huge load of firewood and food, on top of which is the baby swaying precariously to the rhythm of the mother's walk.

Meanwhile the day in the village is comparatively lazy. The children require little care unless they are tiny infants, and then the mother puts in the whole day suckling the child, playing with it, and showing it off to her neighbors.

Motherhood a Great Source of Pride

The Siwai mother takes great pride in her offspring and shows much affection for them. Many an old woman will point to a sturdy young man and beat her breast, saying, "He is my child; I suckled him."

Other occupations of those who remain in the village are shelling and smoking nuts, weaving baskets, and making rope. Some days the women take circular nets to the river to catch eels, while the children find shrimp under the stones in the shallows of the stream.

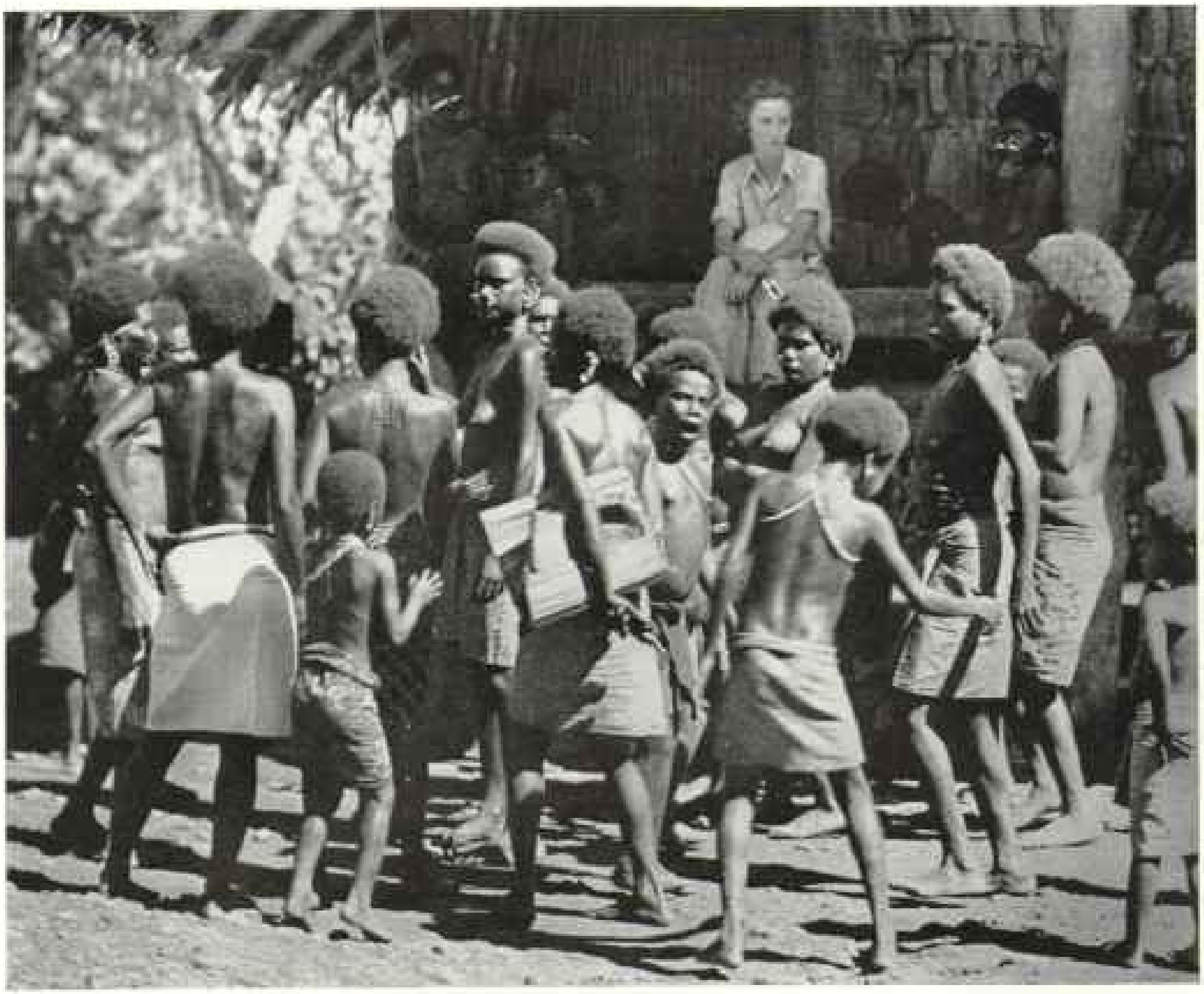
Toward evening the whole village is reunited. The children run to greet their fathers returning from a day's visit in another village, and to meet their mothers coming in from the gardens laden with food for them. The older girls are sent to the river to fill coconut shells with water, the house fires are started, and

Main Dinner Course, a Pig Goes to a Feast in State

A palm-leaf tent is placed over it to keep off the sun. Among Bougainville folk men gain prestige by sending gifts of food for gatherings of their neighbors (page 836).

Before Marriage the Prospective Bride Gets a Ceremonial Bath

She is decked with shell ornaments and taken to the middle of the river, where her relatives and friends splash water over her to chase away evil spirits (page 836).



Among the Women of Turungom Village the Author Was a Strange Being

They regarded her askance until they became convinced that she had "her work" to do (page 831). After being with them for months, she learned enough of their language to talk to them.

the preparation of the evening meal is begun.

Taro and yams are peeled with a sharp pearl shell, leaves are shredded, sago and nut cakes are molded and wrapped in leaves, and the white meat of the coconut is scraped to flavor the food. The women's black hands move swiftly and neatly in these occupations, and soon the pot is making pleasant bubbling sounds and sending up a fragrant steam.

Meanwhile, the men are playing with their babies and continuing the conversation that has been going on all day in the drum house or recounting their day's business in another village, while the children play a last game. By the time dusk has fallen, the meal is ready to be portioned into food baskets.

Damp Nights Keep Villagers Indoors

Little is seen of the villagers after dark, for the cold damp of the jungle nights keeps every one close to the house. Then, too, evil demons and the spirits of the dead wander in the forests at night.

Sometimes a cry in the middle of the night would awaken us. Upon inquiring the cause the following day, we usually were told that an evil spirit had knocked at a house and had asked for a firebrand. This meant that death would soon come to a member of that household.

Numerous customs and beliefs arise from the phenomena of Nature. A cluster of fireflies heralds the approach of a bush demon and is to be avoided; the fury of a thunderstorm may be appeased by sticking a newly split piece of wood in the ground; and the harshness of an earthquake is lessened by beating the largest gong in the men's house.

There is a fantastic story about the moon. In ancient times the moon was a giant possum that climbed down a vine and killed many children every month. One night, some men decided to kill the giant possum, and they cut the vine so that he fell to the ground. Thereupon they cut him up and prepared to eat him.

To Lighten the Drum a Magician Sits on Top of It!

The Siwai believe that he can keep off evil spirits which would make the load extremely heavy. In all village life, sorcerers play a prominent part. Two at Mataras swept through the Olivers' house with leaves to rid it of bad influences before the tenants were permitted to enter (page 820).

As one man was chewing his portion, he reflected that without the "moon-possum" there would be no light to aid in night hunting. He therefore spit forth a mouthful into the heavens. That half-chewed morsel may still be seen there as the greatly diminished new moon.

Even this harsh treatment did not render the moon impotent; and now whenever it appears men must beat their wooden gongs to defend themselves against the revengeful moon.

Earthquakes Keep the Island Rocking

Earthquakes were a new experience to us, though they became so frequent during our stay on the island that we learned to accept them as we might accept rough weather at sea. We learned to lay bottles flat instead of setting them up and periodically we renewed the lashings on the framework of the house.

Sometimes, however, these earthquakes were a real menace. I have seen the ground rise in large waves so that we were thrown off our feet and our house shaken so that it tipped to an acute angle. Natives were often killed by landslides as they worked in their hillside gardens.

Once when we had been standing for some time at the top of an 800-foot precipice, we heard the roar of an earthquake in the distance. We scuttled back from the edge. From safer ground we saw the ledge where we had been standing slide into the abyss!

Our trembling guide's opinion was, "My word, ground he got fever!"

Among all peoples throughout the world, the critical periods in life, such as birth, adolescence, and marriage give rise to beliefs and rituals. In Siwai these crises are fraught with great danger to the individual; unfriendly spirits are most active then, and protective rites have to be performed.

Of all these crises birth is the most dangerous. The newborn infant is weak and helpless against all the powers of darkness; consequently, it must be protected with all the care which its relatives can give. For a month after birth it is kept hidden away inside the house. No one whispers its name, for if some demon knew the name he could use it to destroy the infant.

The period of seclusion is brought to a close by the performance of a ceremony similar to our christening service. Relatives collect large quantities of food and valuables and re-

The Largest Drum in the Drum House Has a Guard of Honor

Important indeed is the wealthy citizen who had this huge log hollowed out and carried to the village. The Siwai publicity-seeker does not "toot his own horn"; he "beats his drum" or has it beaten for him (p. 836).

tain the services of a magician. Crowds of relatives gather to witness the event.

A mat is placed before the dwelling and on it are spread samples of all the good things in life: taro, betel-nut, shell money, and tobacco.

Amid the oh's! and ah's! of delighted relatives the child is carried outside the house, richly decorated with necklaces and bracelets, and freshly anointed with oil. The mother holds it while the magician rubs it with unguents and repeats phrases designed to make it healthy and strong (page 823).

The infant is then made to drag its feet across the mat on which all the good things have been spread. By this action it is assured a large supply of food and wealth.

A Siwai Baby Has Many Parents

For a while it is treated with unusual indulgence by all its parents. Note that *all;* a Siwai child has just as many parents as its mother and father have sisters and brothers!

Nothing is too good for the new arrival. There is no set mealtime; let the infant cry and it is fed. Rarely does a mother leave her infant for more than a moment, and soon after birth the child learns to balance itself on the mother's back, where it remains when she goes about. It is not unusual to see a child clinging to its mother's back while the latter weeds the garden or bathes in the river.

In many primitive communities, young children leave the family circle early in life and roam about with gangs of playfellows. Not so in Siwai. Little boys and girls tag along with their parents until they are twelve or thirteen. No initiation rites are performed to mark a child's debut into maturity. The process is a gradual one which culminates at the marriage ceremony itself.

No Romance in Siwai Marriage

What a world of difference there is between our own romantic conception of marriage and the practical affair of the Siwai! That does not mean that love affairs never take place. On the contrary, most young people have five or six before they finally settle down with a mate and begin the serious business of raising a family.

A pretty girl and a handsome man—those are fine luxuries, ideal for love affairs. But a pretty wife is a constant source of trouble; much better to have a plain, hard-working mate who will bear many children and work faithfully in the garden.

One can always flirt, but a good garden

often is the deciding point between starvation and plenty. For this reason a Siwai father likes to choose a mate for his son rather than leave such an important decision to the romantic inclinations of the youth.

Sometimes the father will go to a good friend and tell him, "I want your daughter for my son."

The age of the girl is unimportant; if she is an infant, so much the better. That means she can be trained according to the tastes of her future parents-in-law. An exchange of valuables takes place at the time of this initial betrothal.

After the girl reaches the age of nine or ten, she lives with her fiancé's family. There she receives rigorous training from her mother-in-law, learns what to expect from her future husband, how to provide him with garden food and prepare his meals.

Later on a marriage ceremony is performed and more food and valuables are exchanged between the families of the young couple. Man and maid are rubbed with unguents, adorned with charms, and ritually united by repetition of magical words. Then the token of union is signalized—not by any such rite as the giving of rings, but by a communal meal.

It is significant that food should be regarded as the symbol that binds one human being to another.

Keeping Up with the Joneses Costly

There is the same scrambling after wealth and prestige in Stone Age Siwai as there is here in the United States. On Bougainville Island, however, a man is great not because his father was great or because of intellectual attainments; these things are incidental. The great man is the "self-made" man, the man who works hardest, accumulates large stores of food, and gives it away to friends and relatives. "Why, of course, that man is a chief; he gives lots of feasts!"

Social climbing, then, follows a set procedure. The man who can give a more sumptuous feast than his rivals reaches the top rung. "Leader," "Feast-giver,"—these words are synonymous.

An ambitious young man begins by killing two or three pigs and inviting his friends and relatives to participate in a small feast. Then he singles out a social rival and attempts to embarrass him by giving him more than that person can reciprocate. In the words of the natives, "he attempts to kill his rival with generosity." Physical death does not overtake the unfortunate rival, but the humiliation and social oblivion which he experiences after defeat in a feast competition are almost as stultifying as death.

Sometimes a competition between two social-climbers will go on for years until one of them is defeated and put to shame. After all the smaller fry have been eliminated from competition—in the semi-finals, so to speak—the feasts become highly ritualized. They become matters of concern for the whole tribe: each community is anxious for its own leader to win out, and every one knows the score.

Drums Summon Feast Guests

One "climber" will draw upon the resources of all his people, accumulating dozens of pigs and masses of shell money to give his rival. Then, on the night before the feast, his followers will beat out drum messages, publicizing the renown of their leader and signaling the value of each pig collected.

On the day of the feast, the rival and his friends will storm the host's village like an attacking war party. They threaten their host with spears, and belittle the host's gifts in carefully prepared speeches and songs. All this is accompanied by the music of hundreds of panpipes (page 827).

The Siwai are honest in their ostentation. To them social-climbing is a serious matter. They believe that nothing is gained by appearing modest and acting subtly.

Finally, when the climber has proved his ability to give things away beyond the power of all other men to repay, he is assured the honor or envy—which is as good as honor—of all his tribesmen, and he can cherish the knowledge that he will occupy a favored position in the afterworld.

War Unlikely to Change Siwai

What will the war mean to these people?

Because they are essentially a peace-loving tribe, their greatest battles seldom resulted in more than half a dozen casualties, and their practice of head-hunting was quickly and easily stamped out by missionaries and civil authorities.

Of the Japanese they have a low opinion, but it is unlikely that the fighting will penetrate the swamps which ring the coast and separate it from the interior. In a way it is too bad; for there is much that the Japanese might learn from the Siwai. The latter have the same preoccupation with gaining and saving "face," but it finds expression in a harmless and even genial form.

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDINGS

SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON, D. C.

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

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

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 300 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society-U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society collaborated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

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 in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

THERE was a pioneer Christmas in America—when a lonely little band of Pilgrims knew fear and cold and hunger.

There was a Revolutionary Christmas—when a nation struggling to be born almost perished at Valley Forge.

There were Christmases in bitter years of civil strife and bloodshed—when brother fought brother, friend took up arms against friend.

There was a Christmas when the outcome of the first World War looked heartbreakingly unsure.

These times, too, shall pass away!

America will live to know a day when boys and girls can love and marry and not be torn apart . . . when mothers can tuck their children into bed without an anxious look to the sky . . . when America will be not only the land we have known and loved but a land of richer promise than man today has even dreamed.

* * *

You can't make this a normal Christmas. Families are scattered, many gifts hard to get. You may have to hunt a little harder, for instance, to find the Hamilton Watch you want most to give the one you like best.

But when you do find it, it's doubly precious now. Like the love you give with it, it's one of the things that endure. Like that love, too, it looks to the future—America's future—when Hamilton Watches may again mark every shining golden hour of peace!

NOW IT CAN NOT BE TOLD! *Hamilton has been asked to make timing devices of the most intricate precision for the armed forces. Their exact nature must remain a government secret. But there are still some Hamilton Watches for your Christmas shopping. See them at your jeweler's. Hamilton Watch Company, 2125 Columbia Ave., Lancaster, Pennsylvania.*

FILMO motion picture equipment has gone to war! It's on the front lines—and behind the lines! In re-enacting actual battles, it provides the key to better weapons and wiser tactics . . . in training men for their war jobs—teaching them "visually"—it trains them *better* and *faster*—because what they see in *action* on the screen, they *get*.

Bell & Howell craftsmanship made "*what you see—you get*" an honest slogan in peacetime...now, in time of war, that same precision craftsmanship is proving priceless.

BUY WAR BONDS

America is out to win—and Bell & Howell precision-made motion picture equipment and sighting devices are vital Victory weapons—vital, because *what our fighting men see—they get!*

Filmo

Bell & Howell Company, Chicago; New York; Hollywood; Washington, D. C.; London. Established 1907.

MOTION PICTURE CAMERAS AND PROJECTORS

PRECISION-MADE BY

Bell & Howell

How to turn a hull into a hornet's nest

THE EFFICIENCY of an aircraft carrier depends upon power—steam power to propel it, electric power to operate it.

Powering these sea-going airfields is a typically *Westinghouse* kind of wartime job. It is a job that calls for the thousand and one different skills in things electrical that are second nature to Westinghouse.

Here is just a small part of the equipment that Westinghouse has designed and built especially to make American carriers outstanding engines of destruction:

- ★ Steam turbines, compact in size, yet so powerful they drive our new carriers *faster* than any enemy carrier afloat.
- ★ Elevators big enough to hold a bomber, fast enough to deliver a plane to the deck with minimum delay.
- ★ Generators on each ship capable of producing enough electric power to light a city the size of Seattle.
- ★ Intricate radio equipment specially designed to stand up under the shock of battle.

Westinghouse "know how" is being applied—not only to aircraft carriers—but to nearly every type of ship in our Navy.

In this, as in all phases of Westinghouse wartime activity, the long-range work of our Research and Engineering Laboratories has played a significant part. Discoveries in many fields are now bearing fruit in the production of better and more powerful weapons of war.

Many of these discoveries, we believe, will someday help to make a better peacetime world.

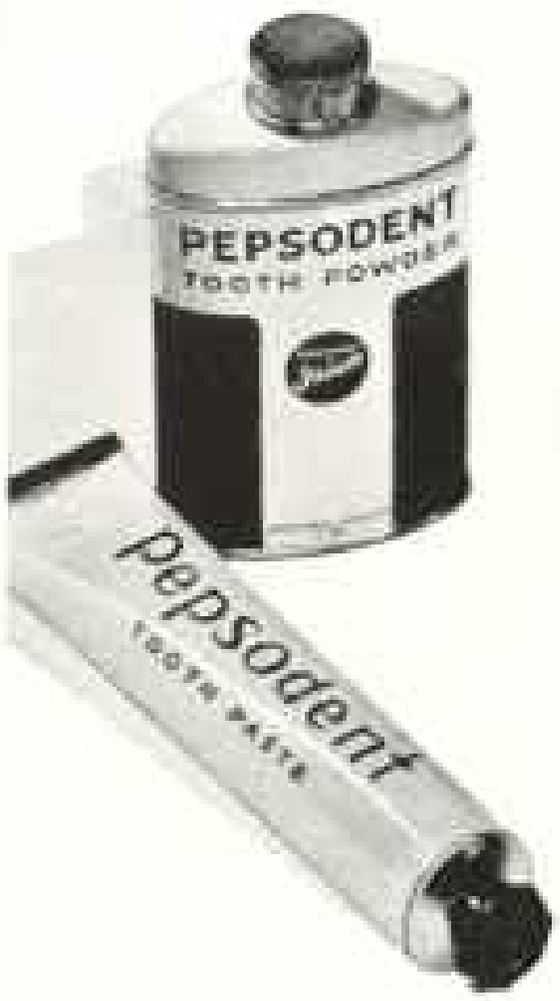
Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Plants in 25 cities; offices everywhere.

This advertisement has been reviewed by Government authorities and contains no information of military value to the enemy.

Westinghouse

...making Electricity work for Victory

Keep your smile bright . . . but



DON'T WASTE PEPSODENT

An overwhelming number of boys in uniform have made Pepsodent their first choice . . . they are taking nearly one-fourth of all the Pepsodent we make.

Civilian demand, too, is the greatest ever.

But, wartime restrictions keep us from making more.

And so . . . we urge you: Don't hoard Pepsodent. Use it sparingly. If you help save enough for others . . . there will be enough for you.

DON'T LET Pepsodent run down the drain. Always wet brush before applying paste. Then finish brushing before rinsing brush.

DON'T USE more tooth paste than you need. About three-quarters of an inch is enough. Pepsodent multiplies itself into a rich lather.

DON'T SQUEEZE tube carelessly. Roll it evenly from bottom. Replace cap. Save empty tube to exchange when you buy paste again.

DON'T POUR Pepsodent powder on your brush. Pour it into the cupped palm of your hand. Enough to cover a 5-cent piece is plenty.

DON'T RUB—Dab moist brush in powder. This way all the powder is picked up by the brush. Measure out powder for small children.

DON'T USE a worn or wilted brush. Keep new ones efficient by hanging them up to dry. Bristles stay firmer, last longer this way.

DON'T BLAME your druggist if he has to disappoint you the first time you ask for Pepsodent. He will have it for you in a few days.

REMEMBER . . . only a little Pepsodent is needed to make your teeth bright, your smile sparkle, because Pepsodent's exclusive formula contains patented ingredients recognized among the safest and most efficient known to dental science. So . . . keep your teeth bright . . . but don't waste Pepsodent. Help save enough for others . . . and there will be enough for you.

Hard-boiled babies

Adolf...here's that bomber—*again*. This hard-boiled baby helped stall your *Wehrmacht* at Dunkerque...and just the other night it was back blasting your ports, hounding your shipping.

Hermann...it's that Hudson your *Luftwaffe* has never really stopped...the ship the R. A. F. calls "Old Boomerang"—because it always comes back.

Hirohito...Tojo's met this Lockheed too, and he'll keep on meeting it...lots of places, and doing lots of things. For the Hudson not only does a job; it invents new ones for itself!

And, boys, it's got a big brother, the Vega Ventura, that has all the family characteristics, and some new tricks of its own! Lockheed Aircraft Corporation...Vega Aircraft Corporation...Burbank, Calif.

for protection today, and progress tomorrow, look to

Lockheed

FOR LEADERSHIP

Member Aircraft War Production Council, Inc.

"Keep 'Em Rollin'..or Else!"

says grandpappy engine 2414 to a 1942 Santa Fe Freight Diesel

"Back in '98, in the Spanish-American War," reminisces little Old-Timer 2414, "20 cars was an average-length freight train. By World War I, we'd upped our Santa Fe freights to an average 35.9 cars. Not bad railroadin', that."

"Not bad is right," answers the big new freight Diesel, "but not good enough for World War II. Now we've stretched 'em out another 41%, to 50.9 cars, and those cars are bigger, loaded heavier, and rolling farther and faster."

"Good work, son," says Old-Timer. "Yours is the BIG war job. Keep 'em rollin'—or else!"

KEEP 'EM ROLLIN'—OR ELSE

★ No nation that does not possess efficient mass transportation can hope to win a modern war. In America that mass transportation job is squarely up to her railroads. *If they fail, we lose.*

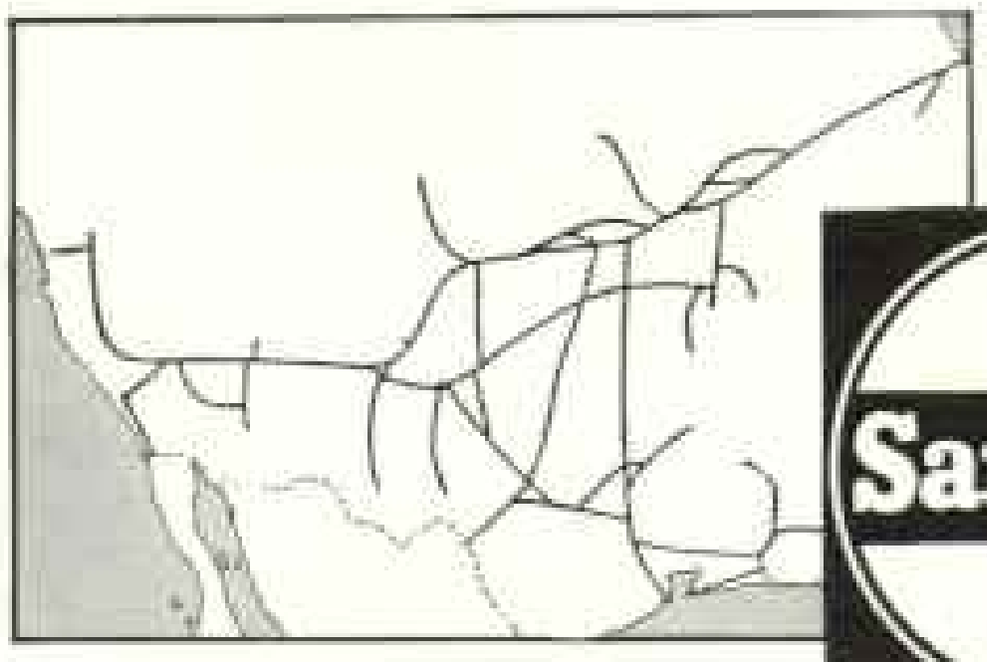
Neither battle gallantry nor industrial wizardry alone will turn the tide. To meet this tremendous responsibility, *we ask for every possible consideration in the allocation of materials for vitally essential repairs, maintenance and new equipment.*

DAILY THE LOAD INCREASES

To date, the railroads have met 100% the staggering demands born of this global war. Many have helped make that record possible —the War Department, the Office of Defense Transportation, civilian shippers and travelers everywhere.

In the first six months of 1942, *with* 25% *fewer locomotives,* the Santa Fe moved 94% *more* freight ton-miles and 27% *more* military and civilian passenger miles than in the first six months of 1918, in World War I.

Daily the load increases. No man knows what the peak will be. We *do* know there is a limit to the performance that can be squeezed out of existing equipment.



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Santa Fe

SANTA FE SYSTEM LINES

General Electric Electronic tubes are linking the world's skies to the earth!

"I want to speak to Mr. Gordon Page, please. He is now over southern China, on Air Flight 625. This is Mrs. Page, and my telephone is Lombard 0100." . . . "Hello, Gordon."

Fantastic?

Not in the electronic world of the future!

General Electric electronic tubes may some day make it possible for you to talk from your home to any airplane thousands of miles distant. This is not yet a promise. But already, by the amazing science of electronics, pilots converse with ground forces as airplanes glide along at five miles a minute. Tomorrow, by electronics, freighters of the sky will safely land "blind" through densest fog.

What is electronics? It is a new science, yet it is not new. Your General Electric radio is an electronic instrument. So will be your General Electric television receiver, after the war. So are magic "eyes" that open garage doors, and so are the talking moving picture and the physician's X ray.

Write for your *free* copy of the fascinating 32-page color booklet, "Electronics—a New Science for a New World." General Electric—Radio, Television, and Electronics Dept., Schenectady, New York.

General Electric Radio News Program, with Frazier Hunt, Tuesday, Thursday, Saturday evenings, C.B.S. and American (FM) networks. See newspapers for time.

GENERAL ELECTRIC

Leader in radio, television, and electronic research

Every General Electric radio is an electronic instrument

This is a General Electric electronic radio tube, used in all General Electric sets. The electronic tubes that may enable you to talk tomorrow from your home to an airplane are essentially of this kind.

A BOY ON A HILL-TOP

He used to wave at me from that hill . . . we lived just beyond it. He knew the exact time I'd be by . . . and I'd wave to him from the cab.

And on my time off, I'd go to the hill with him, and we'd sit together, my son and I, and wait for the trains to come along. We'd hear their whistle calling across the distance . . . then see the long plume of smoke come into view, racing like the wind . . . and as they thundered by, we'd both wave to the engineer.

Maybe there's something in heredity—he seemed to have the railroad in his blood. When he finished school . . . well, I rolled into the yards one day, and there he was—no longer my little boy, but a man. A *railroad* man!

He might someday have taken over my run. But, last December 7, he was twenty-one . . .

I don't know where he is now. He got his two weeks leave before he left. But whenever I pass that hill, I seem to see him, as he used to be, before he became a man and had to shoulder the responsibility of being a man.

I know he wants to come back to the railroad . . . and I'm going to see that he does come back! Those Japs and Nazis who started all this—when they creep up on him and all his fellows in arms—even if they come with a thousand tanks and mobile guns and all the dive-bombers they can find in hell—he and his buddies will meet them with fifty thousand tanks and a hundred thousand planes and two hundred thousand guns. My job, now, is to get that equipment to the ships that'll take it to him and to all the other American boys like him, no matter where they are.

And it can rain and snow and sleet and it can blow, and nothing will stop me. I'll get the stuff through to him. I am getting it through to him. You only have to lie still in the night and listen to the rumble of the trains—the trains everywhere—to know that I'm speaking the truth. It's my son, and it's my country, whose lives are at stake, and I can't fail and I won't.

A REFRIGERATOR AND AN AUTOMOBILE GO TO WAR!

IT hurtles across the Atlantic between dawn and dinner-time . . . a giant cargo-carrying flying boat with a freight-car load of what it takes to smash an enemy.

This, Mr. Hitler—is a picture of a refrigerator and an automobile *going to war.*

Not by ones or twos—but *in fleets*—these Vought-Sikorskys will soon be sailing from Nash-Kelvinator assembly lines—to fly the fight and might of the U. S. Navy.

And when they stretch their wings around this world, there will be proud new Navy *Corsairs* to protect them—new fighting ships that can fly the wings off any Axis 'plane now known!

The Corsair, too, carries the colors of Nash-Kelvinator. Its powerful 2,000 h.p. super-charged high-altitude engine is a *quantity* assignment for men who have already built thousands of propellers for the Axis-blasting fliers of the United Nations.

This is just a sample, Mr. Hitler, of our 1943 models. Just a picture of what one company is doing—in meeting and beating a production schedule four times greater than our best peace-time year. And all America's in the fight—buying War Bonds, getting in the scrap metal—in this war *to win!*

So your happy dreams are about over, Adolf—a Nazi nightmare is turning true. The wings of vengeance are coming—from the west!

• • •

NASH-KELVINATOR CORPORATION

NASH KELVINATOR

"This day, nothing to eat nothing to drink"

The log of lifeboat No. 2, as kept by Captain C. Sidon, of the MATSON freighter S. S. MANINI.

December 18, 1941. 5:04 a.m. (Greenwich Central Time) . . . ship torpedoed by Japanese submarine, without warning . . . ship began to sink rapidly. Topmast crashed down carrying away wireless antenna . . . no possibility sending S.O.S. . . . Abandoning ship. MANINI sank by the stern. Kept lifeboat's bow into the sea all night. Rough sea . . . shipping water . . . men at the oars continuously.

. . . This day, nothing to eat . . . nothing to drink. Saw a plane on patrol duty . . . sent up pistol flares . . . not seen.

December 19. Sea rough and high . . . at oars all night, all day . . . bailing all the time. Another plane . . . sent up flares . . . unseen.

Today . . . for each man, 1 hard biscuit . . . ½ cup of water.

December 20. Last night the worst. . . . men at oars 64 hours continuously.

. . . today . . . 1 hard biscuit, ¼ cup of water, ½ cup canned peas.

December 21. Sea moderated . . . this day . . . 2 hard biscuits, shared 2 small cans of tomatoes.

December 22. Consumed 2 cans of apricots, 1 biscuit, ¼ cup of water.

. . . 1:00 p.m. American Army bomber flew directly over, everybody jubilant. . . . 3 cans of tomatoes to celebrate good fortune.

December 23. No sign of rescue . . . today . . . 1 hard biscuit, 2 cans of cherries, ¼ cup of water.

. . . only enough water left for about 5 or 6 servings of ¼ cup to each man. Our hope lies in heavy rain squalls.

December 24. . . . today, 1 hard biscuit, 1 can of tomatoes (last can!) . . . no water.

. . . patrol plane . . . sighted about 5:15 p.m. . . . 10 minutes later . . . another plane.

. . . thank God! This fellow saw us. . . . ¼ cup of water . . . to celebrate good luck and Christmas Eve.

December 25. No signs of rescue! . . . Christmas Day! . . . what we thought was going to be the happiest Christmas of our lives becomes the saddest.

December 26. Jules Simmons, Messman, died of thirst, hunger and exposure . . . buried with religious services. . . . committed his body to the deep at 5:45 p.m.

. . . today we are nineteen in lifeboat No. 2 of the S. S. MANINI.

December 27. No rain! . . . torrential rain squalls all around . . . but not where we are.

. . . each man now getting 1½ oz. of water in the morning, 1½ oz. in the late afternoon . . . we'll die of thirst, unless we get rain! . . . prayers for our deliverance.

December 28. 6:30 a.m. Sunday services . . . 7:30 a.m. . . . 3 Navy planes sighted us . . . we are signalling . . . big Consolidated plane joined watch over us. . . . signalled . . . "Help coming!"

. . . crew of the big plane zooms low . . . men holding their thumbs up . . . we answer with thumbs up . . . U.S.N. Destroyer [redacted] over the horizon . . . rescued this day.

December 29, 1941. Aboard the U.S.N. Destroyer [redacted]. Everybody happy!

Here's American drama, enacted by 28 American seamen who became 19

. . . *recorded* . . . *American heroism* in a seaman's log, with such superlatives as "this day 1 hard biscuit . . . ¼ cup of water" . . . "this day nothing to eat, nothing to drink" . . . "prayers for our deliverance."

. . . *recorded* . . . a memorable saga of MATSON men and ships, as they serve the Nation, proudly carrying on in the highest traditions of the *American Merchant Marine.*

Matson Line TO **Hawaii** · **NEW ZEALAND** · **AUSTRALIA** VIA SAMOA · FIJI

You can't beat

Interwoven*

SPECIAL QUALITY SERVICE SOCKS

There are more than a thousand different Interwoven Socks from which to choose ...the worthwhile gift.

Also in Black and in White for the Navy

* Reg. U. S. Pat. Off.

BY THE LARGEST MANUFACTURER OF MEN'S SOCKS IN THE WORLD

Wartime "Can't" *Inspires* *Tinless* RING-FREE "Can"

Another example of how Macmillan pioneers for better lubrication

ONE QUART NON-REFILLABLE

HERE'S THE "CAN" that the oil industry has been seeking—the first all-fiber, plastic-lined container impervious to oil!

It's more than an answer to WPB's order forbidding the use of tinplate for packaging civilian products after September 2nd, 1942. It's a permanent contribution to packaging—lighter, easier to open and dispense, non-refillable, easily disposable.

The basic fiber is made of straw and waste paper and the rest is processed from such surplus crops as corn and other grains, flaxseed, tallow, animal tissues and bone. It will replace millions of pounds of metal a year!

* * *

You may be asking yourself how Macmillan—a comparatively small, "independent" company—can be the first to lick this container problem for motor oil.

The answer is that for ten years Macmillan RING-FREE Motor Oil has been blazing new trails in lubrication.

Startling as this new container is, it is not so spectacular as the simple fact that RING-FREE *removes carbon!*

RING-FREE is refined by an exclusive patented process which retains a vital characteristic of the original crude oil, enabling RING-FREE to dissolve the "binder" which holds carbon to the metal parts of your engine.

But this exclusive process does more than that.

It produces an oil that reduces friction so fast that added power is delivered to your drive-shaft.

This added power can be measured in extra mileage. In 1094 Certified Road Tests in many makes of owner driven cars in widely scattered parts of the country, savings as high as 10 per cent were not uncommon.

LESS FRICTION MEANS—

Savings in wear and tear and repairs, in replacement of worn parts—more vital today than ever before, now that you don't know when you will get another car. These savings prove the all-round better lubrication job of RING-FREE as clearly as the way RING-FREE *removes* carbon.

SO REMEMBER—

This new container is the latest concrete proof of Macmillan's capacity for pioneering. But never forget that the oil itself is even greater proof of Macmillan pioneering. And you can see for yourself that RING-FREE is a pioneer in carbon removal by comparing the color of the oil when it goes in your crankcase and when it is drained. It goes in clean and light and usually comes out dark and murky because it has cleansed the metal surfaces of your engine. You can observe the reduction of friction from RING-FREE in the freer, more buoyant operation and in the savings in gas as proved by 1094 Certified Road Tests.

Drive in at any independent filling station, garage or car dealer's, wherever you see the Macmillan RING-FREE sign—and get a fill of RING-FREE as you read this guarantee!

* * *

Try it at OUR risk! Macmillan RING-FREE Motor Oil removes carbon, cleans the motor, saves gasoline, reduces wear—or your money back. RING-FREE Motor Oil is *guaranteed* to make your motor run smoother, give more miles per gallon of gasoline, reduce wear and repair; because it removes carbon, cleans the motor and reduces friction fast, by thorough lubrication. Try one fill, and if you are not satisfied that RING-FREE is doing these things, your money will be refunded by your dealer immediately.

Ask your independent dealer for "What You Can Expect from Macmillan RING-FREE Motor Oil," our new circular, or write us for it direct.

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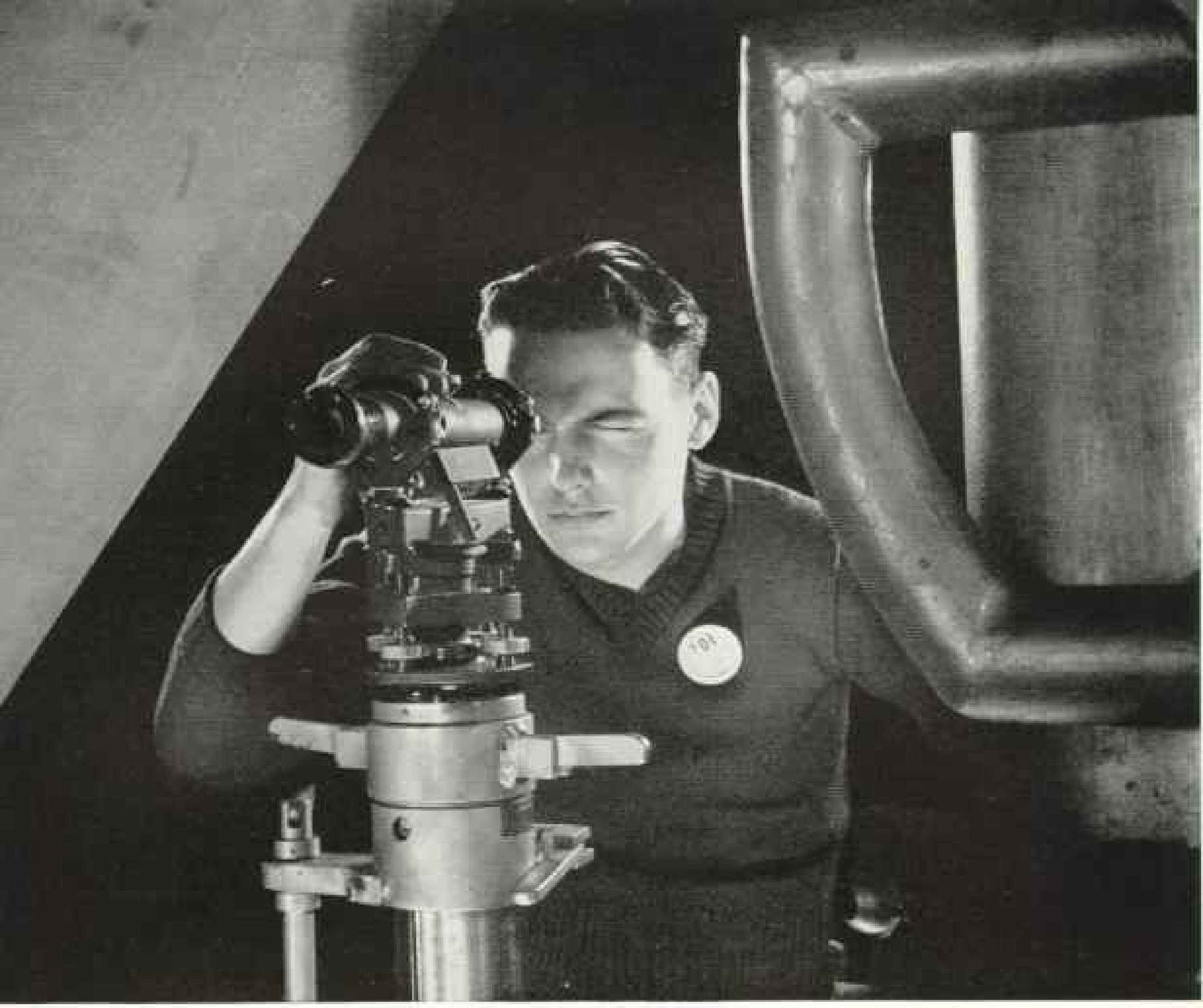


Sighted Fortress—built same

This young sharpshooter is lining up a wing jig for a Flying Fortress.*

From where he stands (in the wing shop of the Boeing Seattle plant) he can see that the wing of the big B-17 he is helping to build is going to be straight and true. He can see that the Fortress is going to be bad medicine for the Axis.

Wing jigs are the "forms," the giant tools, in which the Fortress wings are built. The Boeing jigs are three stories high, built of steel tubing. They are big enough to permit large crews to work freely on each "floor" and they are accurate enough to be adjusted to 1/1000 of an inch.

Jigs are tools, and the Boeing jigs are part of the more than 200,000 special tools and machines designed by Boeing tool engineers, and built by Boeing technicians, for the swift, smooth-flowing production of Flying Fortresses and other war planes.

There are more than 3500 engineers now at work in the Boeing plants. Their know-how ranges over the whole field of engineering. They represent more than twenty-five different kinds of engineering skill. Whether they are designing a wing for a new airplane, a spiral staircase for a Clipper, or a machine that will turn out parts 20—50—100 times faster, Boeing engineers bring to the job an understanding that it must be a better job than ever has been done before.

The designing of the tools and machines with which to build new kinds of equipment . . . for war and for peace . . . is only one of the many projects that form a constant part of the Boeing engineering schedules at Seattle and in the Middle West and Canada.

DESIGNERS OF THE FLYING FORTRESS • THE STRATOLINER • PAN AMERICAN CLIPPERS **BOEING**

*THE TERMS "FLYING FORTRESS" AND "STRATOLINER" ARE REGISTERED BOEING TRADE-MARKS

This is no time for time-wasting methods

To win this war we've got to tighten up—toughen up. We've got to do in one hour the work of three. Old habits of slackness and self-indulgence must go—in the office as in the shop. We Americans have developed the methods. Now let's use them!

For instance: how many of you users of Dictaphone dictating machines have ever realized to the full all the time-saving advantages of Dictaphone dictation? Today, when minutes are precious and fateful, victory demands the self-discipline that will expend no useless effort—that will seek constantly for new short-cuts.

If you will make full use of your Dictaphone, work will flow more smoothly throughout your entire organization. Check your own methods on the list below:

☐ Dictate whenever you please without requiring the presence of a secretary ☐ Give oral messages to your secretary via Dictaphone ☐ Protect yourself against interruptions by leaving your secretary free to intercept phone calls and visitors ☐ Use your Dictaphone for flash ideas ☐ Don't interrupt your associates needlessly—dictate memos instead ☐ Confirm telephone calls, oral instructions and reports by dictating to your Dictaphone on the spot ☐ Put conference high-lights on record ☐ Take your Dictaphone home and on trips—it's a "second secretary" always ready to go wherever and whenever you want.

HELPING TO WIN THE WAR IS DICTAPHONE'S NO. 1 JOB TODAY

• To Dictaphone Corporation has gone the difficult task of making the precise and intricate mechanism required in the U. S. Army's remote control firing device for anti-aircraft guns.

This ingenious device enables the guns to get into action with deadly accuracy and almost incredible speed.

Thus the skill and precision developed in the manufacture of Dictaphone dictating machines are now contributing to the greatest task in all history.

Today, Dictaphone is also making Electricord recording-reproducing equipment for the U. S. Army, the Navy and other essential war services.

DICTAPHONE

ACOUSTICORD DICTATING EQUIPMENT
ELECTRICORD RECORDING EQUIPMENT

The word DICTAPHONE is the Registered Trade-Mark of Dictaphone Corporation, Makers of Dictating Machines and Accessories to which said Trade-Mark is Applied.

FREE CARTOON BOOK

Shows uses for the Dictaphone you probably never thought about. Mail the coupon and we'll mail the book.

DICTAPHONE CORPORATION
420 Lexington Ave., New York, N. Y.
In Canada—Dictaphone Corporation, Ltd.
86 Richmond Street, West, Toronto, Ontario

Please send me your free cartoon booklet.

Name .....

Address .....

"I've just heard from my draft board"

"They tell me I'm in the Army now. I've passed my physical exam and all the rest of it, and I'm certified to do one of the most important jobs in the world—helping to give strength to America's fighting troops. . . ."

The lady has a right to be proud. For today, all over the United States, fresh milk is being served in Army camps as a basic part of the conditioning diet.

The rich and regular appearance of milk and milk products on U. S. Army mess tables is one of the reasons why the boys in the camps grow healthier month by month.

National Dairy is using its far-flung facilities for production, processing and distribution to speed milk and milk products in great volume to Army posts in many areas in this country.

And to the men in service overseas, National Dairy is shipping millions of pounds of an unusual new milk product . . . a preserved butter for export that *will not melt at 110 degrees!*

This versatile food is only one of many products of National Dairy Products Corporation, an organization whose research is devoted to the exciting task of making milk and its many products ever more abundantly available to people everywhere.

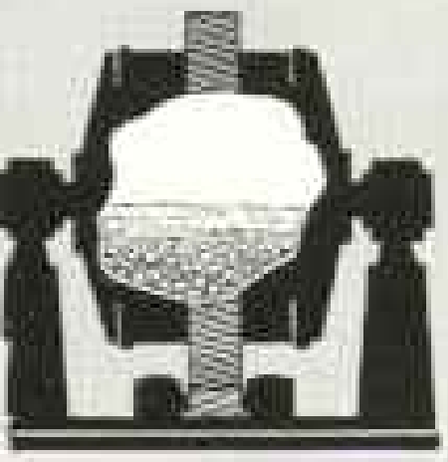
Dedicated to the wider use and better understanding of milk as a human food . . . as a base for the development of new products and materials . . . as a source of health and enduring progress on the farm and in the towns and cities of America.

NATIONAL DAIRY
PRODUCTS CORPORATION
AND AFFILIATED COMPANIES

Originators of the Sealtest System of Laboratory Protection

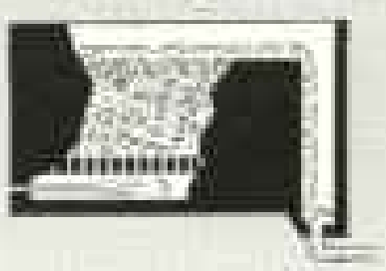
HIS DRILL STARTS COPPER ON ITS WAY TO FIGHTING FRONTS

Deep underground in Butte mines, ore is drilled, blasted loose, and transported to the reduction works—preliminary to the following eight major steps necessary to obtain pure copper from earth-bound Montana ores.



Left—Ore is then crushed and ground to particles finer than sand.

Right—Flotation separates the copper-bearing particles from waste material.



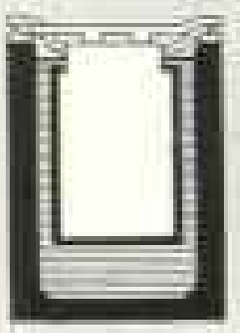
Right—Flotation concentrates are dried; then the sulphur content is removed in roasting furnaces.

Above—Smelting then takes place in reverberatory furnaces.

Below—In huge converters the molten mass is further purified.

Below—After additional furnace treatment, copper containing gold and silver is cast into anodes.

Below—Electrolytic refining produces pure copper cathodes and permits recovery of the precious metals.



With the blast that follows up the driller's work, copper ore begins its trip through mines, smelters and refineries, where we are producing day and night... not only copper, but also zinc, lead and silver...chromium, vanadium and manganese . . . and other non-ferrous metals which are vital to the winning of this war. Our fabricating subsidiaries are devoting every resource at their command to the on-time delivery of essential materials: copper and copper-alloy sheets, plates, rods and tubes... and electrical wires and cables—all are required in huge quantities in the struggle for victory.

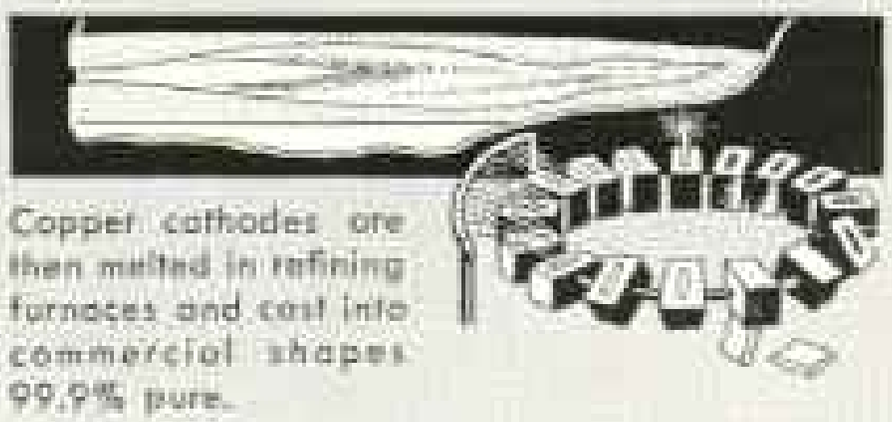
ANACONDA

ANACONDA COPPER MINING COMPANY

THE AMERICAN BRASS COMPANY • ANACONDA WIRE & CABLE COMPANY • INTERNATIONAL SMELTING AND REFINING COMPANY

THIS WE PROUDLY FLY—the Army-Navy "E" waves over five plants of the Anaconda organization, and the Navy "E" over three others. Most departments boast of the Treasury's Minute Man Banner.

BUY MORE WAR BONDS FOR VICTORY



Copper cathodes are then melted in refining furnaces and cast into commercial shapes 99.9% pure.

"Where shall we stay?"

NATIONAL GEOGRAPHIC MAGAZINE'S HOTEL SECTION

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Phoenix

Hotel Westward Ho. Premier Hotel of the Southwest, in world-famous Valley of the Sun. Midtown with desert resort atmosphere. European Plan. Pkit.

Tucson

Pioneer Hotel. Southern Arizona's Finest. 250 Rooms with bath. Europ. Coffee Shop. Dining Room. Roof Garden. Sun Deck. Sensible Rates. Booklet.

ARKANSAS

Hot Springs National Park

Arlington Hotel and Baths

Central location simplifies travel problems. Curative hot waters owned and recommended by U. S. Gov't. for arthritis, high blood pressure, etc. Complete Bathhouse in the hotel. Your favorite recreation in restful climate. Social calendar. Excellent cuisine. For folder and tariffs, address W. E. Chester, General Manager.

Hotel Majestic. Rooms, suites, apartments. Government supervised bath house in hotel. Also Lodge on Lake Hamilton. Write for booklet.

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16th and M Streets, Washington, D. C.
Please have booklet and rate information sent to me at once by the following hotel(s)

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Del Monte

Del Monte & Pebble Beach Lodge. These world-renowned resorts on the famed Monterey Peninsula are meccas for those needing vacations.

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Wardman Park Hotel. Washington's Largest. 1000 outside rms. Surrounded by parks. Near everything. Popular prices in dining rms. Rates from $3.50.

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Lakeside Inn. High in hills of inland Florida, 30 miles from ocean and gulf. 2½ blocks from movies, shops yet in private park. Rates from $7. Am. Plan.

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Wynehm Hotel. New, Modern. Exquisite appointments. Fronts on finest bathing beach. European plan. Selected clientele. Booklet.

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Ideally located, overlooking Park, Bay, Ocean, yet right "downtown," on local bus lines, accessible to every sport, attraction. Convenient shops, services save time—allow more hours for vacationing. 500 Rooms, each with bath and shower; steam heat, fireproof. Modern appointments throughout. Superior cuisine. Leonard K. Thomson, Manager.

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Palm Beach Hotel.—Excellent service, finest cuisine, home-like atmosphere. Semi-roof, Bathing. All Sports. Am. and Europ. Plan. J. J. Farrell, Mgr.

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The Cloister—pledges the best and most in rest and recreation. Golf and all sports. Early season rates. New York Office, 630 Fifth Ave. Circle 5-8956.

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Three Toms Inn. The ideal winter resort of the deep South. Inland, no dampness or Army camps. Highest standards. Golf, hunting, riding. Booklet.

MARYLAND

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The Belvedere. Baltimore's Finest Hotel acclaimed everywhere for its spacious rooms, unexcelled service and superb cuisine. Ideally located. $3.50 up.

MINNESOTA

Rochester

Hotel Arthur. Fireproof. $3 up double. Block to Clinic. An Arthur L. Roberts Hotel. Also 2 New Palm Beach, Fla., Hotels. Write us.

NEW YORK

New York City

The Biltmore, Madison Avenue at 43rd St. All that is best in atmosphere, appointments, service. Single, $5.50 up; Double, $7.50 up; Suites, $12 up.

The Commodore—Right at Grand Central and Air Lines Terminals. Near all attractions. 2000 comfortable, outside rooms all with private bath.

Essex House, facing Central Park. Rooms and Suites with butlers' pantries—at moderate rates. 160 Central Park So.

Hampshire House—Central Park South. New York's most beautiful hotel. For transient visits or longer stays. Vincent J. Coyle, Manager.

Park Lane Hotel. Park Ave. at 59th. Convenient, distinguished. Single rooms from $5; double from $7; suites from $12. Apartments, permanent occupancy.

The Plaza. A traditionally famous hotel. Facing beautiful Central Park. Single from $6; double from $8. Henry A. Rost, President.

Hotel Seymour, 50 W. 45th St. Near Fifth Ave., theatres, shops, art galleries, Radio City. Quiet, refined surroundings. Single $4; double $5.50; suites $7.

The Waldorf-Astoria, Park Ave., 49th to 50th Sts. At heart of New York business, social life . . . no one needed. Send for bklt., "A Plan for Duration Living."

NORTH CAROLINA

Asheville

Battery Park Hotel. Special weekly & monthly rates, Nov. thru Mch. Cheerful lounges & dining rms. Comfortable bedrooms. Request folder "B" & rates.

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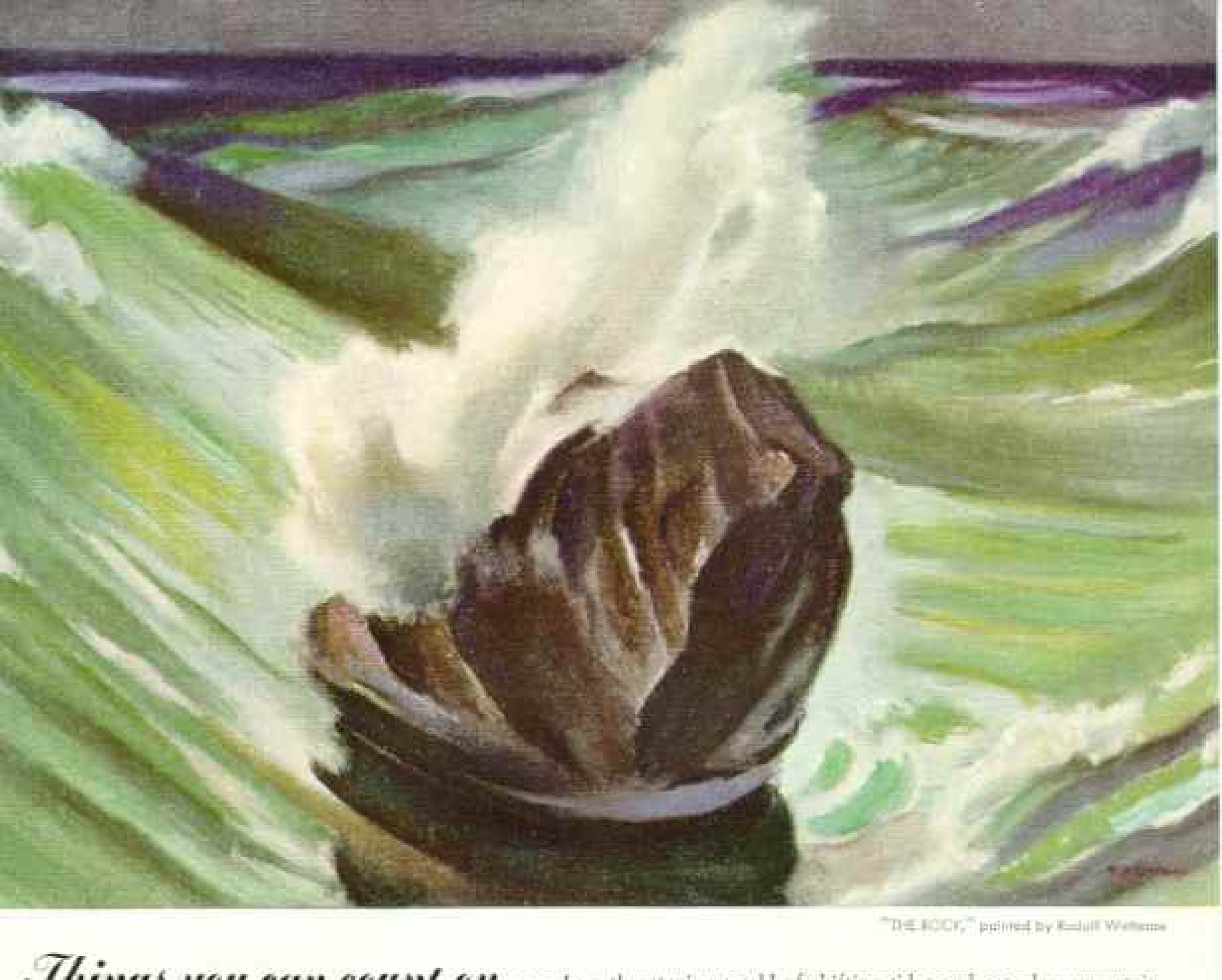
Hotel Hershey. One of America's finest. Magnificent setting. Open year around. European and American plans. Four Golf Courses. All outdoor sports.



"THE ROCK," painted by Rudolf Wolfsona

Things you can count on ... In a threatening world of shifting tides and ceaseless uncertainties, what man doesn't wonder—doesn't pause to ask himself, "Is anything the same"? These tough times have changed things plenty, but still there are lots of life's good things—good food, good clothes, lots to do, and freedom to choose.

There's smoking, and there's Kaywoodie Briar. Thanks to prudence and foresight, *we still make these fine pipes from the same sweet-smoking, mellow Kaywoodie Briar we always used.* Fortunately this doesn't interfere with war-needs. It *might* have been different. There might have been no Kaywoodie Briar (world's only source of it is in the Mediterranean).

But that didn't happen. Long before the war, our men abroad warned that sources of Kaywoodie Briar in Greece and Albania were in danger of being lost. We got the briar out in time. More than enough for regular Kaywoodie requirements for several years. We brought it to America before the boats were needed for war-loads.

This fine Kaywoodie Briar, selected from the oldest and best offered by a free Earth, has been mellowing in a safe place. It has been prepared according to our own formula. It will give you the satisfaction you expect, from a Kaywoodie Pipe. It has the Kaywoodie Flavor. When you feel you should have another Kaywoodie Pipe, you can get one. It will be as good as ever. You can always count on Kaywoodie Briar.

This Kaywoodie Pipe is a "Bulldog" Shape Home Grain Briar, $15. (¾ actual size)

In the U. S. Navy Press Room, Tracing the Geography of a War Story on a National Geographic Map

GEOGRAPHIC WALL MAP SERIES—magnificent atlas and gazetteer of world at war!

FOR CHRISTMAS GIVING or personal use—timely maps in ten colors published by the National Geographic Society! Here is your opportunity to complete your set. These maps of the continents and oceans, and corresponding Indexes, make up the world's most up-to-date atlas and gazetteer. Maps come on either paper or linen. Indexes available for maps marked *.

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The World: 41 x 22 inches; ideal to determine quickly the "lay of the land" wherever news happens.

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	Paper Maps (50c each in U. S. & Poss. Elsewhere 75c each)	Linen Maps ($1 each in U. S. & Poss. Elsewhere $1.25 each)	Indexes (50c each in U. S. & Poss. Elsewhere 60c each)
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*Central Europe & the Medit.			
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What flavor has a vitamin?

WE DON'T KNOW the flavor of a vitamin . . . but we do know that flavor and food value generally go hand in hand in cooked foods.

This means that when food is prepared so that its flavor is retained, the chances are that most of its vitamins and minerals have been retained, as well. The most *nutritious* food is usually the most *delicious* food . . . especially as regards vegetables.

This is cheering information. It is also a challenge to every person who cooks a meal, either for herself or for others. Unskillful cooking can be responsible for flat-tasting, unappetizing meals . . . and for the loss of valuable minerals and vitamins.

Good cooking can make even the most inexpensive foods into appetizing, nourishing dishes. Variety may be obtained by combining them with other foods, and by using tasty sauces and garnishes. Modern cook books, magazines and radio programs offer many suggestions.

Here are some suggestions for conserving vitamins — and flavor! — in the meals you serve your family.

Suggestions for saving vitamins

► In cooking vegetables, it is best to raise the temperature to the boiling point as rapidly as possible. Heat may then be lowered.

► Stirring air into foods while they are cooking causes vitamin destruction.

► Foods should not be put through a sieve while still hot.

► When cooking, use as little water as possible.

► The water used in cooking and from canned vegetables is valuable for soups, sauces, gravies.

► Chopped fruits and vegetables should be prepared just before serving.

► Start cooking frozen foods while they are still frozen.

► Frozen foods which are to be served raw should be used immediately after thawing.

Additional suggestions and information about the nutritive value of various foods can be found in Metropolitan's free pamphlet 122-N, "Your Food — How does it rate for Health?" We will gladly send you a copy.

• • •

This advertisement is published in the interest of the National Nutrition Program of the Federal Security Administration.

Metropolitan Life Insurance Company

(*A MUTUAL COMPANY*)

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CHAIRMAN OF THE BOARD

Leroy A. Lincoln,
PRESIDENT

1 MADISON AVENUE, NEW YORK, N. Y.

The Great Northern Diver

THE GREAT NORTHERN DIVER is a bird about the size of a goose. Most people know him by the name of loon. It is popularly supposed that this name comes from his peculiar cry which echoes over the wooded lakes of the North like the laughter of a lunatic in the night.

But, although the expression "crazy as a loon" is a common one, the word *loon* was originally *lom*, a corruption of a Scandinavian word meaning lame, or, in the loon's case, a "lame walker."

The loon's legs are set farther back on his body than those of other birds. They enable the loon to dive like a flash, going as far as 50 feet under water; and, with his large, webbed feet, he can outspeed the fish on which he feeds.

Diving is also the loon's protection against the foe that wild things fear most: man. Although men do not hunt the loon for food, fishermen often try to shoot him because of the large number of fish he destroys.

This is a task easier tried than accomplished. For the loon, hunters insist, is such a remarkable diver that he can actually dodge bullets. When he sees the flash of a gun, he gives a flip of his paddle-like feet and is safe beneath the water before the shot reaches him.

On land, however, the loon is one of the most awkward creatures imaginable and no more difficult to shoot than a barnyard duck. For, without his marvelous diving ability to protect him, the loon finds himself in much the same position as a man who has let his insurance policies lapse. Both suddenly find that a form of protection they have learned to rely on, is no longer working.

But man is more fortunate than the loon. He does not have to rely upon himself alone to make sure that his insurance doesn't lapse and leave him unprotected against such unforeseen mishaps as fire, wind storms, burglars, or an expensive fall down the cellar stairs.

There is a capable man in your community to jog your memory and make sure that you don't lose the protection of insurance through oversight or carelessness. This man is the local Travelers agent or broker.

He will not only be glad to help you work out the most effective and economical insurance program possible for your needs, but he will also make it his personal business to see that your policies do not lapse and deprive you of protection.

Moral: Insure in The Travelers. All forms of insurance. The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, Hartford, Connecticut.

That Extra Something!

...You can spot it every time

Supposing you were Old Santa Claus. What a job you'd have! Chimneys waiting everywhere . . . youngsters' gift lists to be checked. The job certainly calls for that extra something.

You'd get tired and thirsty, too. You'd want that extra something in refreshment—ice-cold Coca-Cola. Well, you'd find it in many homes everywhere. You could help yourself at the icebox and be welcome.

You'd find thirst gone and refreshment arriving. You'd thrill to the taste so delicious and distinctive that it stands alone. You'd know you were enjoying all the quality that skill and choicest ingredients could put there. You'd find refreshment going quickly into energy. You'd be ready again to shout, "Ho, Prancer! Ho, Vixen . . ."

(You can pretend you're Santa. You don't have to pretend you're enjoying an ice-cold Coca-Cola. Have one!)

It's natural for popular names to acquire friendly abbreviations. That's why you hear Coca-Cola called Coke. Coca-Cola and Coke mean the same thing . . . *the real thing* . . . coming from a single source, and well known to the community"

The best is always the better buy!

Coca-Cola 5¢

Happy moments at home are brighter when ice-cold Coca-Cola adds its life and sparkle. It's an old friend of the family ready to take off its cap and help out any time.

An American Tradition

—HOME MOVIES ON CHRISTMAS NIGHT

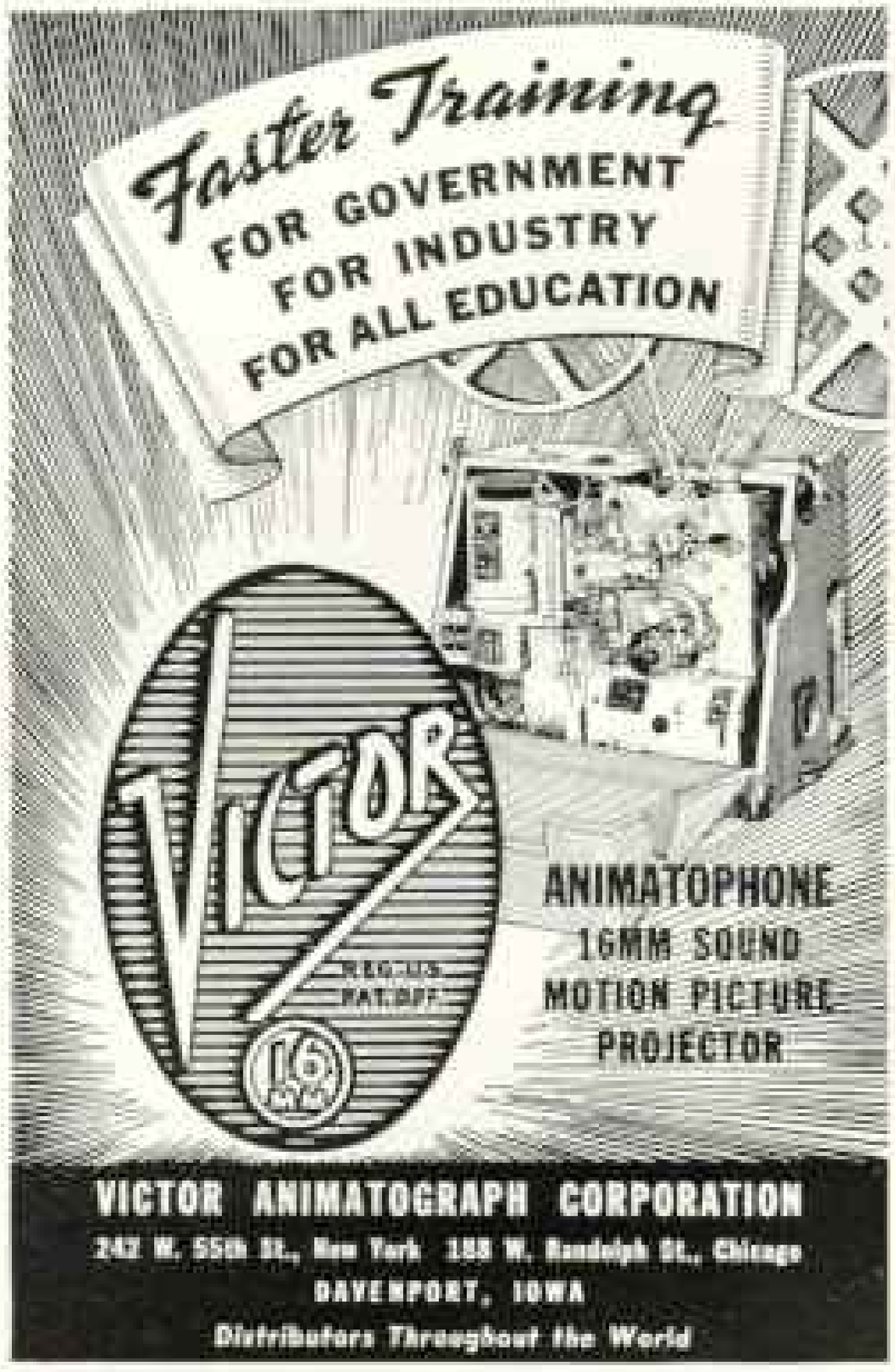
SOMEBODY brings home a film or two, for the home movie camera. Like evergreens and turkey, it's part of the Christmas ritual . . .

For Christmas, more than any other day, is a time for "family." For gathering, revisiting, marking the changes, thinking over Christmas a year ago, two years ago . . . In hundreds of thousands of American homes, this is the day of days when the Ciné-Kodak is very busy.

Later, in the evening, comes the time for living over other Christmases. On the home movie screen, each holiday unfolds: the new baby's first Christmas; the year when Christmas morning was bright with the beauty of falling snow; the Christmas when Jack came home after his first long absence; Alice's last Christmas at home before she was married . . .

Year by year the record grows. This Christmas will add a priceless chapter. Visit your Ciné-Kodak dealer . . . Eastman Kodak Co., Rochester, N. Y.

Life is a movie—**CINÉ-KODAK** *gets it all*



THESE FINE BOOKCASES MAKE EXCELLENT CHRISTMAS GIFTS

These useful and attractive Globe-Wernicke bookcases are fine examples of wood craftsmanship ... always in good taste ... a Christmas gift that will bring joy for many years. They are made in a variety of styles and finishes for home and office. FREE ... Ask our dealer for 32-page booklet, "The World's Best Books" ... or write direct to us.

★

(Top left) Economy ... sectional bookcase ... "grows as your library grows."

★

(Top right) Ambassador ... solid end bookcase ... smartly styled ... adjustable shelves.

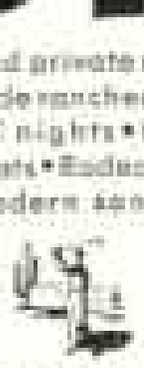
The Globe-Wernicke Co.
CINCINNATI, O.

What wouldn't America's healthiest winter resort do for you! *Relax in*

TUCSON

Come to rest or play—you'll find a complete change in Tucson's *dry*, unmatched desert climate! You'll be amazed how quickly this land of exhilarating sunshine tones you up... makes you *alive* again! Send now for information. *Reservations advisable.*

Good private schools • Dude ranches • Tranquil nights • Cactus forests • Rodeos • Polo • Modern sanatoria



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May Cause Fatal Infection

Use **KLIPETTE** *New Invention*

You can cause serious infection as a result of pulling hair from nose. Use of scissors is also dangerous and impractical. No better way to remove hair from nose and ears than with KLIPETTE. Smooth, gentle, safe and efficient. Rounded points can't cut or prick the skin.

Guaranteed to Satisfy or Money Back

So Simple!
Just turn and. Surplus hair comes out easily, gently.

$1. Made from finest surgical steel. Chromium plated.

HOLLIS CO., 11 Commerce St., Newark, N.J., Dept. 288 • Enclosed is $1.00 for KLIPETTE. If I am not entirely satisfied, I may return it and my $1.00 will be refunded.

Name _____ Address _____

You'll never get cold feet under the new G-E Automatic Blanket

Look, Cousin Oswald! For a bomber pilot, we make an electrically warmed suit that keeps him comfortable at temperatures down to 60° below. But for you, we have a zephyr-light Automatic Blanket that works similar miracles for your sleeping comfort. Just *one* keeps your whole bed as warm as you like—Winter, Spring and Fall!

Speak to Mother about it, Oswald. We'll give you *automatic warmth without a mountain of covers* (or canines) . . . and always the *same* warmth, no matter how the bedroom temperature changes.

Just set the small Bedside Control *once* for the warmth you choose. From then on, protected from chills and overheating, you'll know the luxury of really restful, uninterrupted sleep.

You'll find this "Blanket with a Brain" at department stores, electric companies and other dealers — in limited quantities. For this is the sort of thing we've quit making "for the duration." We've more important jobs to do — for the Armed Forces — now.

WARMTH WITHOUT WEIGHT! One zephyr-light blanket instead of mountains of heavy covers. More comfort for both when two sleep together.

BED WARM ALL OVER! No cold zones when you change position — no muscular kinks or cramps when you wake.

UNIFORM WARMTH ALL NIGHT! The warmth you select, no matter what the bedroom temperature. A special blessing if you are keeping your home cooler than usual by conserving fuel.

WARM BED WHEN YOU RETIRE! No chilly sheets if you switch on the Blanket *before retiring*.

REFRESHING, RELAXING SLEEP! Wake really rested —you haven't wasted energy trying to keep warm.

$34.50 plus excise tax. Pacific Coast and Rocky Mt. areas slightly higher. Prices subject to change without notice.

The Automatic Blanket makes up like any fine blanket. 72 x 86 in. — ample for double beds. Colors: Blue, Green, Cedar, Gold, Wood Rose and Beige. Washable.

For more details or dealers' names, write direct to General Electric, Dept. OG-1222-16, Bridgeport, Conn.

GENERAL ELECTRIC

GRAND BOOKS to give!

Man-o'-war bird, photographed by Claude C. Matlack

Leaping pike; photograph from Dr. Edward Booth

OR KEEP! These superb books enable adult or child to appreciate the living wonders of Nature. They will help you solve your Christmas problem, for their lifelike illustrations and authoritative text appeal to all lovers of the outdoors. Economical—*not priced for profit, and sent postage prepaid*—they are ideal Christmas gifts.

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Nine hundred and fifty birds—all major species of United States and Canada—are shown in *full color* in the paintings by Allan Brooks which illuminate this magnificent work *in two volumes*, edited by Gilbert Grosvenor and Alexander Wetmore. Among other illustrations are 252 photographs and 17 migration maps. "The Book of Birds," indexed with 5,000 specific references, contains 37 fascinating articles and 635 biographies—an encyclopedic wealth of bird lore for pleasure and enlightenment of young and old. 748 pages. Green cloth covers, 7 x 10¼ inches, $5 *the set in U. S. & Poss. Elsewhere*, $5.50.

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Every outdoor enthusiast will enjoy the thrilling experiences provided by this comprehensive *full-color* presentation of the important food and game fishes of North American inland and coastal waters. This remarkable book, edited by John Oliver La Gorce, contains 443 *color portraits*, 162 action photographs, 102 biographies, and 11 chapters of stimulating narrative. 372 pages. Light-blue cloth covers, 7 x 10¼ inches. $3 *in U. S. & Poss. Elsewhere*, $3.25.

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National Geographic Society 1942
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Book of Wild Flowers	3.00	3.25	
Our Insect Friends, etc.	2.50	2.75	
Wild Animals of No. Am.	2.00	2.25	
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All this you can give him by doing whatever you can — no matter how little — to win this war so that he may live to appreciate fully the true meaning of Christmas . . . peace on earth and good-will toward men.

Today, in the Union Pacific family, thousands of fathers are working tirelessly to justify the steadfast faith of their children. Theirs is the task of assuring the safe transportation of trainloads of war materials and troops. It is a tremendous job but they are doing it gladly. They know, as do we all, that only through hard work and sacrifice can we give our little ones the greatest gift of all . . . peace and freedom.

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_____ *1942*

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Address _____

_____ *for membership in The Society.*

12-42 *Name and Address of Nominating Member*

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means "city watch"

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means "stranger, foreign"

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means "proud chief"

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The Ethyl trade mark emblem on a gasoline pump means that Ethyl fluid has been put into high quality gasoline and the gasoline sold from that pump can be called "Ethyl."

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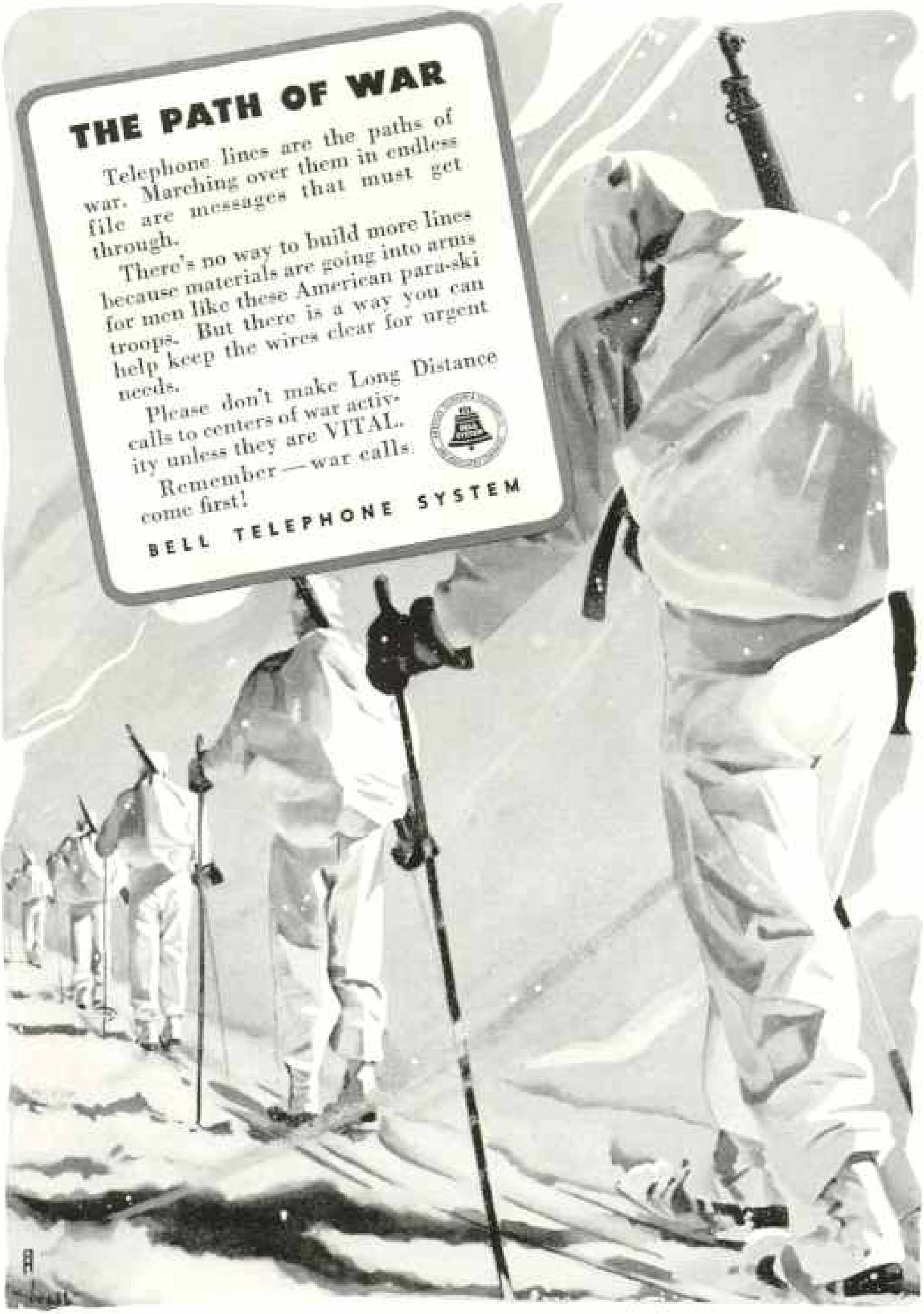
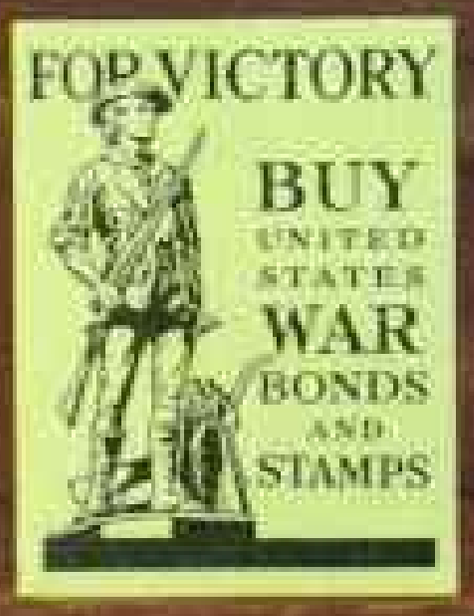


U. S. PARA-SKI TROOPS



DEATH CAR . . .

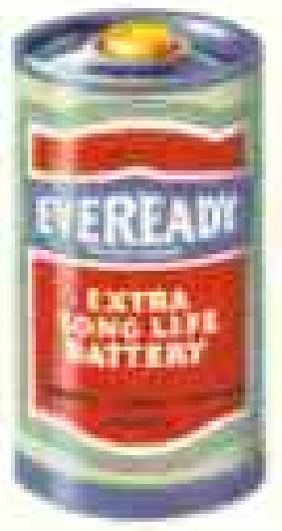
ONLY A CHILD'S TOY on an unlighted stairway. Yet as lethal as a speeding truck for killing or crippling. For causing heartbreak and tragedy in someone's home.

Accidents . . . in the home . . . on the highways . . . in factories and offices . . . cost this nation 102,500 lives last year. This tragic toll, preventable to a great extent, was augmented by the permanent disabling of 350,000 other people . . . by 9,000,000 lesser casualties.

Production-wise, America's war effort lost heavily. In all, 480 *million* man days were lost forever. Enough to have built a total of 20 battleships, 100 destroyers, 9,000 bombers, and 40,000 tanks! Money-wise, the loss was almost 4 *billion* dollars!

Where did these accidents happen? Two-thirds of them happened outside of industry. In the home, where workers take chances they would not dream of taking on the job. They happened in darkened hallways . . . in bath tubs . . . in garages and basements. They happened in industry where someone gambled with safety.

No matter what you do, your life is precious to this nation. Don't take chances with it. Guard it for America . . . at day . . . and at night. Fight carelessness, the Master Saboteur! Join the anti-accident crusade! Help save a life!



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