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THE NATIONAL GEOGRAPHIC MAGAZINE

The Aerial Invasion of Burma

BY GENERAL H. H. ARNOLD

Commanding General, U. S. Army Air Forces

With Illustrations from U. S. Army Air Forces Official Photographs

IN 1943 the late Major General Orde C. Wingate led a daring campaign against the Japanese in Burma.*

He proved that Allied ground troops could operate behind the enemy's lines, cutting off his supply system and upsetting his schedule. General Wingate marched fast and struck hard. The enemy, never knowing where he was going to strike next, was completely thrown off balance. Indeed, this British general's behind-the-lines operations in Burma brought to mind the brilliant cavalry maneuvers of Nathan Bedford Forrest in our own Civil War (page 144).

In 1944 General Wingate wished to lead another expedition into Burma on a larger scale. Previously he had had to leave some of his sick and wounded behind his swiftly moving columns, but in 1944 he wanted to fly all of them to safety.

We promised we would do that—and more.

We visualized an Air Commando Force, the first in military history. Large numbers of Allied ground troops would be conveyed by aircraft deep into Burma and, once there, they would be wholly supplied by air. General Wingate believed that, while the Japanese were excellent jungle fighters, well-trained Allied troops could defeat them at their own game, provided they were mobile, in sufficient force, and exploited the military value of surprise.

We would not only evacuate all wounded by air; we would also replace them with fresh combat troops. Furthermore, none of the soldiers would have to make long marches through tough jungle to get inside Burma. They could start fighting in top physical condition. In the same project, the AAF would gain airbases from which we could fight the Japanese at closer quarters and relieve the threat to our aerial life line to China over the Hump.

Obviously, the men to lead this unprecedented project had to be aggressive, imaginative, and endowed with organizational talent of a high order.

The Original of "Terry and the Pirates"

To AAF headquarters in Washington came two young men who were strongly recommended.

One was a 34-year-old fighter pilot who had shown remarkable leadership in North Africa, Col. Philip G. Cochran, of Erie, Pennsylvania. In my office Cochran still wore his Natal leather boots with the trouser tops stuffed in. In North Africa he had originally headed a unit of replacement pilots, but before anyone was aware of it he had them up at the front fighting as a unit. Later he commanded a squadron of fighter pilots who were frequently so far ahead of our other forces that it was humorously remarked that they were fighting a war of their own (page 131).

At the time, I did not know that Cochran was the original of the character Flip Corkin in the comic strip "Terry and the Pirates," but he sounded like a good man for the job.

The other man was Col. John R. Alison, who had been an outstanding fighter pilot with the 14th Air Force in China and had also

* See "Burma: Where India and China Meet," by John LeRoy Christian, NATIONAL GEOGRAPHIC MAGAZINE, October, 1943.

Prelude to Wingate's Raid: Bombers Blast Wuntho, Jap Burma Base on the Mandalay-Myitkyina Railroad

In March, 1944, the enemy was threatening Allied airfields in India. British Maj. Gen. Orde Charles Wingate's forces and the U. S. First Air Commandos delivered a lightning counterblow at the Jap rear in Burma. Gliders and planes flew in engineers, troops, supplies, mules, bulldozers—in fact, everything needed, landing them in a jungle clearing called "Broadway" (page 132).

fought the enemy from England, Russia, and the Middle East. He was short, slender, and self-possessed. He knew his business (p. 142).

I told both of them that they were going to Burma. Cochran immediately protested that he wanted to go "where there was some fighting." I informed him that he would get all the combat he wanted. I explained the unprecedented mission and ordered them to carry it out. "To hell with the paper work," I added. "Go out and fight."

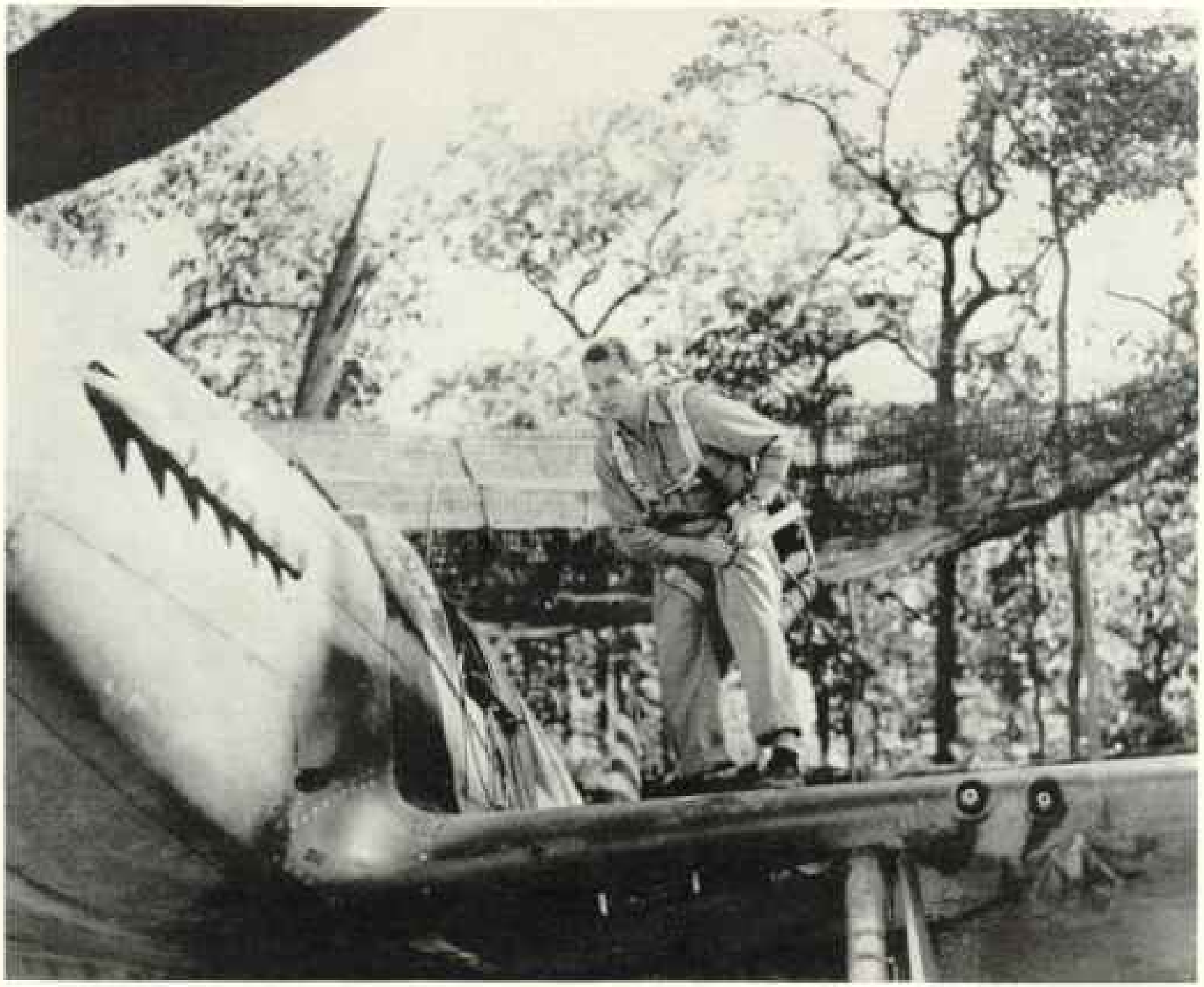
Perhaps my last words constituted a personal whim, for systematic organization work is necessary in modern war, and I knew they could do it.

Cochran, as commander, and Alison, as deputy, established their first headquarters in a Washington, D. C., hotel room in August, 1943. Their initial task was to select men to help them. They then flew to England to coordinate plans with the British. General Wingate was enthusiastic and said heartily, "We are going in this time to stay."

The aircraft Cochran and Alison selected for the mission were: transports and gliders to move troops, equipment, and supplies; light liaison, or "grasshopper-type" planes to evacuate the wounded; fighters; and medium bombers.

The glider pilots were selected volunteers. Liaison-plane pilots were chosen for ability to repair as well as fly ships. An exhaustive training program was begun in America and concluded in India. Everything to be transported by glider was loaded and unloaded endlessly. Army pack mules became accustomed to bamboo stalls in the gliders.

In India there were work-filled months of final preparations. Visitors to our installations were confounded by the lack of "rank."



"Flip Corkin" Comes to Life as Col. Philip G. Cochran, USAAF

The adventures of the popular comic-strip character in "Terry and the Pirates" are based on the real-life exploits of the leader of the First Air Commandos. Here at his India base headquarters, he buckles on his parachute before taking off for Burma. One of the war's most brilliant and likable air officers, the 34-year-old colonel came to General Arnold's attention as commander of a fighter squadron in Tunisia (page 129).

Morale was high, and there was little paper work. The men said, simply, "If Phil or John says we do it, then, by God, we do it!"

Officers and men, hot, dusty, and bearded, lined up together at the chow lines, ate quickly, and went back to work. They sweated shoulder to shoulder unloading freight cars. For security reasons native help was kept to a minimum. At one base the headquarters was a bamboo hut, and the men slept at night on hard charpoys, or native cots.

There were many obstacles.

At first, some cooperating Allied units were not sure that the AAF could do what it promised; so Cochran and Alison put on demonstrations and proved their points. At one base, until it could get equipment, Cochran's photographic section developed its photos at night, using water from a near-by well and posting a sentry so that no wandering jeep's headlights would spoil the print.

The Gurkha troops had never seen gliders before. They went through their training doggedly, but finally said, "We aren't afraid to go; we aren't afraid to fight. But we thought we ought to tell you—those 'planes' don't have any motors!"

The battle plan was as follows:

The C-47 transports would tow the heavy gliders carrying General Wingate's troops and equipment to the areas he had selected in north-central Burma.* He would indicate the areas; the AAF would pick specific places where our gliders could land. The first troops to land would guard the fields while Airborne Engineers built an airstrip with airborne bulldozers, scrapers, and other engineering equipment. C-47 transports could then land with antiaircraft guns and other field equipment,

* See "Manipur—Where Japan Struck at India," National Geographic Magazine, June, 1944, for map showing north-central Burma in detail.

In One Day Engineers Turn Broadway into a Bustling Airfield

By evening of the first day nearly 100 C-47's landed with thousands of troops. This end of the field needed little leveling, but the other was badly rutted, easily filled big holes.

Glider-landed bulldozer and carryall in background

so that any Japs attacking in force could be held off. Our fighter planes could also use the field for aerial patrol and offensive operations.

Cooperating with the AAF in this project were a British Army unit under Lt. Gen. W. J. Slim, the Indian forces under General Wingate, the tactical air force under Air Marshal Sir John Baldwin, and the Troop Carrier Command under Brig. Gen. William D. Old, of the U. S. Army.

All would work together.

At the time, Lt. Gen. Joseph W. Stilwell was pushing down in northern Burma with Chinese-American forces. The Japs were threatening our airbases in India, just over the Burma border to the west. The Chinese were holding mountain positions against the Japanese in east Burma. If General Wingate could establish his men *behind* the Japanese in north-central Burma and cut their various supply lines, the Japs would be put in a difficult position regarding Allied attacks on three of their Burma fronts.

The Fighting Begins

In February, 1944, the fighting began. Fighters and medium bombers flew into Jap-held Burma, blowing up bridges, destroying warehouses, supply centers, and supply trains.

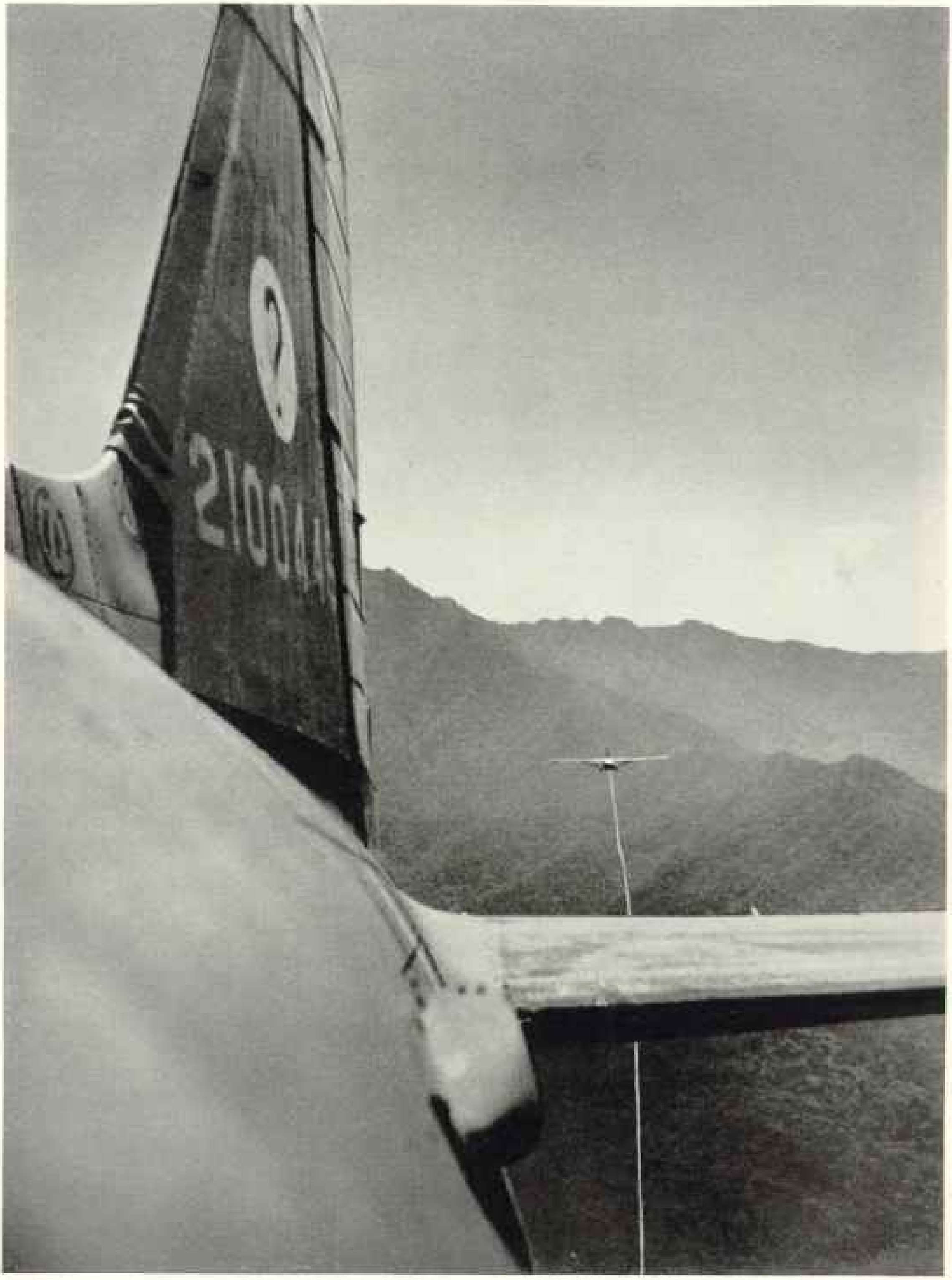
General Wingate had indicated two areas where he wanted troops set down. Cochran and Alison had surveyed the areas in their fighters; then photo-reconnaissance planes mapped the areas thoroughly. The two open places were picked to set the gliders down in, nicknamed "Broadway" and "Piccadilly" to suggest the joint effort of the two nations. Once decided on, planes did not fly over these places again, to allay Jap suspicion.

D Day arrived.

The Japs had been repeatedly bombed and strafed. The weather was suitable. But on D Day Colonel Cochran, on a hunch, ordered a last-minute photo-reconnaissance of Broadway and Piccadilly to make sure that both fields were clear. The year before, a C-47 had made a landing at Piccadilly to pick up some of Wingate's wounded; so the Japs might expect landings there. Their espionage must have warned them that something was up.

Transports, gliders, pilots, troops—all were ready for the great adventure of March 5, 1944.

The first take-off was set for 5:40 p.m. At 5:15 the last-minute photos of Broadway and Piccadilly were rushed from the laboratory.



Aerial Locomotive Hauls a Troop-filled "Flying Boxcar" into Burma

Sailing 400 feet behind a Douglas Skytrain (C-47), the glider ferries reinforcements for General Wingate's columns far behind enemy lines. At 8,000 feet it easily crosses the Chin Hills, which form a natural barrier between Allies and Japs. Question mark on tail is the unofficial squadron insignia.

British Troops, Armed to the Teeth, Board an American Glider Bound for Broadway

Carrying enough ammunition and rations for several days, these Tommies were well fortified against Japs and hunger in case the glider cast off before reaching its objective. Several craft made forced landings, obliging soldiers to fight through jungle to the new airstrip. Rough air over the mountains caused towlines to foul.

Cochran's hunch had been a good one. The Japs had dragged huge tree trunks all over the open space at Piccadilly and very possibly had mined it as well! No glider could possibly land. However, Broadway was clear, and although the Japs might purposely have left it that way to draw us into an ambush, it was decided to land all gliders at Broadway.

D Day would stand.

The first C-47 took off at 6:12 p.m., towing two heavily loaded heavy gliders. Others followed. From a green tea-garden valley they rose in wide sweeping circles to gain altitude, for they had to cross a range of 7,200-foot mountain peaks.

The gliders carried cargoes of resolute men, armed with Tommy guns, carbines, rifles, pistols, and hand grenades. The men knew that, because of the distance and the heavy loads, the gliders would have to land at Broadway. They could not be towed home, even if the Japs disrupted our plans.

There was no turning back.

The sun was going down, and its golden tints were gradually swallowed up in the jungle haze below. The men settled down in cramped positions for the 200-mile flight to their destination—and their fate. As Cochran had told his men, "Tonight you are going to find out if you've got a soul. Nothing you've ever done, or nothing you are going to do counts now. Only the next few hours. Good luck."

Mule Makes a High-altitude Kick

Some of the gliders held heavy bulldozers, tractors, jeeps, and pack mules. Most of the mules rode calmly enough, except one which kicked a hole in the side of his glider at an altitude of 8,000 feet. This must have been the highest mule kick ever recorded! But to the muleteers it was no joke.

As the gliders crossed the Burma frontier the moon came out, but there was too much

British and Gurkha Wounded Are Swiftly Flown to Base Hospitals in India

Huge aerial ambulances, like this Curtiss Commando, operated a shuttle service, carrying in fresh troops and bringing out wounded. Gurkhas, fearless north-Indian fighters, were hesitant at first about entering gliders. One of them whispered to his British captain, "These planes don't have any motors!" (page 131).

air turbulence over the mountains for the men to appreciate it. Some of the heavily loaded gliders were in trouble because of the rough air. The night had to be clear for the operation; the moonlight would reveal the aircraft to any Jap fighters who might be waiting for them. There was an enemy airfield close by.

The pilots and passengers anxiously searched the sky, but no Japs appeared. As they neared their destination, each man checked his firearms.

They were now over Broadway; it was time to cut loose.

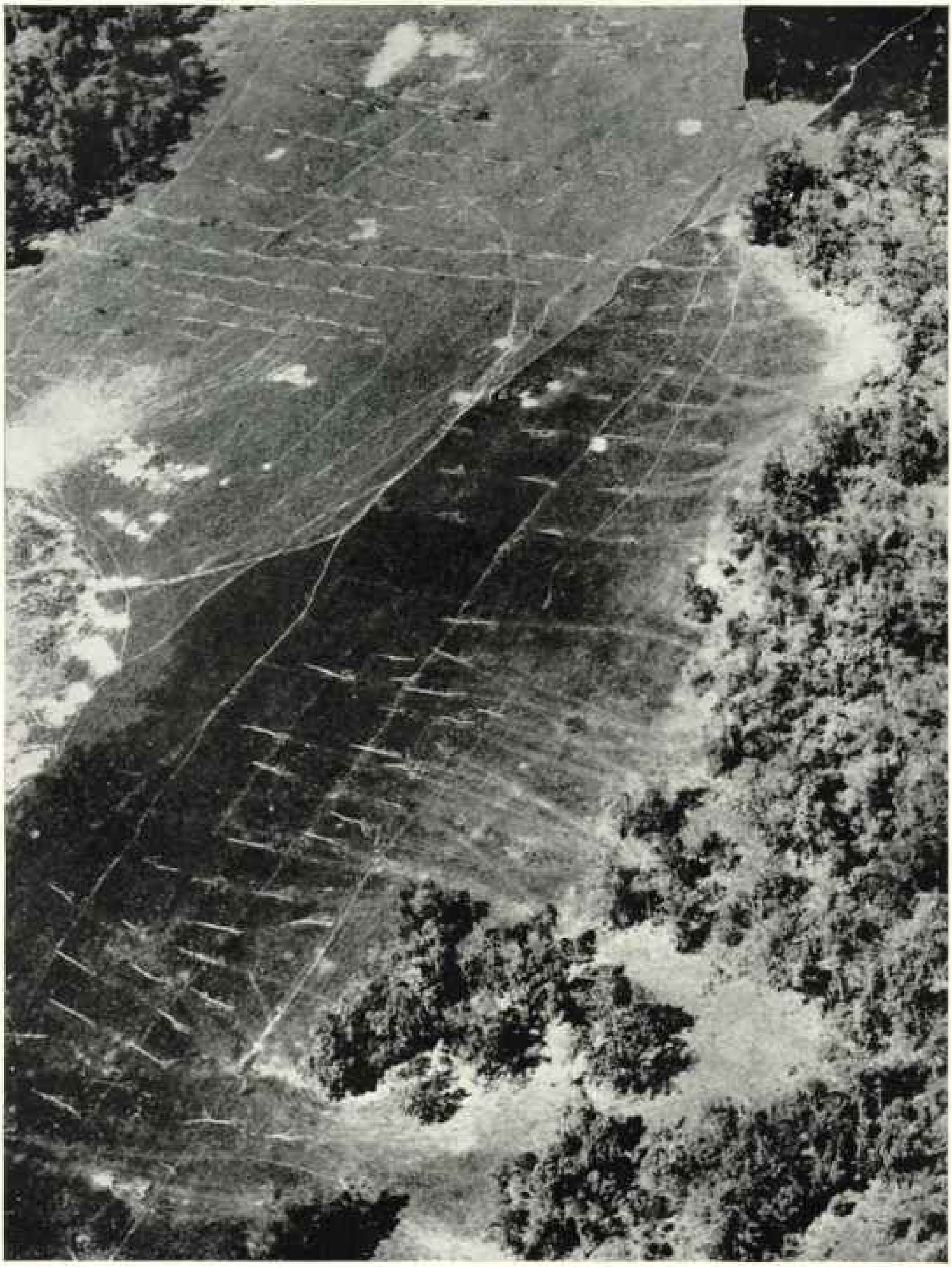
Colonel Alison was one of the first to land. He was signaled in by the crew of the pathfinder which landed under the hand of Maj. William H. Taylor. The big craft came down out of the darkness to the jungle glade that was Broadway.

Unfortunately, the field had numerous ruts and holes covered with high grass which had not shown up in aerial photographs. Teakwood had once been cut in the neighborhood, and the logs had been dragged by elephants over the ground when it was wet and soft.

Some of the gliders had their undercarriages torn off and landed hard on their skids. Some were wrecked. As soon as possible, a new landing strip was marked out with flare pots to avoid the crashed gliders. Landing a glider at night under ideal conditions is difficult, but here conditions were at their worst.

The first ground troops to land immediately fanned out to scout Japanese opposition. Photographs had showed that there were two places where the Japanese might mount machine guns. The first glider crews to hit the dirt went on the dead run to these two points —but no enemy machine guns were there. A green flare was sent up to indicate to gliders still in the air that the first ones to land were not being fired on.

There was no opposition. We had taken the Japs completely by surprise!



Logs and Ditches Blocked This Clearing at Piccadilly; so Yanks Landed at Broadway

Last-minute reconnaissance of the two fields showed Piccadilly unusable for glider landings. As Broadway was untouched, the whole force landed there, completely surprising the enemy. The names were suggested by the British-United States joint operation (page 132). During the weeks of preliminary bombing, planes deliberately avoided these clearings to allay Jap suspicion.

Two Gliders Tangle in Night Landings

Landing gear of the glider to left was crippled by logs or ruts. Before runway flares could be changed, two more "whisper ships" came down to land. The first saw the cripple in the faint moonlight and swerved in time. The second smashed head-on. Here, on the morning after, survivors survey the wreckage before starting to clear Broadway for transports to land.

A second wave of gliders, on their way to Broadway, were recalled to their bases by radio. With no opposition, they were not needed immediately.

One glider in the first wave, which contained a bulldozer, missed the landing area and slashed off both of its wings between two trees. The bulldozer had been lashed in the glider so that its first forward movement would lift the nose of the glider. It was a happy thought, for the bulldozer, torn loose from its fittings, kept right on going. It threw the glider nose up, pitching the pilot and co-pilot into the air. They landed unharmed, save for a broken thumb.

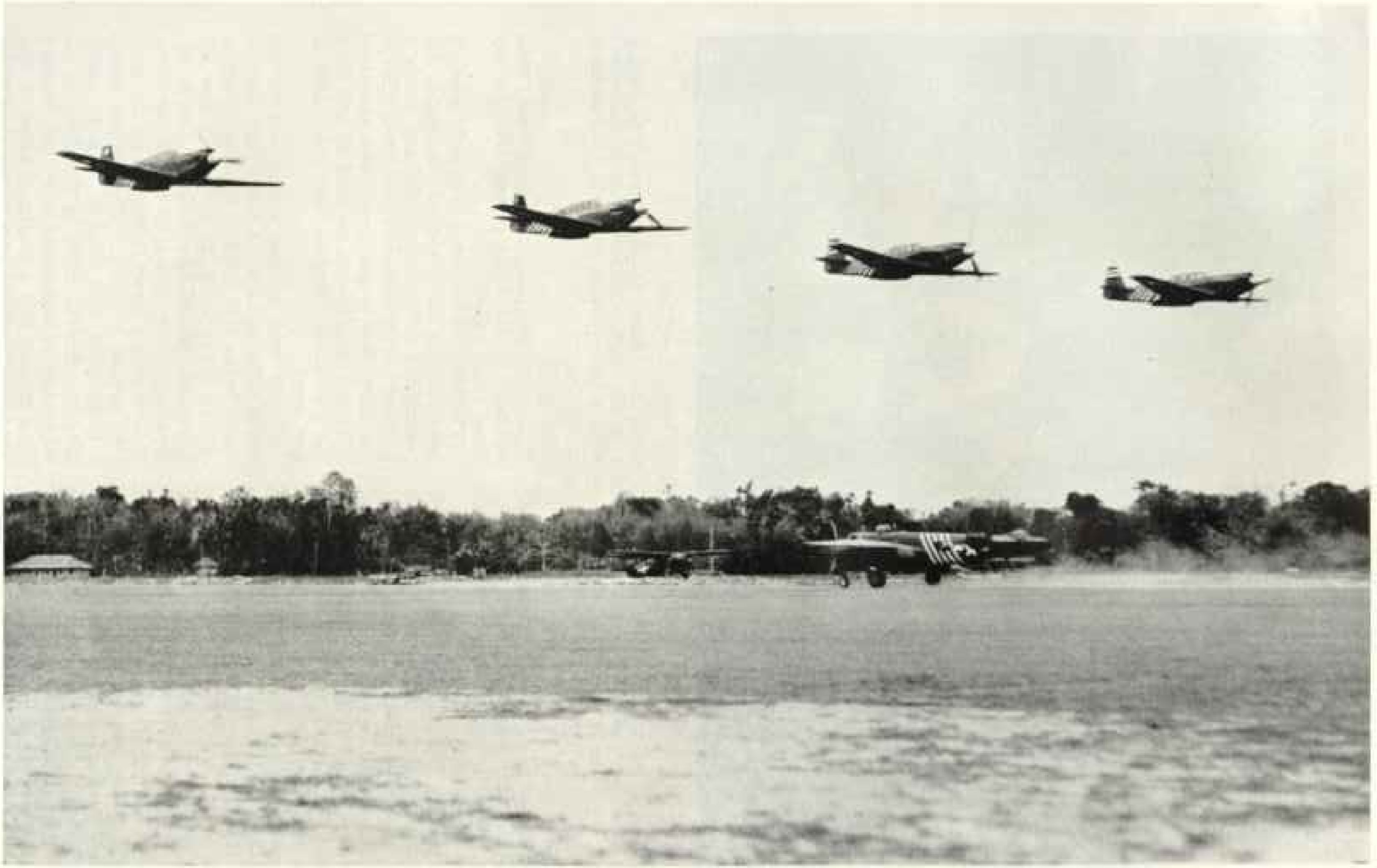
Gliders Bring in Bulldozers

Three undamaged bulldozers were enough to start building, with the first morning light, an airstrip on which our C-47 transports could land later with more troops and antiaircraft guns. The Japs might attack any minute. That first morning there was a burial of the 23 men who had been killed in glider crashes. A Burmese chaplain read the service, while overhead circled Allied planes, alert for any Zeros (page 147).

The Airborne Engineers filled in Broadway's holes and ruts and leveled off the humps. By evening the airfield was ready, and nearly a hundred C-47 transports of the Troop Carrier Command flew in and landed with thousands of armed men, enough to stand off any force the Japs could bring to bear upon them in that area.

In any large military operation there are bound to be mishaps. A few gliders were released before they reached Broadway because of their heavy loads, air turbulence over the mountains, or the poor visibility met in descending. Some landed in friendly territory.

Most of the crews landing in enemy territory escaped to safety. One medical officer, a glider pilot, and co-pilot, with 15 native troops, walked 85 miles to Broadway in ten days. Out of food at one point, they tossed a hand grenade into a pond and killed 60 fish. There was a soldier hero in one crew whose

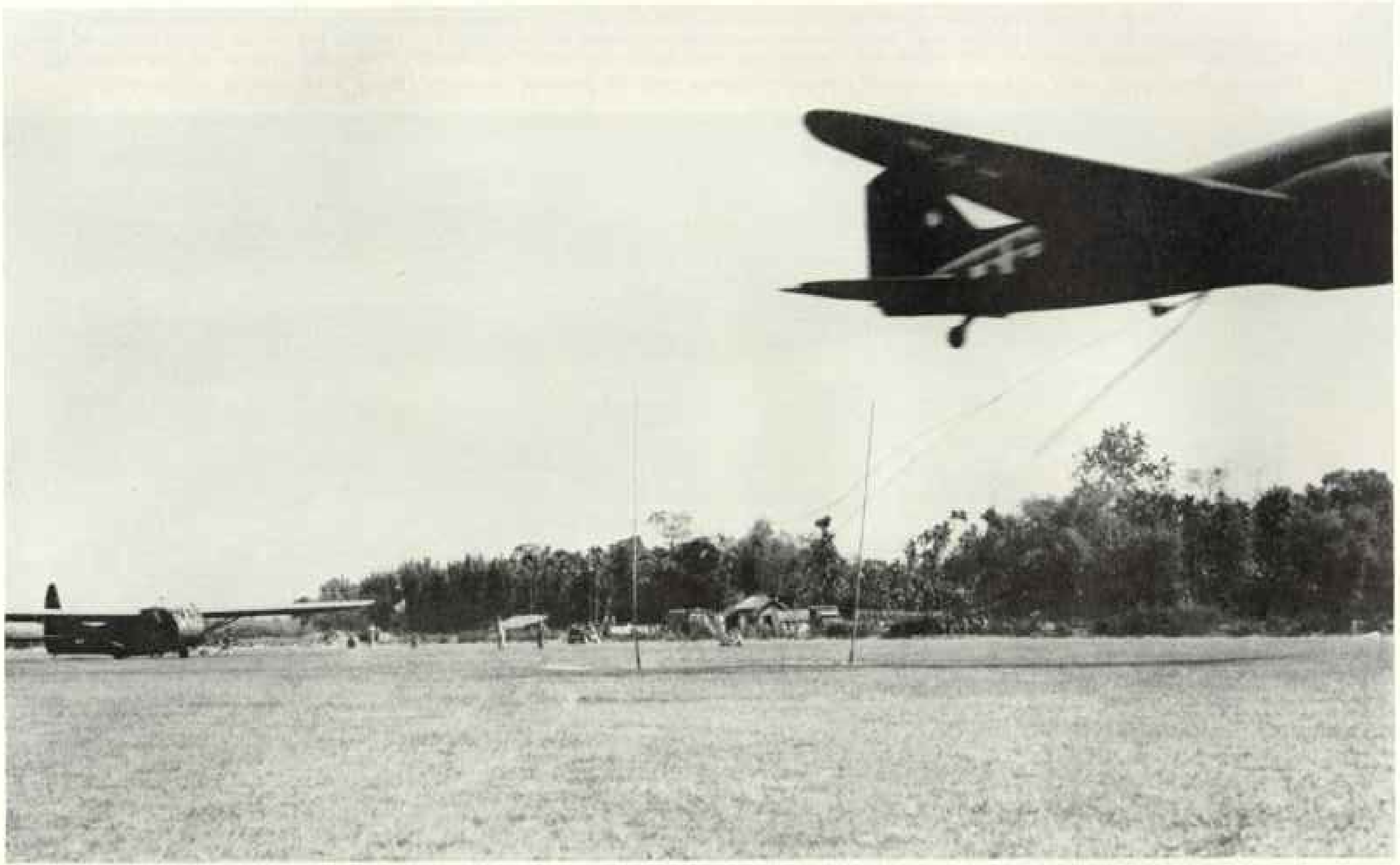


Mustang Fighters Buzz the Home Strip as They Return without Loss from Action in Burma

In training school they would have been "washed out" for circling low over the field before landing, but in the field, regulations and rank are minimized. These swift planes were Wingate's artillery. They blasted paths for ground troops, strafed enemy columns, and provided air cover against Zeros. They shot down Jap planes at a ratio of ten to one, getting 34 in one day.

Pointing to Broadway, a Jungle Clearing Mapped on Bed Sheets, Colonel Cochran Gives His Men Their Final Briefing

They are to take off at dusk, each transport towing two gliders, and fly 200 miles into Burma. The gliders cut loose over Broadway and landed in the dark. Troops fanned out to hold off any Jap attackers. At dawn engineers started the airstrip for powered planes. The map partly hidden by "Flip Corkin" is of Piccadilly, unused rendezvous (pages 131, 136). White areas are clearings surrounded by dark-colored jungle. The hazards of landing gliders on a never-before-used field prompted the Colonel's final remark—"Tonight you are going to find out if you've got a soul!"

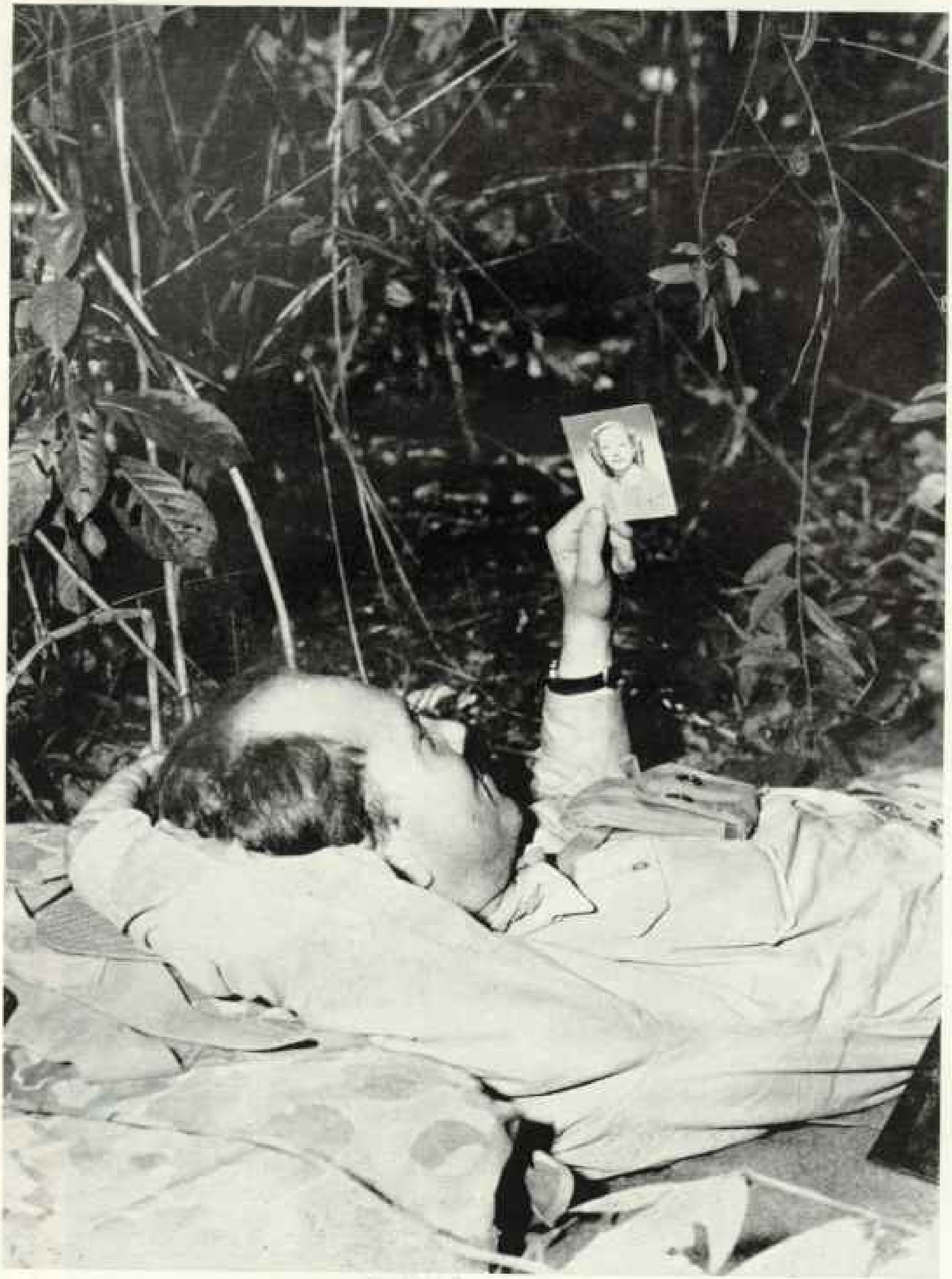


Snatching a Loaded Glider Off the Ground, a C-47 Roars Across the Blue—Lalaghat, India

Only way to recover a glider in a small area is by this pick-up system. A nylon towline attached to the glider is looped over two poles. From the towplane extends a nylon leader, to which is fastened a hook. The other end of the rope is connected with a steel cable reeled on a drum in the plane. This drum has a braking device. Here the plane, traveling about 100 miles an hour, has hooked the loop. The elastic nylon will stretch, overcome the inertia of the glider, and gently pull it into flight. The strain would break the nylon were it not for the cable, which plays out gradually, like a fisherman's reel and line, and helps absorb the shock.

Pioneers in Aerial Warfare: These Glider Pilots Spearheaded the Air Invasion of Burma and Paved the Way for Ground Troops

On them depended the success of the whole operation. They had to carry in and land the Air Commandos who would build the airstrip, even if it swarmed with Japs and was jammed with obstructions. Capt. Vincent Rose and Maj. William Taylor (front row center); Flight Officer Jackie Coogan, former movie star, at right.



The Prettiest Pin-up Girl in the World: His Wife

Col. John R. Alison, Cochran's deputy and field commander of the Broadway glider operation, relaxes after the first day's work. In 13 hours his men built a complete, modern airport in the jungle, 300 miles behind the enemy lines. Mosquitoes were absent for several days after the landings. When the malaria-carrying pests appeared, the men slept under protecting nets.

The First Dawn at "Chowringhee" Finds Commandos Asleep beside Their Equipment

In honor of the Indian troops under Wingate, this auxiliary strip was named after Calcutta's main street. It handled air traffic from near-by Broadway, but was abandoned when the congestion subsided. The push cart is a wire reel on wheels.

men were crossing a river in Jap-held territory. This man drowned rather than call for help and thus endanger the lives of his friends.

The plan for flying out the wounded in light liaison planes worked out as scheduled. To elude the Japs, they flew at treetop height, under the noses of enemy antiaircraft. A man could be wounded behind enemy lines in Burma during the day and be resting in a hospital in India that night. All troops received equal care: British, Gurkhas, Burmese, Yanks, West Africans, and Indian soldiers.

Gliders Confuse Japs

The Japanese did not realize what was up for a whole week, or could do nothing about it, and the gliders that made forced landings before they reached their destination added to the Japs' confusion.

During the first six days, thousands of Allied troops, 175 ponies, over 1,000 mules, and 500,000 pounds of supplies were brought in by air.

On the eighth day the Japs discovered the field.

Twenty Japanese aircraft came over, but our detection apparatus warned us they were coming and we were ready. Four Japanese planes were shot down by fighters, and one was destroyed by our antiaircraft.

The Air Commando Force discovered that the Japanese were bringing more airplanes into Burma. Twenty P-51 Mustangs promptly raided enemy airfields and destroyed 34 planes, with a loss of two.

The same day nine of our B-25 medium bombers destroyed twelve more Japanese planes on the ground.

The Japanese came over and shot up two or three Allied fighters at Broadway but did no real damage. Since that time the Japs have attacked Broadway repeatedly, but have hindered our operations on or from it only slightly.

Broadway and Chowringhee

A subsidiary airfield to relieve the congestion at Broadway was built near by and named "Chowringhee," after Calcutta's main street. After it had served its purposes, Chowringhee

Blood Plasma Saves a Tommy's Life

Though the landing was unopposed, 23 men were lost in glider crashes. Ruts and grass-hidden logs, not shown in aerial photographs, ripped off undercarriages. Many British troops were from the English north country and Scotland. Australian-type hats were issued by General Wingate in India.

Wingate and Cochran, a Ground-Air Team That Stunned the Japs

Called the "second Lawrence," the late Major General Wingate cleared Axis-backed Arabs in 1936 from British pipe lines in Palestine. He entered Addis Ababa, Ethiopia, at Emperor Haile Selassie's side in 1941. Cochran's Air Commandos made his 1944 airborne invasion of Burma possible.

"That Doesn't Look Like a Barn!" Says Long Ears, Balking at His First Plane Ride

Even airborne soldiers need pack mules. In specially prepared bamboo stalls, six mules were carried in this transport plane, three in gliders. After practicing at the India base, the mules usually became accustomed to air travel. One kicked a hole in the side of a glider at 8,000 feet—highest mule kick ever recorded (page 134).

A Tenuous Thread in the Jap Life Line Is Snapped by American Medium Bombers

The original railroad bridge (foreground) at Meza had been knocked out earlier. This raid destroyed the temporary wooden bridge beyond it. Smoke from bomb bursts fills the narrow canyon. Air Commandos began disrupting communication lines and bombing Jap airfields in Burma 1½ months before the glider landings.

was abandoned. The next day the Japanese bombed it.

In addition to establishing Broadway and other behind-the-line fields, the First Air Commando unit carried on the air side of Wingate's operations. A special task was to parachute needed equipment for river crossings to columns on the march.

In one such drop the Americans added precious cigarettes and extra food with a note saying that they "wanted to do more than lip service" for their Allies. The British commander thanked them and apologized that he had no typewriter in the jungle to phrase a formal reply.

B-25 medium bombers aided Wingate's ground forces by dropping parachute fragmentation bombs on enemy troops and working out unique techniques for supporting ground troops in this theater.

Asked by the ground forces to break a telephone line between two Jap-held towns, a P-51 did so by diving through the wire at five different places. However, most operations were more extensive.

On one occasion a British unit was on a hill two miles from a Japanese-held town. The enemy had machine guns and field guns and was using them very effectively. The British called for air support.

A Burmese Chaplain Reads Final Rites over 15 Allied Dead

The airmen died in a glider crash. The native chaplain, attached to the British forces, added one more nationality. Gurkhas, West Africans, Indians, Burmese, English, and Americans made up the striking force.

Smoke Indicated Targets

The British would indicate with smoke the targets they wanted bombed, and then tell our bombers and fighters in the air just where the target was in reference to that smoke. The bombers worked from low levels without bomb sights. The fighters would follow, and dive-bomb.

The conversation went something like this:

Ground Forces: "Do you see that building with the red roof in the center of the town?"

Air: "Yes, we see it."

Ground: "Will you get it for us?"

Air: "O. K."

Lessons Learned of Glider Operation

The B-25, or fighter-bomber, would either bomb the building or hit it with 75-mm. cannon. The Japanese nest destroyed, the Allied forces would go on to the next, until the town was stormed and captured.

At this writing, it is too early to estimate the military significance of this operation, except to say that its successful execution gave

Jap Guerrillas Got in a "Sneak Punch" at Night against Cochran's Plane "Sports"

The enemy apparently did not discover Broadway until eight days after it was built. Then they sent 20 fighters over the field (page 143). This plane, however, was damaged on the ground sometime later. "Squads of Jap infantry practically lived with us," Colonel Alison said. "They hid in the jungle by day and infiltrated at night to cripple equipment and steal food."

a terrific lift to all Allied operations in the China-Burma-India theater. Many lessons were learned that will be valuable in the future. The able General Wingate was killed in March of this year in an airplane crash, but his good work continues.

Supplies Come by Air

At this writing, we have aerial superiority in this part of Burma. By proper use of air power, the Japanese are denied freedom of movement. Every day by air, Allied troops are being supplied by the Troop Carrier Command with food, ammunition, and replacements.

One Japanese railroad line has been severed, and two main lines of supply cut off. The Japs now operate small supply boats on the Irrawaddy and Chindwin Rivers at night and hide them from our fighter planes by day. They do the same with their motor trucks on the roads.

Red Tape Avoided

That the mission was carried out despite many uncertainties and obstacles is a tribute to the cooperation of all British and American units taking part in it.

Colonels Cochran and Alison carried out their orders: they went to Burma to fight, and did not concentrate on the paper work that some officers confuse with winning a campaign. A statistician assigned to them at a later date was reported to be on the verge of despair.

It would appear clear that new weapons of war have not lessened the value of personal leadership; indeed, science has increased the effectiveness of the imaginative military man and made his operations more decisive.

Gliders—Silent Weapons of the Sky

By William H. Nicholas

With Illustrations from Official Photographs, U. S. Army Air Forces

MORE than 400 American gliders, towed by big C-47 transport planes, swept over the English Channel on the second day of the invasion of Normandy. The huge armada stretched across the sky for 50 miles.

Swishing to earth behind Nazi coastal defenses in Normandy, the gliders brought reinforcements, supplies, and tactical equipment to the first assault wave of airborne troops.

This force had landed by parachute and glider the day before, to open the invasion. Its mission was to capture bridges and nip in the bud any German attempts to launch counter-attacks against seaborne troops storming the beaches.

The first large-scale mission for gliders in warfare was accomplished successfully. The young Troop Carrier Command and its new silent weapon had come into their own. Hopes of military glider enthusiasts, from General Arnold down, were on the way to realization.

Preview of Gliders in Action

Only a few weeks before D Day I had stood with a handful of Army Air Force officers and a group of foreign newspaper correspondents on the edge of a tree-rimmed field at Laurinburg-Maxton Army Air Base in North Carolina. Our eyes were fixed on an approaching air armada of a dozen big transport planes, each towing two gliders almost as large as themselves.

Steadily the procession drew nearer until the towropes were visible. Once overhead, the glider pilots released the lines. The transports with their throbbing motors sped on. The freed glider brood wheeled gracefully into the brisk wind. Silently, except for the whir of their wings against the breeze, they coasted earthward, heading toward a clump of trees.

The pilots cut the speed of their craft by bringing flaps and other obstructions to smooth airflow into play. The stiff air currents made landing difficult, but one by one the gliders hit the field in a cloud of dust. The pilots worked energetically to align them with noses headed directly into the tree clump.

Even before the "flying crates" came to rest, Air Commando troops sprang from the side doors. In a matter of seconds, others began to raise the big stub noses. From the capacious maws came howitzers, jeeps, trucks (page 156). Into the protecting clump of trees the glider troops streaked with their implements of war.

Routine training? Yes. But it had a new meaning for onlookers at Laurinburg-Maxton that afternoon last May. No longer were gliders the "stepchildren" of the Army Air Forces.

This exhibition of landing, unloading, and deployment carried deep meaning. Gliders and troops had proved themselves in spectacular action, first in Sicily, then in Burma.

Everyone on the field knew that gliders in steadily increasing numbers had arrived in, or were en route to, Great Britain. Everyone knew this exhibition was a preview of the glider's role in helping to spearhead the invasion of Europe.

Gliders Invade Europe

On the night of July 9, 1943, a fleet of 139 American gliders had first invaded Europe. Towed over the island of Sicily, they cut loose and landed near the bridges south of Syracuse and Catania. In the darkness of night, armed men, howitzers, jeeps emerged silently.

Their attack preceded the full-scale invasion, which started next day. Their work of destruction and the confusion they created within enemy ranks were so impressive that General Sir Bernard L. Montgomery credited them with shortening the Sicilian campaign by a full week.

Even more spectacular was the achievement in the Far East. The night of March 5, 1944, a fleet of gliders landed American Engineers and British assault troops in the jungles of north-central Burma, 200 miles behind the Japanese lines. By dawn glider-borne troops had established an airfield to which transport planes brought thousands of soldiers and hundreds of tons of equipment and supplies (page 129).

Landings Made in Jungle

The Burma exploit gave tremendous impetus to the Army's glider program. Only gliders had made possible this daring campaign of the late Maj. Gen. Orde C. Wingate. Airplanes could not land in the jungles. Paratroopers could not carry with them the bulldozers and other heavy equipment necessary to carve out landing strips.

What are these huge motorless aircraft which have brought destruction to the enemy on both sides of the world?

Two similar types are now in use by the Troop Carrier Command of the Army Air Forces. The smaller model is the CG-4A (CG stands for cargo glider). It has a wing span of 83 feet 8 inches, about 10 feet less than the span of its customary towplane, the C-47, which is the military adaptation of the well-known prewar Douglas airliner.

Empty, the CG-4A weighs about a ton and a half. Fuselage is of tubular steel and plywood; wings are of wood and plywood; both are fabric-covered. This model can carry 15 fully equipped men, or six men and a jeep.

Its larger sister ship, the CG-13A, has about the same wing span, but weighs over four tons. Wide enough to admit a light truck, and seating 30 fully equipped glider troops, it can carry a pay load of more than its own weight.

Leonardo Built Gliders

For centuries man has experimented with gliders. Leonardo da Vinci built small models and experimented along scientific lines, but with little practical success.

Among the more celebrated pioneers was the German, Otto Lilienthal, who built his first batlike glider in 1891.* Five years later he was fatally injured in a glider crash. But he had succeeded in making flights up to 1,300 feet in length and turns in the air of almost 180 degrees.

Lilienthal's exploits inspired the Wright brothers to gliding experiments. They used a new "box kite" developed by the Australian Hargrave, the American Octave Chanute, and themselves. They flew their first gliders in 1900 and controlled their movements by manipulating cords attached to the corners.

Alexander Graham Bell added greatly to the scientific knowledge of aeronautical stability with a series of man-lifting kite experiments at Baddeck, Cape Breton Island, Nova Scotia. He built a gigantic kite, the *Cygnet*, which he sent into the air in December, 1907, bearing Thomas E. Selfridge, Army lieutenant.**

Selfridge was aloft for seven minutes and reached a height of 168 feet. He was killed in a plane crash in 1908, at Fort Myer, Virginia, the first United States airplane fatality in history. Selfridge Field, at Mount Clemens, Michigan, is named for him.

Inventive and mechanical America turned full attention to the development of motor-powered airplanes and for a time the glider was neglected here.

But when, after the First World War, Germany was forbidden military airplanes by the Versailles Treaty, the German Government developed the sailplane.

Germany taught thousands of young men and some women to soar high in the air in motorless gliders. Ferdinand Schulz made a solo continuous-flight record of more than 14 hours, and another of 9 hours 21 minutes with a passenger.

Young Germans learned meteorology and the effects of air currents. Thus they could be transformed into fighter pilots with this basic knowledge of flying.

Of 17 international distance records set between 1920 and 1937, 15 were made by Germans. Then Soviet gliders began to make new marks. In 1939, the Russian, O. Klepikova, soared 465 miles.

The first report published in America of Germany's extraordinary motorless sailplanes, and of its 200 glider clubs and annual glider competitions, was given in the National Geographic Magazine in 1929.† This account stimulated sportsmen in our country to undertake similar soaring experiments.

Foremost among these was Richard C. du Pont. Youthful champion in the 1930's, he set a world distance record for single-seated gliders in 1934 when he made a cloud flight of 158 miles.

Another famous peacetime glider was Lewin B. Barringer, who broke Du Pont's record in 1938 when he flew from Wichita Falls, Texas, to Tulsa, Oklahoma. Du Pont and Barringer were key figures in promoting the annual soaring meets held at Elmira, New York.‡

When General Arnold decided to build military gliders for this war, first Barringer and then Du Pont was assigned to head the Army Air Forces glider program. Both gave their lives in the effort. Barringer died in a plane crash in the Caribbean in January, 1943. Du Pont died in a glider crash at March Field, California, eight months later.

Why Gliders Glide

A glider glides for two reasons.

First, as it is drawn to the ground by the force of gravity, it coasts at an angle instead of dropping vertically, because of the lift created by its wings.

* See "Aerial Locomotion," by Alexander Graham Bell, National Geographic Magazine for January, 1907, and "Remarkable Photograph of Lilienthal's Gliding Machine," by R. W. Wood, August, 1908.

** See "Dr. Bell's Man-Lifting Kite," by Gilbert Grosvenor, National Geographic Magazine, January, 1908; "Air Conquest," August, 1927; and "Man's Amazing Progress in Conquering the Air," by J. R. Hildebrand, July, 1924.

† See "On the Wings of the Wind," by Howard Siepen, National Geographic Magazine, June, 1929.

‡ See "Men-Birds Soar on Boiling Air," by Frederick G. Vosburgh, National Geographic Magazine, July, 1938.

General H. H. Arnold Inspects "Purple Peril's" Nylon Towline

The Commanding General, U. S. Army Air Forces, pays a visit to Laurinburg-Maxton Army Air Base in North Carolina. With him are Col. Reed Landis (right) and Col. Y. A. Pitts, Troop Carrier Command Wing Commanders. When the glider pilot wishes to cut loose from his towplane, he releases the hook in the nose. The line then drags behind the towplane, which drops it before landing where it may be retrieved. A 350-foot towline contains enough nylon to make 1,620 pairs of women's stockings (page 154).

Second, its flight is governed by "thermals." When the sun warms the earth, its heat is best absorbed by plowed fields, streets and roofs of cities, and similar features of the earth's surface.

Air in contact with these warm areas becomes warmer than adjacent air. The near-by cooler, hence heavier, air pushes the warmer air upward and out of the way, thus creating a thermal current. Such a conflict goes on constantly, and often the currents produced are very strong.

These currents may be either up or down; hence an experienced sailplane pilot can take advantage of them, rising or descending at will as eagles and vultures do.

A few weeks ago, a young paratrooper jumped with his comrades from a plane over Fort Benning, Georgia. To his amazement, he went up instead of down when his chute opened. He had been caught in a thermal current and his descent was held up for several minutes.

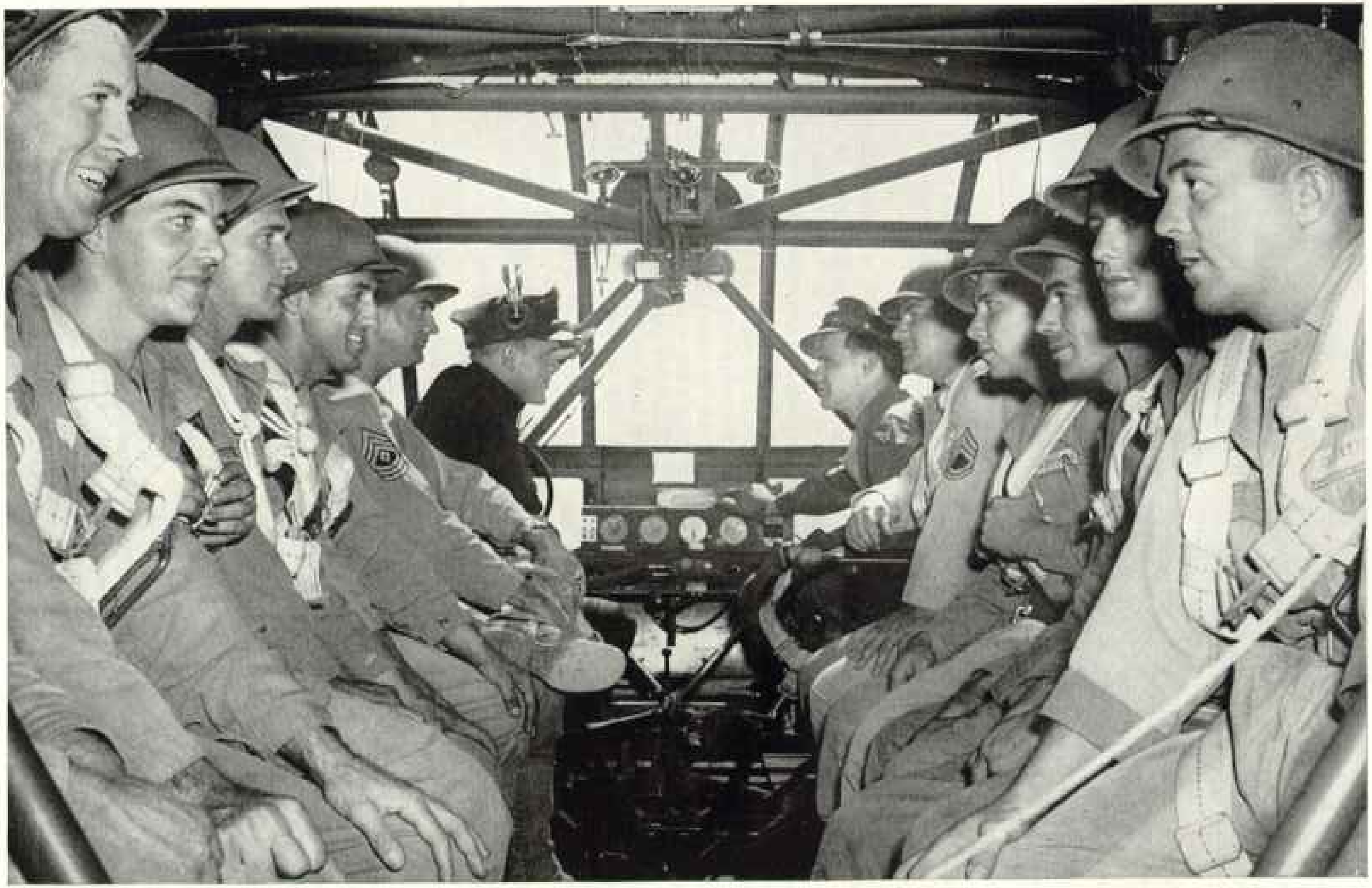
It is a far cry from the graceful, lightweight sailplane of peacetime to the bigger, heavier military craft.

Glider Towed Across Atlantic

The army is not concerned with thermal currents. Towplanes take military gliders to their destinations. Soaring has no part in this operation.

For example, a C-47 pulled a loaded CG-4A glider across the Atlantic Ocean in July, 1943.

Flanked by Towships, CG-4A Gliders in England Await D-Day Orders to Invade Normandy



Glider Troops Await Take-off for a Practice Flight at Laurinburg-Maxton Army Air Base

They are seated in a CG-4A, hundreds of which landed in France on the opening days of invasion last June. Glider pilot and co-pilot are at the controls. The CG-4A carries 15 troopers, six troopers and a jeep, or an equivalent cargo.

That same month a C–47 towed two gliders from Sheppard Field, Texas, to Laurinburg-Maxton Army Air Base, flying a distance of 1,243 miles.

"We have only two things to do," a practical young lieutenant at Laurinburg-Maxton told me. "One is to get the gliders up, the other is to get 'em down."

Astonishingly, a heavy military glider can soar much like a sailplane if thermal conditions are exactly right. Lt. Col. Mike Murphy, of Indiana, glider specialist, can put a CG-4 through sailplane paces, including loop-the-loops, if he finds favorable thermals. But the Army doesn't waste time teaching young glider pilots such tactics.

Incidentally, Colonel Murphy piloted the Fighting Falcon, first invasion glider to land in France.

The Nazis were the first to use gliders in the war. They were the "secret weapons" with which the Germans reduced the Belgian fort of Eben Emael on May 11, 1940. Silently the gliders landed troops at night, close to the walls of the fortress—within it in some instances, according to Nazi propaganda.

What really awakened British and Americans to the vast military possibilities of the glider was the Nazi invasion of Crete in 1941. The Germans succeeded in landing 70 fully loaded gliders on the Greek island. Glider troops neutralized airdrome defenses as paratroopers swarmed down. Soon transport planes landed heavy reinforcements and Crete fell.

Officers at Laurinburg-Maxton are convinced that American-made gliders are at least the equal of any in the world. They are an important element of the Troop Carrier Command, youngest branch of the Army Air Forces.

Primary combat use of gliders is to land specially trained troops, or Air Commandos, behind enemy lines. But gliders also can transport supplies and equipment, including whole field kitchens, repair shops, weather stations, first aid stations, or similar units to advanced positions and move wounded troops or prisoners to the rear. They also can descend upon wrecked enemy airfields, carrying equipment to repair them quickly so motor planes can land.

Nylon Towropes Replace Nylon Stockings

Getting gliders into the air today is a simple task, thanks to Army precision and training (page 158). I saw 12 big C-47's each take two gliders off a Laurinburg-Maxton runway in a steady procession. All 36 craft were in the air within seven minutes.

One reason for the nylon-stocking shortage is glider towlines. They are made entirely of nylon. One 350-foot stretch of 15/16-inch cable (normal towline length) is the equivalent of 1,620 pairs of women's nylon stockings (page 151).

Nylon has exceptional elasticity. It can stretch one-third of its length without breaking. In addition, it contracts to its normal length gradually. As a result, when the moving plane overcomes the inertia of the standing glider and sets it in motion, the effect on the occupants is about the same as that on passengers in a streetcar when it starts to move.

When one plane tows two gliders, the second craft uses a cable 75 feet longer than the first, so that there is no danger of colliding in mid-air.

Glider Troops Must Know Their Knots

Jeeps, trucks, and guns must be lashed securely in a glider so they will not break their moorings and jeopardize the lives of soldiers in case of a bumpy landing. Glider troops learn to tie almost as many knots as a sailor because they must tie them securely and still be able to unlash their heavy equipment instantly when a landing is made.

Gliders are "expendable." In combat, they often land where airplanes cannot come in to tow them out. But many can and will be recovered from small areas by a novel pickup system. This is an adaptation of the civilian method by which a moving plane snatches mailbags from the ground (page 140).

When the Army Air Forces instituted their glider program a little more than 2¼ years ago, they started with nothing. There were no gliders and no glider pilots. Today there are thousands of both.

How the gliders were built is an absorbing chapter in the history of American manufacturing ingenuity.

The Aircraft Laboratory of the Materiel Command, at Wright Field, Dayton, Ohio, was told to supply the Army with gliders. Laboratory officers, collaborating with the Waco Aircraft Company, Troy, Ohio, proceeded to design one in 90 days—the celebrated Waco CG-4A.

Finding plants to make it was the next problem. Big airplane manufacturers were engaged to the hilt in the greatest warplane-building program the world had ever seen. In addition, they had working for them virtually all the Nation's skilled aircraft builders. Their important work could not be interrupted.

So American industrialists came to the rescue.

Using the Waco design, the Gibson Electric Refrigerator Corporation of Greenville, Michigan; the newly formed Northwestern Aeronautical Corporation, Minneapolis, Minnesota; Pratt, Read & Co., Inc., Deep River, Connecticut, furniture manufacturers; and a few other similar concerns went into the glider business.

Other firms became subcontractors, such as Anheuser-Busch, Inc., St. Louis brewers, and the Brunswick-Balke-Collender Co., Chicago billiard-table makers, which turned parts of their plants over to making steel glider frames. The H. J. Heinz Company, Pittsburgh; Grand Rapids Industries, Inc., Michigan furniture group; and Steinway & Sons, New York, piano firm, began to make glider wings.

Later, when the Army's demand for gliders doubled and tripled, the Ford Motor Company converted its big station-wagon plant at Iron Mountain, Michigan, into a glider factory. Today it is the biggest producer in the country.

Typical example of the ingenuity and drive which enabled American business to meet the Army's glider needs is revealed in the history of the Northwestern Aeronautical Corporation.

First Contract for 30 Gliders

This infant company, which grew out of a small aircraft factory in Kansas, was organized by John E. Parker, New York and Washington banker with much experience in aircraft financing. The Kansas factory had made small planes for civilian pilot training. Its work in that field, because of the war, was drawing to a close.

Early in 1942, Northwestern received an Army contract for 30 gliders, to be delivered during the year.

On the surface this sounded reasonable enough. But the contract stipulated that no workers were to be hired from airplane factories and that least critical materials were to be used. In March the contract was increased to 84 gliders and a short time later to 300, all for 1942 delivery.

To complicate matters further, machine-tool firms, caught in the wartime jam, were unable to deliver manufacturing equipment to Northwestern.

Today the firm has built 900 CG-4A gliders and supplied spare parts equivalent to 100 more. It has retooled and, together with the Ford Motor Company, has gone into production on the big CG-13A glider.

From a handful of employees the company payroll has grown to more than 2,500, with an additional 2,500 working for Northwestern's two principal subcontractors, a lumber company which makes wings, and a machine shop which makes steel frames.

Workers Recruited from All Walks of Life

To solve the labor problem, Northwestern hired anyone who wanted to work. People from all walks of life applied, and nearly everyone made good.

One of the company's top wing inspectors formerly was a hotel waiter. Two orchestra leaders, a chiropractor, a violin maker, a bond salesman, a music teacher, a minister, a schoolteacher, several cabinetmakers, a former bank president, a civil engineer, and a palm reader took jobs and stuck with them.

The efficient shipping clerk is an ex-bartender. The solemn director of purchases, who now buys two million dollars' worth of materials each month, formerly was a Minneapolis undertaker.

All employees started from scratch without knowledge of the business in which they are now engaged, except Robert Whittingham, production manager. How he got his job is a story in itself.

Almost as soon as Parker got settled in Minneapolis, he had to rush to Washington on company business. He returned late one night and hurried to the lumber company's planing mill, transformed into a glider plywood-wing plant. Wings for the company's first glider were due at Northwestern's assembly plant the next morning.

When Parker got to the plant, he found men struggling to get one of the big wings from the second story to a waiting truck in the street. Today such a procedure is ridiculously easy. To complete the first wing and then get it out of the building was a definite engineering problem. As Parker stood watching, an employee approached him.

"You'd better send Bob home," he said, pointing to a man near by. "He's been at work for 60 hours now and I'm afraid he'll crack up."

Parker went over to Bob, who turned out to be a wing supervisor named Robert Whittingham.

"You'd better go home," Parker told him.

"I said I'd stay till this wing got to Northwestern, and I mean to," Bob replied in such tones of finality that the conversation ended.

Five hours later the pair of wings had been loaded at last, despite a last-minute holdup caused by a hailstorm. Bob started to board one of the trucks.

From the Cavernous Depths of a Big CG-13A Glider Chugs a Jeep; Troopers Sprint from Side Doors—Laurinburg-Maxton Army Air Base

This newest Army glider has seats for 30 fully equipped soldiers. It weighs more than four tons and can carry a pay load greater than its own weight. Hydraulic power lifts the big nose. Controls and seats for pilot and co-pilot are built into the nose and rise out of the way with it.

Troopers Double-quick to Their Gliders; Trucks Stand By to Line Up the "Flying Crates" for Their Towships—Laurinburg-Maxton

A gun crew rushes its howitzer across the runway for loading. Gliders also can carry supplies and equipment, including whole field kitchens, repair shops, and first-aid or weather stations. An important element of the Troop Carrier Command, they ferried U. S. airborne forces to Normandy when invasion began.

A Sky-Train Makes Up—One Unit of Giant Transport and Two Gliders in Tow Takes to the Air

When the big transport plane starts down the runway, nylon towlines stretch one-third of their length before they gently tug the gliders into motion. Gliders, with more lift in their wings, take to the air before the towplane does. One towline is 75 feet longer than the other so the craft cannot collide in mid-air.

Workers Hoist a Wing into Position for Attachment to a Glider Fuselage

Here the wing-strut fitting, vital connection between wing and body, is being secured in a plant of the Northwestern Aeronautical Corporation, Minneapolis, Minnesota. Wings are of mahogany plywood and spruce, covered with highest-grade muslin painted with nitrocellulose.

Vail News Bureau

Orville Wright Soars over the Sands of Kitty Hawk in an Early Glider

The photograph was made in 1911, when the inventor returned to the scene of the Wright brothers' 1903 triumph in North Carolina for further study of aeronautical stability. The brothers' principal glider experiments ended in 1902, but on this occasion Orville Wright made a record soaring flight of 9 minutes 45 seconds.

"Where are you going?" demanded Parker, who had kept an eye on him.

"Oh, I want to see that they make the trip across town O.K.," said Bob.

This time Parker acted. Calling two guards, he had them hustle Bob into a taxicab, take him home, and put him to bed. Parker went along with the trucks.

On investigation, Parker discovered that Whittingham was a veteran aviator. Within a few weeks he was production manager, and he has been showing novices how to make gliders ever since.

Today the makeshift force has been worked into an efficient machine. It's the only way gliders could be built.

CG-4A Design Altered 7,000 Times

A CG-4A glider has more than 70,000 parts. Every single item, down to the tiniest aluminum rivet, must be inspected before it is installed. This includes the raw materials that go to the subcontractors. A magna flux inspection apparatus detects hidden flaws in nuts, bolts, and similar parts. Gliders must be safe for American soldiers to ride in.

The original CG-4A glider design has been altered and improved more than 7,000 times.

One of the latest glider innovations is an automatic pilot. When a glider is being towed, its pilot must constantly keep it in proper alignment with the towship, preferably above and to one side so that it will keep out of the airplane's propeller wash.

With the new device, the pilot can automatically keep his glider in proper position relative to the towplane. A gyroscope is the principal motivating force in the new device. Power to operate it comes from a small propeller mounted just outside the glider.

Northwestern worker morale has been high ever since the company was organized. There are several reasons for the workers' attitude, but none quite so compelling as those which crop up in the chat columns of *Tow Lines*, the company's own news weekly. In each issue scores of items tell of workers who have received letters from their husbands, brothers, cousins, sweethearts, on Guadalcanal, in New Guinea, the Marshalls, North Africa, Italy, England and France.

Every worker thrilled to the news of glider operations in Sicily and Burma. Now they avidly follow the big-scale invasion of Europe. From their president down, they feel they all have a part in it.

A Land of Lakes and Volcanoes

By Luis Marden

With Illustrations from Photographs by the Author

IF YOU like to look at volcanoes, go to Nicaragua. Twenty-three of them are strung in a chain down the west side of this largest republic of Central America. Half a dozen are active.

Near Managua, the capital, footprints in solidified volcanic mud show where ancient men and animals fled an eruption two to five thousand years ago (page 164).

Where rivers and roads have cut into the hills about the capital, superimposed strata of mud, pumice, and lava are revealed in bands of contrasting colors like an illustration from a geology textbook.

Nicaragua has great lakes, too. One, Lake Nicaragua, is a hundred miles in length; its smaller twin, Managua, is nearly half as long. Geologists think these were part of a big bay of the Pacific, until the restless earth of the Central American isthmus, which still moves uneasily now and then, rose up and cut off the sea. Rivers flowing into the new-formed lakes eventually turned the water fresh.

This may explain why several species of salt-water fish are found in Lake Nicaragua. Of greatest interest to ichthyologists is the fresh-water shark, *Eulamia nicaraguensis*, found, so far as is known, only here (pages 178, 183, and Plate IV).

On the eve of my departure for Central America, Dr. Alexander Wetmore, Assistant Secretary of the Smithsonian Institution and a trustee of the National Geographic Society, asked me to collect specimens of this unique fish for the United States National Museum.

I got for the Museum three sharks that are the first large, complete specimens in any scientific institution.

Not all of Nicaragua is mountainous and volcanic. The east-coast area is a broad lowland of tropical rain forest laced with torrential rivers. Down these water highways now move rubber and mahogany for the war machine of the United States and its Allies.

Managua a Friendly Town

Managua, in common with most of the Republic's larger cities and towns, is on the western side of the isthmus. Situated on the shore of Lake Managua at an altitude of only 180 feet, it was partially destroyed by an earthquake on March 31, 1931, but has been largely rebuilt along modern lines (Pl. VII).

However, the capital is still a friendly, leisurely place where everyone knows everyone else. At dusk, families place rocking chairs on the narrow sidewalks before their houses and sit and talk. Friends come and bring their guitars (page 179).

City telephones have numbers but few know them. You ask for your party by name. Central may cut in and say, "Don Carlos is at the club. I heard him telling his wife he was going there."

Streets and avenues have their official designations, too, but these are rarely used. When you ask for directions, a Managuan will say, for example, "Two blocks beyond the Cathedral and three to the right, across from So-and-so's house."

But everyone knows the name of the main street. It is Roosevelt Avenue. I lived in the MacArthur Hotel on Roosevelt Avenue.

Horse-drawn public carriages, never absent from Managuan streets, are even more numerous now because of gasoline and tire rationing.

On the Pan American Highway

For the past several years my assignments have seemed to follow big construction jobs. First came the Third Locks in Panama, then the West Indian defense bases, and in Nicaragua I saw the construction of part of the Pan American Highway.*

The Highway runs from the Rio Grande to Panama, and already you can drive—if you have the gasoline—from the Mexico-Guatemala frontier to San José, capital of Costa Rica. Some day you will be able to motor from the Texas border to the Panama Canal, and eventually beyond to South America.

One morning I drove north along the road with Col. Edwin C. Kelton, of the U. S. Army Engineers. Colonel Kelton was in charge of the construction from Mexico to Panama.

"My orders were to follow as closely as possible the route of the Inter-American Highway, planned by the U. S. Public Roads Administration some time ago," the colonel said. "We have had to make a few deviations from the original plan, because we had to complete the road as speedily as possible. However, the road will be of permanent all-weather

* See, in the National Geographic Magazine, "Panama, Bridge of the World," November, 1941, and "Americans in the Caribbean," June, 1942, both by Luis Marden.

Orchids and Jeeps Meet on the Pan American Highway in Nicaragua

The boy talking to a Highway engineer near Esteli has two *torito*, or little bull, orchids in his hat. Eye-like spots and hornlike protuberances give these highland orchids their name. They smell like sweet chocolate. Passenger cars can now drive over all of the Pan American Highway in Nicaragua.

construction, lacking only a macadam or asphalt surface."

From Managua north into Honduras the Highway was being constructed by United States contractors, who brought down about 3,000 American engineers, cat skinners, truck drivers, and mechanics for the job. From Managua south, Nicaraguan engineers and labor, with engineers from the United States as consultants, built the road to the Costa Rica frontier.

Near Esteli, in northwestern Nicaragua, was the Big Cut, 158 feet in depth, deepest excavation of the Honduras and Nicaragua stretches of the road (Plate VI).

Here I met Livin' Yesus Pete, so called because he was always going "to blow the livin' Yesus" out of something.

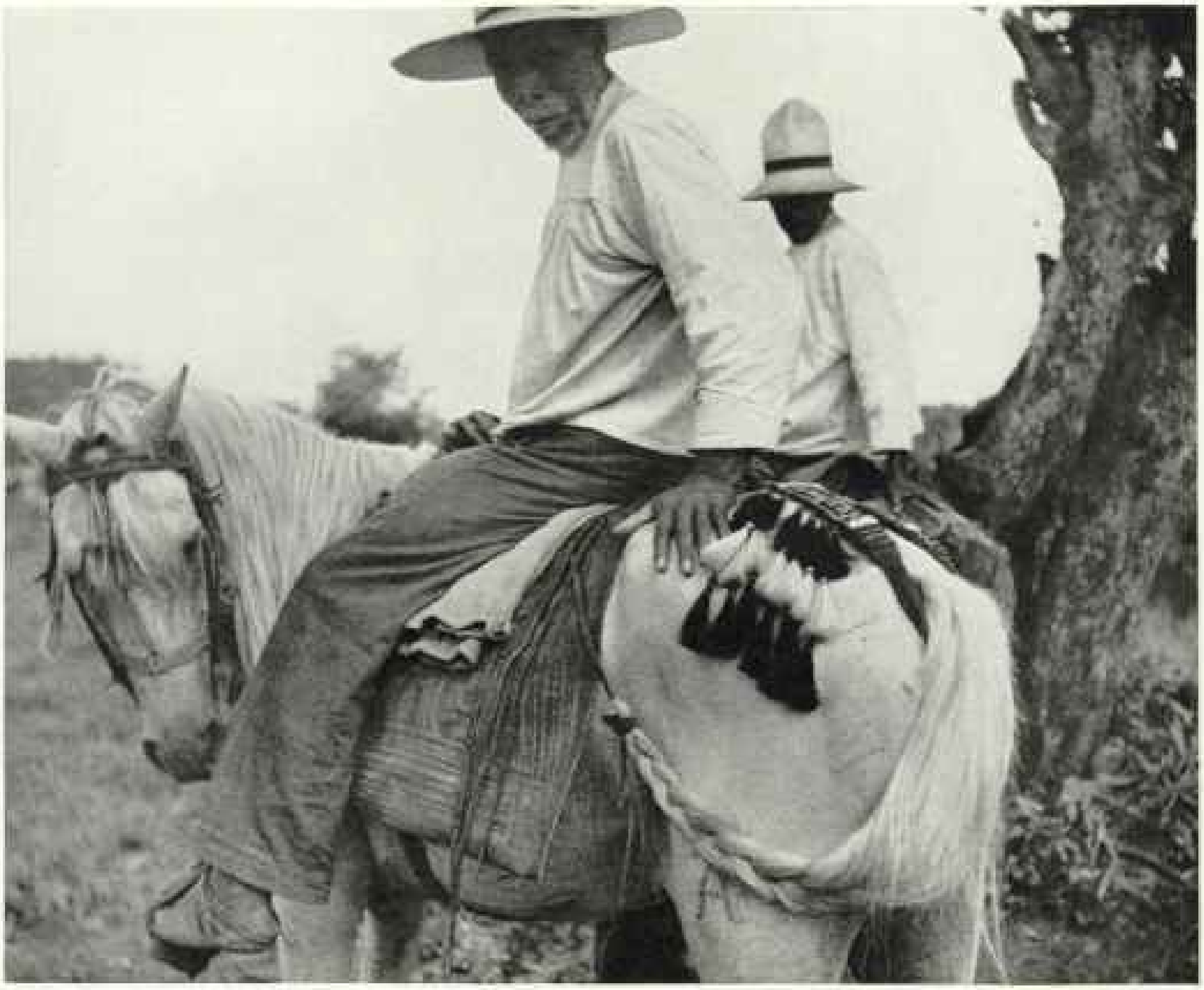
Pete and some other Scandinavians were famed the length of the Highway for their inability to work without snuff—or "snoose," as they called it. To keep them happy, a ration of snuff had to be issued at regular intervals. This nicotine bonus was written into their contracts.

When I listened in on the radiotelephone to Managua headquarters, the first thing I heard was, "Say, has Pete's snoose arrived yet? He'll sulk until it gets here."

Nicknames of other men on the job had a frontier flavor. There were Chompipe (Turkey), Dr. Livingstone (he came down with a complete Abercrombie & Fitch tropical outfit), and Pasadena Charlie.

Construction men in the road camps were so comfortably quartered that one camp humorist wrote a poem telling of the hardships of the road builder's life. One stanza ran:

> He'll tell of the Battle of Tipitapa;
> The bloody defense of Masachapa;
> Where fifteen dauntless engineers
> Held out on only sixty beers.
> Of how they even missed one meal,
> And stood the test like men of steel,



And Thereby Hangs a Tail—but Not in the Mud

During the rainy season Nicaraguan horsemen braid and tie up their horses' tails to keep them clean. Tassels on the crupper are made of horsehair. Nicaraguan saddles are nearly flat and are set well back of the withers (Plate XI). Hackamores, or bitless bridles, are sometimes used.

Most people travel up and down Central America by airplane.* Birds have always used this land corridor in their migrations north and south (page 180). Today aircraft of the United States and other American nations make use of this natural flyway.

When bad weather grounded transient airplanes, a mixed group of pilots would stop overnight at the MacArthur Hotel. Sometimes I would see Brazilian, Chilean, Dominican, and United States uniforms in one evening.

With a pilot of the Nicaraguan Air Force I flew in a United States-made aircraft over some of Nicaragua's volcanoes.

The mountain chain that runs down the west coast of the country is part of the long line of Central American volcanoes that begins on the Mexican border and ends in Panama.

* See "Flying the World's Longest Air-Mail Route," by Junius B. Wood, National Geographic Magazine, March, 1930.

Momotombo, the "bald and nude colossus" of Victor Hugo, stands on a peninsula in solitary majesty, last in line before the file of volcanic peaks hurdles Lake Managua.

In colonial times Spanish priests used to climb to the crater of active volcanoes (thought by the Indians to be a hell of evil spirits) to plant a cross and baptize the mountain. Those who attempted the ascent of Momotombo were never heard from again, and the mountain came to be known as the only rebel among Nicaraguan volcanoes.

It was this legend that Victor Hugo celebrated in his poem, *Les Raisons du Momotombo*.

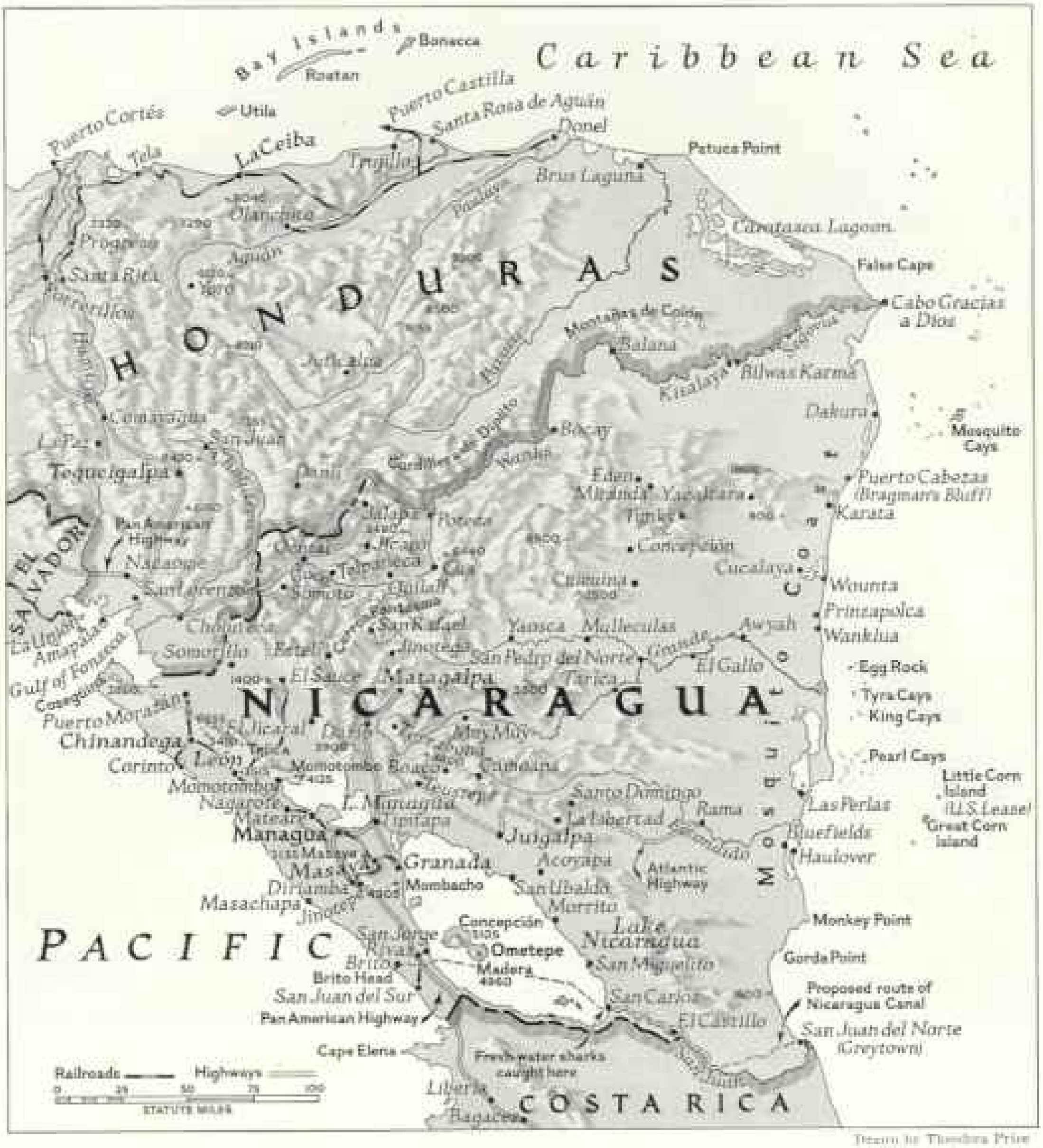
A Poet Views a Volcano

But Momotombo, 4,125 feet high, has been climbed several times in recent years.

Victor Hugo never saw the mountain of which he wrote; Rubén Darío, national poet of Nicaragua, speaks in a poem of seeing it

Here Men and Beasts Fled a Rain of Death Millenniums Ago

Humans, a deer, a medium-size cat, and other animals left these footprints in freshly deposited volcanic mud two to five thousand years ago. Such mud hardens almost at once, and today the layer is like stone. These prints near Managua were revealed by erosion of a small stream years ago, but only recently has the site been excavated and housed by an archeologist of the Carnegie Institution of Washington.



Drawn by Theodora Prise

Rich in Wood, Water, and Minerals, Lake-studded Nicaragua "Has Everything"

Vast areas of hardwood forest, fertile soil, and lakes and rivers full of fish make life easy in Central America's largest country. Nicaragua's relatively sparse population is concentrated mainly in the lowland area paralleling the west coast. The proposed interoceanic canal, connecting the Pacific with the Caribbean, would be nearly 173 miles long (pages 182, 184).

from a train. Thinking to give a modern writer a new view of the volcano, I flew a Nicaraguan poet friend past the still-steaming crater of Momotombo.

Black with congealed lava and streaked with cinnabar red, the volcano was compared by my friend in a newspaper account of the flight to the wrinkled red neck of the condor. He said the peak looked different close up than when seen from the "mechanical worm" of a train (Plate I).

Nicaragua is a nation of poets, as Popayán in Colombia is a town of poets.* Common greeting of Managua literary men is "Good morning, Poet." Poet is a title spelled with a capital letter, like Doctor or Professor. People say, "I should like to present Poet So-and-so."

Well may the Nicaraguans carry on the tradition of versemaking. Rubén Darío,

* See "Hail Colombia!" by Luis Marden, NATIONAL GEOGRAPHIC MAGAZINE, October, 1940.

Grackles Soar Angrily as Managua's Indian Laurel Gets Its Bimonthly Clipping

Though commonly called laurel, the glossy-leafed tree is really *Ficus retusa*, a species of fig. Big blackbirds, related to the boat-tailed grackles of southeastern United States, nest in this tree by the score. Grackles and a similar bird, the ani, are found in many parts of Central America (page 181).

born in Nicaragua in 1867, became one of the major forces in modern Spanish poetry. He introduced bold new rhythms, revived ancient forms, and wrote prose which is as original as his poetry. He is buried beneath a marble lion in León's magnificent Cathedral (p. 181).

Dario's portrait hangs like that of a patron saint in the new American Library in Managua, which is one of the first free lending libraries in Latin America.

I once saw a bootblack and the Chilean Ambassador borrowing books from the library at the same time, so widespread is the appeal of all books to those who speak Spanish.

Another time I flew in a United States Navy seaplane over Cosegüina, first of the Nicaraguan volcanoes, on the shores of the Gulf of Fonseca in the northwestern corner of the Republic. This is the area described in the first of the *Captain Horatio Hornblower* stories of C. S. Forester (Plate VIII).

Cosegüina today is a squat, topless mountain, with a lake deep in its heart. When I first saw the lake, it was emerald green; at other times it may be deep blue, buff, or brown. Variations in color are explained by the state of the sky, silt washed into the crater by rain, and sulphur in suspension in the water.

On January 20, 1835, Cosegüina exploded. The noise was heard as far as Jamaica, 800,

and Bogotá, 1,100 miles distant. For fifty leagues the sea was covered with floating pumice, and for years old inhabitants referred to that time as "the year of the ash."

A rocky islet in the Gulf of Fonseca is pointed out as the blown-off top of Cosegüina.

Second Biggest Noise

Cosegüina's eruption made the second biggest noise of modern times. The first was the explosion of Krakatau, in the Sunda Strait, in 1883. Mount Katmai, Alaska, also comes high in the list.*

Dust thrown high into the upper atmosphere by tremendous volcanic eruptions such as these often causes a lowering of temperatures over large areas, sometimes of the entire world, through its action in screening rays of the sun. Fine dust in the air also may paint magnificent sunsets, by filtering out all but the red and orange rays of the setting sun.

Since the explosion, Cosegüina has been regarded with fear and superstition by the rural population of the gulf region. A friend of mine, Mario Gastenzoro, owns the land on which the volcano stands; it has been in his family for over two hundred years.

Mario told me that, some years before, his father had been approached by an old peasant woman who offered to sell him a 3-months-old infant. Asked why she wished to sell the child, she said, "Don't you know that it is necessary to cast a 3-months-old baby into the crater of Cosegüina at least once every 25 years? That is the only way we can be sure that the mountain will not come to life and erupt again."

While flying along the west coast one day I watched a violent gas-and-dust eruption of Telica, the peak that today is the most active of the Nicaraguan volcanoes. Telica steams continually, but that day, as I looked inland, a column of steam and gray dust suddenly shot nearly 2,000 feet into the air.

As we turned inland, the dark plume, flattened and frayed out by the wind, stretched toward us. Heavy grit dropped from the cloud base into the streets of León.

Explosive eruptions after a long period of quiet, like that of Cosegüina, may be caused by the sudden extrusion of a plug of congealed lava that has sealed up the volcanic pipe. Heated gases slowly melt and eat away the cold stopper in the volcano's throat, until the remaining thickness has not strength enough to resist the pressure below; then—boom!

León, second city of Nicaragua, lies almost against the row of volcanoes northwest of Managua. From the air the domed roof of immense León Cathedral dominates the rectangular area of red-tiled roofs. More than any other city of the Republic, León has preserved its colonial architecture and atmosphere.

I felt here something of that calm and quiet, that brooding peace of other centuries, that I had sensed in such cities as Popayán and Cartagena in Colombia.

The Cathedral of León was built mainly in the eighteenth century; treasures in gold and diamonds are among its collection of Spanish sacred vessels.

Here is the marble tomb of Rubén Darío (page 181), and here are interred others of Nicaragua's great. Curious coffers of leather, studded with hand-wrought nails, in which the monstrances and other church objects made the long voyage from Spain in the 1700's, are still preserved.

Volcanoes' Good and Bad Effects

The flat country around León is extremely fertile. Old sea bottom and weathered volcanic deposits have formed one of the most fertile soils of Nicaragua. Cotton is cultivated here, also coffee (chief agricultural export of the Republic), beans, castor and sesame seed, and corn.

Around León, as in other parts of Central America, grows teosinte, a tall grass that may be the ancestor of maize, or Indian corn.

Noxious gases emitted by volcanoes sometimes destroy coffee crops and corrode barbed-wire fences near León. The three-cratered volcano overlooking Masaya (Plate III) killed so much coffee with its exhalations in 1927 that planters put a voluntary tax on each sack. The money was used to bring two European volcano experts to Nicaragua.

These men set out to cap the gas vent of the mountain. They built a metal cover for the opening, with a chimney to direct the escape of gases, from which acids and other chemicals were to be extracted.

The night before the cover was to be lowered into place, an earthquake sealed the opening.

Seeing two years' work wiped out in a single night, one emotional volcano capper committed suicide by leaping into the crater.

Not all the effects of volcanism are harmful. Coffee thrives in volcanic soil. Slopes of extinct or dormant volcanoes are ideal coffee zones, as they combine rich soil with the right altitude for coffee culture.

* See, in the National Geographic Magazine, "Recent Eruption of Katmai Volcano in Alaska," by George C. Martin, February, 1913; and articles by Robert F. Griggs on his explorations of the Valley of Ten Thousand Smokes, January, 1917, February, 1918, April, 1919, and September, 1921.

Single falls of "ash," rich in potash, iron, phosphorus, and other minerals, enrich soils of Central American coffee plantations. Some of the world's finest coffees are grown in soil of recent volcanic formation.

Source of Nicaragua's finest coffee is Matagalpa, in the northwestern highland, but coffee also thrives on the hills about Managua.

Coffee needs shade, and in the past many of the shade trees planted were rubber trees. Rubber of Nicaragua, like that of most of Central America, belongs to the genus *Castilla*. Not identical with the *Hevea* rubber of Brazil and Malaya, Castilla produces a latex next to Hevea in quality.

The great bulk of Nicaraguan rubber still comes from wild trees, most of which grow on the east side of the country.

Nicaragua furnishes more rubber than any other of the Central American republics (Plates XII and XIII).

Cutting Rubber the Primitive Way

In the back country primitive methods of cutting rubber still are employed. A gash is hacked about halfway around the trunk with the *machete*, the broad, long-bladed clearing knife of the Tropics. Milky latex oozing from the cut turns black and hardens on exposure to air.

Days later, the ribbon of crude rubber is stripped from the tree. Such strips of *burrucha* are wound into tapering sausagelike rolls big as a man's leg (page 183).

To avoid waste and harm to trees caused by old methods, technicians of the U. S. Rubber Development Corporation are instructing Nicaraguan rubber cutters in a technique that originated in southern Mexico.

A special knife, incorporating a thin blade guided by a roller which fixes the depth of the cut, is used to make a shallow, narrow incision. This ensures that only the outer bark, and not the inner cambium layer, will be cut. Less harm to the tree and a greater flow of latex result (page 182).

Under ideal conditions, trees are tapped two or three times a year.

Exposed to air long enough, latex will harden of itself, but to hasten uniform coagulation, juice of the moonvine, or *chasmol* (*Calonyction aculeatum*), is added to the liquid latex. In about 15 minutes the rubber has curdled into a white mass that looks like fresh cheese.

New rubber is placed in the sun to dry, where it turns brown and looks like a flitch of bacon.

Chemical coagulants with a soap base are being introduced to replace the vine juice, as the artificial product makes stronger rubber.

Racially and geographically, there are two Nicaraguas. The west side, studded with lakes and volcanoes, is the Spanish Nicaragua. The flat, river-threaded jungle of the east coast is predominantly Indian and Negro.

Columbus, on his fourth and last voyage in 1502, discovered the east coast of Nicaragua. But after sailing down to its present border with Costa Rica he went on farther south to Panama.

The conquerors Gil González Dávila and Francisco Hernández de Córdoba (the monetary unit of Nicaragua is named for the latter) were the first to penetrate to the interior. Hernández de Córdoba founded Granada and León (on its first site) in 1524.

Nicaragua was named for an Indian chief, Nicarao, who lived on the shores of Cocibolca, the Great Lake (today Lake Nicaragua).

Chief inhabitants of the hinterland of the east side are the Miskito Indians, whose name, corrupted to Mosquito, has been applied to part of the eastern coast.

For two hundred years the Mosquito Coast was a British protectorate. The Mosquito king first recognized British protection in 1655. In 1670 the Spanish crown assigned this area to England "forever," but in 1859 and 1860 Britain ceded it to Nicaragua and Honduras.

When I flew to Nicaragua's east coast I went in a TACA airplane. The red, blue, and yellow macaw insignia of this airline has been a familiar sight over Central America for years. We crossed Lake Managua, then flew over a region of mountains and electrical storms.

The corrugated metal of the old reliable Ford trimotor resounded to the crashing thunderclaps above the steady beat of the motors.

When at last we emerged from the squalls and clouds we were over the flat land of the coast. The swampland below, green and smooth as the top of a billiard table, seemed to be solid and traversed by branching man-made paths. Actually the green is a thin veneer of floating plant life on shallow water; "paths" are trails made by alligators.

Meet Mr. Gentleman

At Puerto Cabezas on the northeast coast I saw my first Miskito Indians. They are dark, taciturn people who, if they like you, adopt your name as their own. When you incur their displeasure, they drop your name. One I met was named simply Gentleman.

Many speak only the Miskito tongue and English. More English than Spanish is heard in parts of the coast.

 Reduction by Lois Darling

Momotombo, "Bald and Nude Colossus," Is a Light Sleeper

Nicaragua's most famous volcano normally steams quietly, but sporadically breaks into noisy activity. Eruptions are decreasing in frequency. Victor Hugo and Rubén Darío wrote poems about the mountain, which is on Lake Managua's shore. Black area in right background is one of several tongues of old lava.

Kodachrome by Luis Marden

President and Ambassador Clasp Hands before the Victory V on Flag Day, June 14

Nicaragua celebrates Flag Day on the same day as the United States. Here General Anastasio Somoza, President of the Republic, shakes hands with United States Ambassador James B. Stewart, in an expression of the warm friendship that unites the two countries. Blue and white Nicaraguan flag at right.

Kodachrome by Luis Marden

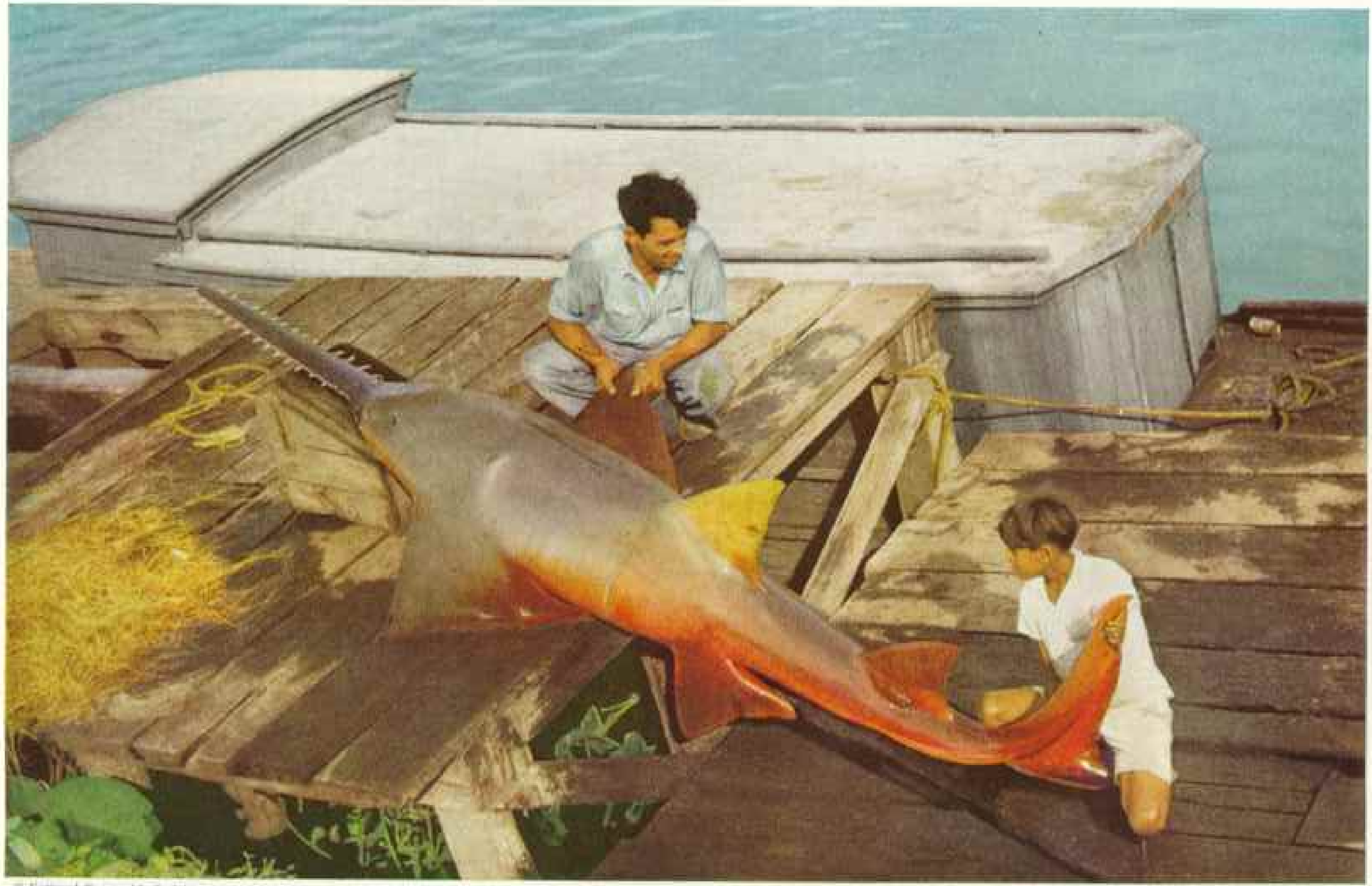
Masked Dancers of Masaya Whirl to the Rattling Marimba on the Feast of San Jerónimo

Masaya, on the railway from Managua to Granada, lies close to a volcano that until 1927 killed valuable coffee crops with exhalations of poisonous gases. An earthquake sealed the opening just as technicians were about to fit a cap over the gas vent. Masaya produces fine hammocks, ropes, baskets, pottery, and shoes.

Reduction by Luis Marden

Unique in the World of Fishes Is *Eulamia nicaraguensis*, Fresh-water Shark of Lake Nicaragua

At San Carlos, at the head of the San Juan River, the author caught several of these voracious fish, which attack humans and cause at least one death a year on the lake. This small 76-pound specimen is one of three that were shipped in alcohol to the Smithsonian Institution, Washington, D. C.



Kodachrome by Lois Marden

The Sawfish, a Specialized Type of Ray, Loves to Lie on the Bottom

Normally a marine animal, the sawfish, like the shark, may have become landlocked when Lake Nicaragua, once a gulf of the Pacific, was cut off from the sea by a land uprising. The saw-toothed proboscis of this 354-pound specimen is used for defense and to capture food by slashing through schools of small fish.

Kodachrome by Luis Marden

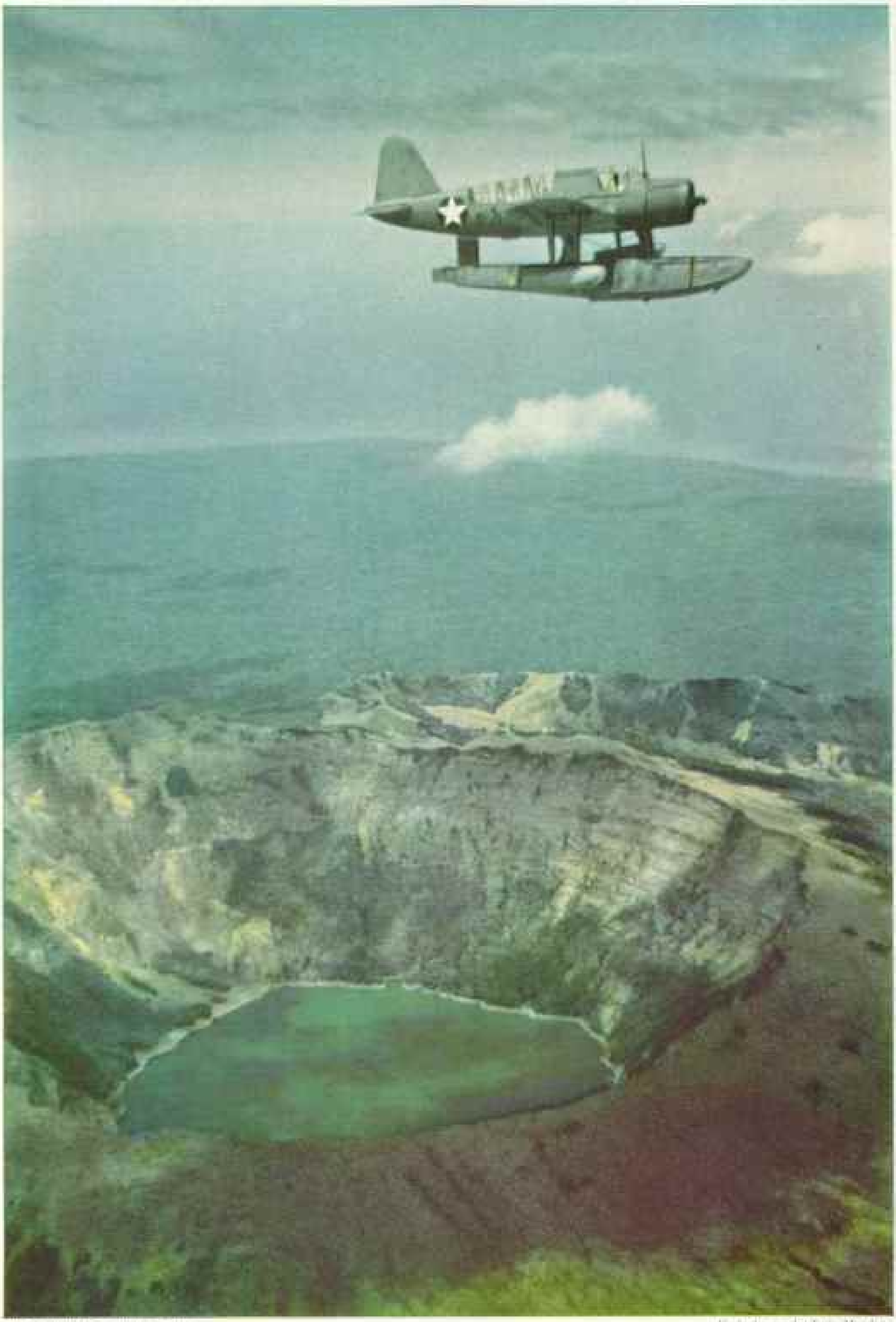
Esteli's Big Cut Was Deepest of the Nicaragua-Honduras Stretch of the Pan American Highway

The driver's shade umbrella makes the bulldozer coming down the steep slope look like a Chinese coolie on a sled. It is now possible to drive over an all-weather road from the Mexico-Guatemala frontier to San José, Costa Rica. Eventually the road will go through to the Panama Canal.

Kodachrome by Luis Marden

Nicaragua's Capital Stretches East and West on the Shore of Lake Managua

Almost completely destroyed by an earthquake in 1931, Managua has been largely rebuilt along modern lines. From the Presidential House on the right rim of Tiscapa crater lake (left), Roosevelt Avenue runs to the Cathedral plaza near the lake front. Peak rising in center background is Momotombo (Plate I).



 Kodachrome by Luis Marden

Cosegüina, Nicaragua's Northwesternmost Volcano, Shook the Earth in 1835

The crater lake may appear to be blue, green, or brown, according to the sky and weather.

The Miskito greatly outnumber the Sumu, another tribe of the east-coast hinterland. Though both, particularly the former, have become mixed with Negro and white blood, many pureblooded Indians still inhabit the upper reaches of the rivers and creeks, "children," as a missionary writer put it, "of the sluggish waterways." The sluggish waterways can awaken to torrential life in some seasons.

Negroes of the coast are descended in part from those of a Spanish slave ship wrecked on these shores some 300 years ago. In later years many Negroes immigrated here from Jamaica and other West Indian islands.

The Moravian Church, which has maintained a mission on the Coast since 1849, has established a modern hospital far up the Segovia, or Wanks, at a place called Bilwas Karma (Rattlesnake).

Some of the missionaries whom I met at their headquarters in Bluefields had been in the country forty years and spoke Miskito fluently. Grammars and dictionaries have been published of the language, and the New Testament has been translated into it.

Puerto Cabezas used to be the outlet for an important banana-growing area. But two banana diseases, the Panama disease and sigatoka, struck a few years ago, and now bananas have virtually disappeared as a commercial crop. Sigatoka spores are thought to have arrived with the hurricane of 1935.

Pine Heavier than Mahogany

At Puerto Cabezas I saw a large sawmill, but here they were cutting up tough yellow pine (*Pinus caribaea*, the same as the slash pine of southeastern United States). It is heavier, I was surprised to learn, than mahogany. Though classed as a hardwood, mahogany really is not very heavy when compared with some other tropical woods.

Nicaraguan pine grows on the meadowlike savannas; mahogany along the creeks and rivers. Today there is more pine than mahogany, the latter having been cut continually since the eighteenth century.

There is no such thing as a mahogany forest. Trees grow singly or in isolated clumps, but not in a continuous wood. Since good trees close to sizable streams have been cut long since, they are today hunted out by ground parties or spotted from airplanes.

In the early part of the year, mahogany trees can be identified from the air by the reddish color of their leaves. Position of trees seen from the air is plotted on a map, distances from river or creek noted, and, if the number of trees warrants it, a camp is established.

Mahogany trees are giants that usually tower above the general forest level and may be over 100 feet high. For export to the United States, logs 18 inches in diameter at the smaller end are wanted, though a certain number of 16-inchers are accepted. An 18-inch tree may be more than a century old.

When cut, trees are dragged to the creek by teams of oxen or by tractors, then floated downstream in time of high water in rafts of about 200 logs (Plates X, XV).

According to Nicaraguan law, when a mahogany tree is cut down two must be planted in its place. Loggers look for the large seed pods, break them open, and plant the seeds.

Why Mahogany Is Valued

Most of the mahogany now shipped to the United States goes in the form of logs. We use it for airplane fuselage construction, torpedo boats, pattern making for metal parts, and other war equipment.

It is straight-grained, works easily, resists rot and insects, and has a high strength-to-weight ratio.

Sawdust of freshly sawed mahogany smells like ripe olives and runs red as blood when wet. High in tannic-acid content, the dust is often used to smoke hams.

In Bluefields I saw houses entirely constructed of mahogany. The humble Coast resident may live in a mahogany house, use a mahogany canoe, and ultimately be buried in a mahogany coffin.

Bananas in commercial quantities have died out around Bluefields, too. Abandoned banana fields, for some reason, are ideal ground for growth of balsa trees. Some of this wood is exported to the United States to be used in airplanes and in life preservers.

In this eastern area Nicaragua is rich in fine cabinet woods. Rosewoods, cocobolo (especially useful for cutlery handles), lignum vitae, primavera (often incorrectly called white mahogany), and many other fine-grained heavy cabinet woods abound.

Bluefields has a mixed population. But Chinese, French, Syrians, British, Germans, "United States-ers," and Spanish Nicaraguans commonly converse in a West Indian brand of English, imported from Jamaica and other British West Indian islands by Negro immigrants.

Chinese from Canton dominate the business of the port. Here, as in other parts of tropical America, they are well liked for their industry, fair dealing, and conformity to the customs of their adopted country.

The leading Chinese merchant of the port is a long-time member of the National Geo-

Lake Nicaragua's Fresh-water Shark Is a Killer

In the spring of 1944, a single shark attacked three persons near Granada, killing two. All sharks have several rows of teeth; when a tooth is broken off, another takes its place. This 112-pound specimen was caught by the author on a rod with 6-ounce tip after two hours' play. Sharks heavier than 200 pounds have been reported from the lake (page 184 and Plate IV).

graphic Society and displays The Society's maps on the walls of his office.

Still feeling their newness as a part of the Republic, Bluefields residents often speak of Nicaraguans from the west as "the Spanish."

Wooden buildings with jigsaw fretwork and overhanging verandas, as well as the rising inflection of the local brand of English, reminded me of the Antilles.

Many Jamaica locutions are in use here, as when buzzards are called by their Jamaica nickname. Bluefields Negroes say, referring to the bald head of these useful vultures, "Look de John Crow; him got peeled head."

Colored people here have many beliefs in the moon's power over men and animals.

For example, port fishermen say, "In de new moon, fish mouth soft. You hook many, but lose dem."

Hunters watch behavior of domestic animals before going out to hunt. If oxen chew their cud and barnyard animals lie down, so will beasts of the forests and plains be inactive, they say.

Mahogany and other timber, as well as palm leaves for thatching, they say, should not be cut in the new moon, for that which is cut then rots easily.

Rubber cutters told me that latex flowed more readily in the waxing quarter of the moon than in the waning.

When I flew back to Managua from Bluefields, the airplane for a while paralleled the Escondido River. Before the Bluefields lagoon silted up, ocean-going fruit steamers used to go seventy miles up this river to Rama to load bananas.

Rama is at the beginning of the trail that goes overland to the west side of Nicaragua. A road from Rama to Managua is projected which will land-link the east and west coasts of Nicaragua.

Near the capital, we flew over the Tipitapa River, which flows between Lakes Managua and Nicaragua.

Waters of Lake Managua, approximately 15 feet higher than the Great Lake, flow underground into Lake Nicaragua. Normally there are dry stretches in the bed of the Tipitapa River, though every decade or so extremely high water fills the river and there is water connection between the two lakes.

Because of this occasional flooding, I was puzzled to find that tarpon, sawfish, and

A President Helps a Queen Cut Herself a Slice of Cake

Each year, at a colorful ceremony in Managua, a Queen of the Military Academy is selected. General Anastasio Somoza, President of Nicaragua, said he did not mind how long the photographer took to make this picture! Señora de Somoza smiles at right; the outgoing queen stands at far left.

Just a Song at Twilight—Nicaraguan Style

In the cool of the evening Managuans place chairs in front of their homes and sit and chat on the sidewalks.

What Pierced This Dead Volcano's Side?

From the air, this amazingly symmetrical hole in the crater wall of an extinct volcano near Momotombo (Plate I) looks small. True size is indicated by full-grown trees below its rim. Geologists say that undermined walls may have collapsed and broken into a nearly perfect circle, or something may have been violently expelled through the side wall when the volcano was active.

sharks, all abundant in the Great Lake, do not exist, so far as I could learn, in Lake Managua.

From Managua I went by rail across the fertile floor of an ancient crater to Granada. Here I stayed at the Colegio Centro-América on the lake front, founded and maintained by the Jesuit order. Sons of many leading families of the Central American republics are enrolled here.

The College is exclusively for boys and young men. Boys may enter when seven years old and stay until they are over twenty. Thus the terms embrace the period normally covered by elementary and high-school grades and first-year college in the United States.

I was the guest of Father Bernardo Ponsol, a Basque priest who is Rector of the College. He has an active interest in natural history, especially ornithology.

Perched on a cliff, the school is in an excellent position for the study of bird life, being almost in the center of one of the great flyways used by many birds migrating north and south. Of nearly 900 individual birds recorded in the catalogue of the College museum, almost 70 percent are migratory.

Golden Plover Recorded at College

One day the Padre made a real find. On April 17, 1942, two long-legged birds alighted in an inundated playing field of the school. The one specimen collected was identified as the golden plover.

The eastern form of these remarkable birds migrates each year from northeastern Canada to Patagonia and back again. Golden plovers sighted in South, Central, and North America established the south-to-north flyway of the birds.* But only a few had been recorded

* See "Our Greatest Travelers," by Frederick C. Lincoln, in Volume II of *The Book of Birds*, by Gilbert Grosvenor and Alexander Wetmore, published by the National Geographic Society.

Beneath This Sculptured Lion in León Cathedral a Poet Sleeps

Born in Metapa (renamed Darío) in 1867, Rubén Darío spent most of his life in Europe, but returned to his native land, to die in 1916. Darío boldly experimented with new forms in prose and poetry (pages 165-6).

between Panama and Mexico. Father Ponsol's specimen fitted a Nicaraguan link to the chain that definitely fixes the plover's northbound route.

Abundant on the College grounds, as in much of tropical Central America, is a kind of boat-tailed grackle, a handsome bird with glaucous plumage, yellow eyes, and a saucy walk. Seen with them, but less numerous, is another large black bird, the groove-billed ani, which has a peculiar flutter-and-glide mode of flight.

Steamer Plies Lake for 60 Years

Across the Great Lake, nearly a hundred miles to the southeast from Granada, is San Carlos, at the head of the San Juan River. I went there on the *Victoria*, a steamer that has been on the Great Lake for some 60 years.

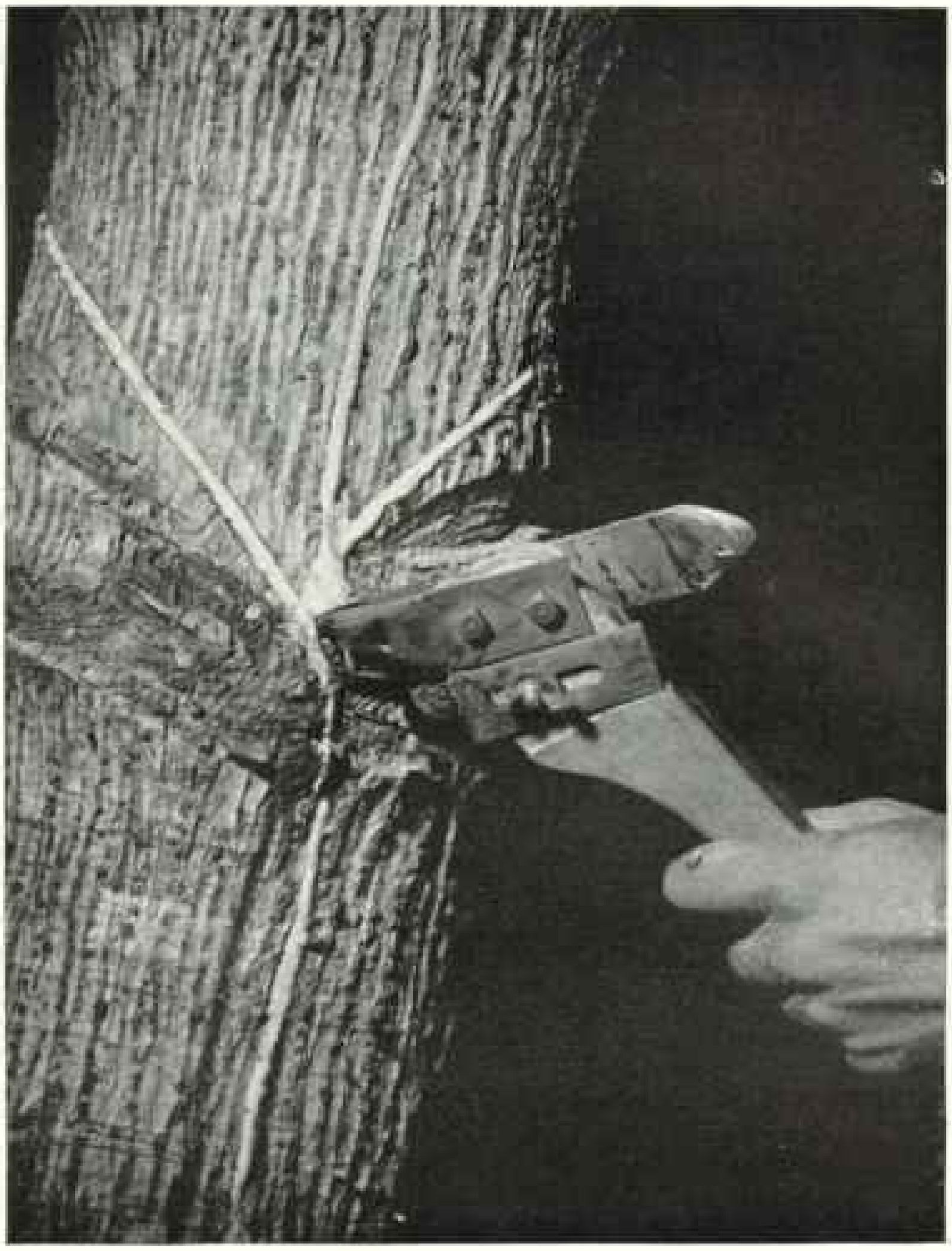
The *Victoria* has figured in revolutions and historical novels; she has become a Nicaraguan legend. Her maker's plate on the lower deck reads: "Pusey & Jones, Wilmington, Delaware, 1882."

A passenger who remembered the *Victoria* with affection from childhood said, "I don't even want them to change the tone of the whistle."

Sailing on Lake Nicaragua is almost like going to sea. When the frequent squalls of the rainy season blow up, an ugly chop, shorter and quicker than the movement of the open ocean, develops.

But the *Victoria* has weathered much heavier seas. In 1882 she was sailed down the Atlantic and Caribbean coasts to Nicaragua, then up the 130 winding miles of the San Juan to the lake. Since then rapids and sand bars have built up to the point where deep-draft vessels can no longer ascend the San Juan.

Commodore Vanderbilt once operated a line of river boats in which he brought "forty-niners" up the San Juan and across the lake, thence by stage to the Pacific at San Juan del Sur, where they embarked for the California goldfields.



Old and New in *Castilla* Rubber Tapping

This knife, introduced by the U. S. Rubber Development Corporation, makes a shallow, narrow incision. More latex is obtained with it than with the harmful *machete*, which leaves the wide scar. A main channel, into which feed branching side cuts, is carried up the trunk to the first branches. Latex flows down the canal into a receptacle (pages 168, 183).

We stopped that night at the island of Ometepe—Two Hills in the Aztec tongue. One of the island's symmetrical twin peaks, Concepción, is still sporadically active. In it the chain of active volcanism that broke off with Momotombo on Lake Managua resumes its march down the isthmus.

Close to Ometepe Lake Nicaragua reaches its greatest depth—about 200 feet.

Next morning we saw floating masses of water hyacinth, many of which bore a solitary white egret, motionless among the pale-violet spikes.

San Carlos is small, hot, and unlovely. A few buildings of wood and galvanized iron, one shattered royal palm; the rest bush and jungle. Yet the village is important as the terminus of river traffic moving up and down the San Juan.

The U. S. Hydrographic Office established in connection with the Nicaraguan Canal Survey maintains a substation in San Carlos to gather meteorological and hydrologic data, such as the rise and fall of river and lake, rainfall, and allied matters which would be of use in the building of a canal.

I stayed with Herman, keeper of the San Carlos station. When I asked him if there were any sharks around San Carlos, he said, "Plenty."

So common are the fish, in fact, that no one dares bathe or swim in deep water. For the sharks of Lake Nicaragua are definitely man-eaters—there is no myth about that. Sharks claim at least one life a year on the lake. Usually the victim has had a leg or arm carried away and dies from loss of blood.

Desultory shark fishing for the livers and fins is carried on at San Carlos. Livers, rich in vitamins, bring five cents a pound; fins are sold for soup to Chinese merchants of the village.

The Hunting of the Shark

San Carlos youths have queer nicknames. For example, the bow paddler in the dugout canoe from which I fished was called The Camel; the stern man, Dry Sardine. Other names I heard along the water front were: Rubber Pig, Half Chicken, Microbe, Hot Rumba, Butter, Sharp Face, Coconut Eater, and Square Banana.

We fished within sight of the docks, on

the bottom, in about eleven feet of water. But first we had to catch a small fish for bait. We caught a 5-pound machaca (*Brycon dentex*) on a fly rod. For this silvery fish I used a very delicate lure—I hope none of my dry-fly purist friends read this—fried banana.

With a large chunk of fish on a heavy, chain-leadered shark hook, we fished from the anchored canoe.

We had not long to wait. In less than five minutes the coiled heavy handline began sliding steadily over the gunwale.

"Let him go, let him go a while," whispered Dry Sardine, the shark expert. When about ten feet had run out, "Now!" he cried. "Set the hook!"

As I hauled the line up taut, I felt the solid weight of the fish. The shark started off with a rush that sent the heavy line hissing through my gloved hands.

For several minutes the fish rushed and bored, but he could not do much against the heavy hook and stout sash cord. As I brought the shark alongside, I could see the long gray body and the broad, flattish head typical of this species.

The first specimen was the largest we caught, a female weighing 158 pounds. It was too large to pack into the gasoline drum full of alcohol in which I was to ship the specimens to the United States, so we continued fishing. We got a bite every five to ten minutes.

Three specimens were eventually sent to the U. S. National Museum. All males, they weighed 98, 76, and 48 pounds. Ichthyologists identified them as *Eulamia nicaraguensis* (Plate IV).

Nicaragua Has Rubber, but Few Tires

Tires are rationed in the Republic for the duration. This is *barrucha*, or strip rubber. Deep cuts are made halfway around the rubber tree with a machete; later the solidified latex is stripped from the gash and wound into these sausagelike rolls (page 168).

Museum specimens assured, we rigged a light rod and reel to see what sport the fresh-water shark could give. I fished on the bottom in the same place with the same bait, but used a light salt-water rod with 6-ounce tip and 150 yards of 9-thread (27 lb. test) line on a small reel.

I hooked and lost five before I could set the hook deep enough to keep a fish on. But then the fun started. The shark made typical long, boring runs, and several times ran off so much line that I saw the metal of the reel spindle.

We had to up-anchor and paddle after him, as the tackle was too light to stop his runs.

Only once did the shark break water.

breaching silently like a sleek gray torpedo.

I have never known an ordinary marine shark to fight longer than 15 or 20 minutes. Usually they struggle furiously for a short time, then give up. This fish took me exactly two hours to boat, and when I finally gaffed him we were three miles down the San Juan.

It was a 112-pound male, six and a half feet long (page 178).

700-pound Sawfish in Lake

One day while fishing for shark we caught four enormous sawfish. The first and smallest weighed 354 pounds; the largest, more than 700 pounds! All this, mind you, in a freshwater lake.

Sawfish are related to the sharks (both are elasmobranchs). There seem to be two species in Lake Nicaragua, though all we took were of a single kind, common in both oceans, *Pristis microdon* (Plate V).

The lake at San Carlos is full of tarpon. Often we saw more than a dozen rolling at the surface at one time. I was too occupied with bottom fishing for sharks to catch tarpon, but according to local accounts they grow to enormous size. They are harpooned by local fishermen and not caught on a hook.

Virtually nothing is known of the breeding habits of the tarpon. There has been some speculation whether Lake Nicaragua may be the original home of this largest of the herring-like fishes.

Now, all these fish are not, strictly speaking, landlocked. They may have access to the sea by way of the 130-mile-long San Juan. Despite sand bars and rapids, they could move up and down the river. But sharks and sawfish do breed in the lake. Females have been taken who dropped their young at the moment of capture.

To follow the sinuous San Juan from San Carlos to the Caribbean, I took to the air again, this time in a U. S. Navy seaplane.

About a third of the distance downstream from San Carlos the brown water flakes into white rapids at El Castillo, a hamlet at a bend in the river. These and other rapids and sand bars of the San Juan would have to be dredged if a canal is ever built here (Pl. XIV).

On a hill above El Castillo I saw the eroded remains of a Spanish fort. In 1780 Horatio Nelson sailed up the river and took this fort, but had to abandon it when tropical fevers killed off most of his men.

Some years earlier, in 1762, an English force attacked the fort. When the garrison commander died of an illness, his 19-year-old daughter, Rafaela Herrera, took command and fought off the invaders, and so became the national heroine of Nicaragua (Plate XVI).

We followed the twisting river through thick jungle that looked like green-dyed sponge from the air, and through rain squalls that sometimes formed pale rainbows beneath our wing tips.

This is one of the world's rainy regions. In 1938, 334 inches of rain were recorded at San Juan del Norte (Greytown), at the mouth of the San Juan; it averages 260 inches.

Forty-five minutes after leaving San Carlos we came to the Caribbean, not blue here but a muddy brown.

The river diffuses over sand bars and through several mouths, some silted up. The inexorable sands have slowly filled in the harbor at Greytown to the point where a new harbor would have to be made to the north of the town if a canal were cut through.

From 1890 to 1893, the Maritime Canal Company actually cut a few miles of canal just north of Greytown. From the airplane I saw two abandoned dredges forlornly sticking up out of shallow water at the head of the cut.

Robert E. Peary, then a lieutenant of engineers, made the survey on which the company based its work and later wrote of it in the National Geographic Magazine.*

Under direction of the Interoceanic Canal Board, consisting of two U. S. Army Engineers and three civilian engineers, a provisional battalion of U. S. Engineer troops, headed by Lt. Col. Dan I. Sultan,† made a new survey in 1929-31. The route selected for the Nicaragua Canal, including sea approaches to harbors, would be nearly 173 miles long (as opposed to Panama's 51). It would start north of Greytown on the Caribbean side and follow the course of a small river southwest toward the San Juan. Then up the San Juan to San Carlos; across Lake Nicaragua to a point on the western shore, and over 16 miles of land to the Pacific at Brito.

There would be three locks at each end of the canal, to raise and lower vessels to and from Lake Nicaragua's 105-foot level.

Ships would require about 23 hours for the passage from ocean to ocean; transit of the Panama Canal is made in eight hours.

We came out over the rocky promontory of Brito Head just as the sun was sinking, a perfect red disk, into the Pacific. Someday liners and merchantmen may lie up here, bringing the travelers and cargoes of peace. Nicaraguans like to think so.

* See "Across Nicaragua with Transit and Machete," by Robert E. Peary, National Geographic Magazine, Vol. I, No. 4, 1889.

† See "Army Engineer Explores Nicaragua," by Lt. Col. Dan I. Sultan, National Geographic Magazine, May, 1932.

 Kodachrome by Luis Marden

Open Carriages Reveal Costumed Beauty at the August Festivals

From August 1 to 10, the feasts of Santo Domingo de Guzmán are celebrated in Nicaragua. On the first day of the festivities, a small image of the venerated saint is brought from an outlying village into the capital, where it remains for ten days. Open carriages, called *berlinas*, are popular for evening drives.

Reduction by Luis Marden

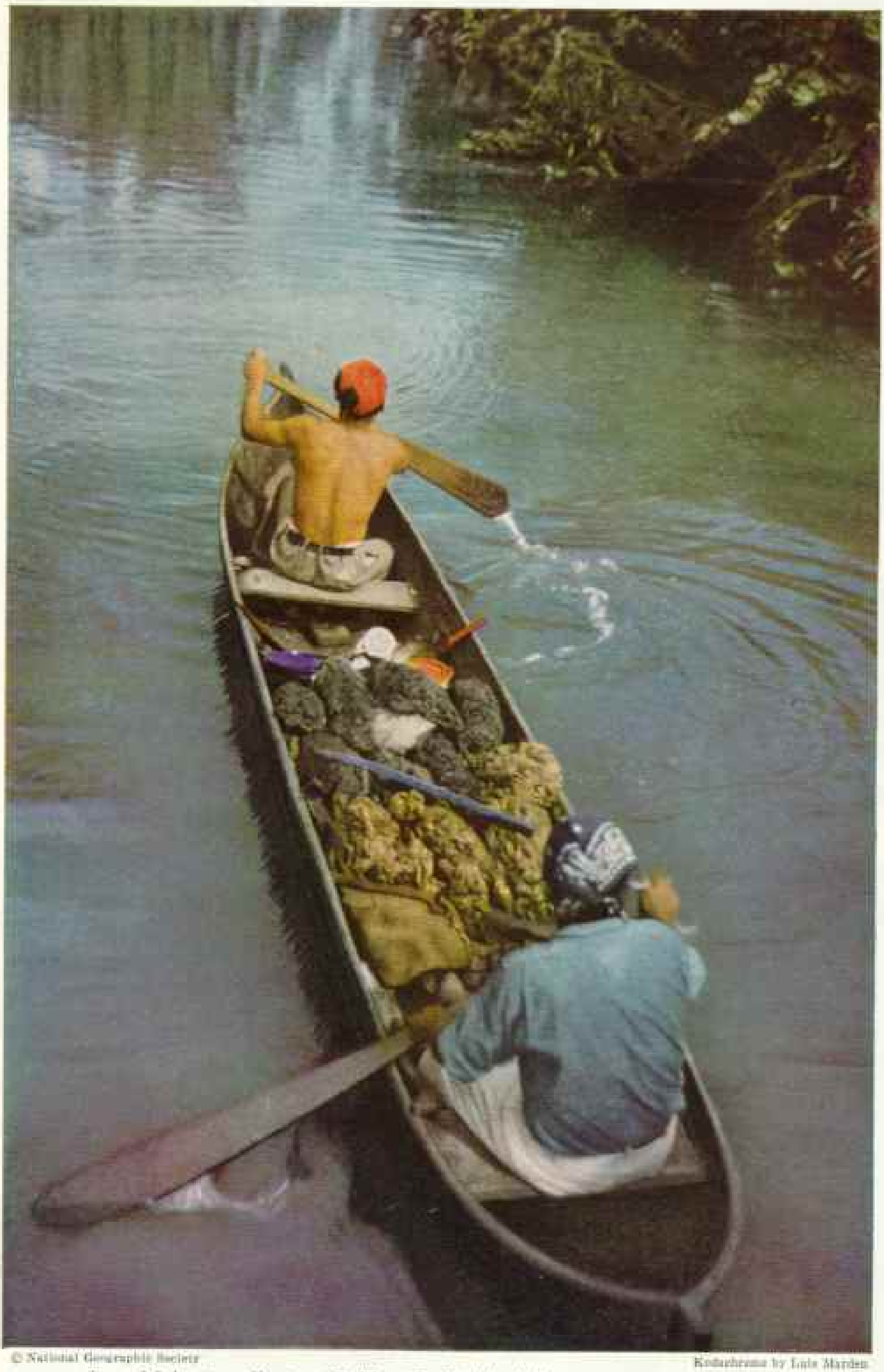
Cedar and Mahogany Logs from across the Lake Bob in the Surf at San Jorge

This lake port serves Rivas, rubber and cacao center. Steamer *Victoria* is partially silhouetted against Concepción, one of the twin peaks of the island-volcano of Ometepe. Built in Wilmington, Delaware, the *Victoria* has carried passengers and freight on Lake Nicaragua since 1882.

Kodachrome by Luis Marden

A United States Army Officer Joins Nicaraguan Friends in Traditional Holiday Horseback Riding

Nicaraguan saddles are fitted with a crupper, which is often elaborately ornamented with horsehair, like the bridle of the horse in center foreground. The ten days of the August festivals are celebrated with processions, rodeos, and carnivals. Cavalcades of costumed celebrants accompany the image of the saint in procession.



Kodachrome by Luis Marden

In a Mahogany Dugout Rubber Is Paddled Downstream to Bluefields

Much latex comes from east-coast jungles, where rivers are roads. Usually *Castilla* rubber grows wild.

Some Nicaraguan Rubber Is Flown to the United States

Rubber is heavy, and the bulk goes by ship. Only when an Air Transport Command airplane passed through Managua with available cargo space did some sacks go by air.

Kodachromes by Luis Marden

Nicaraguans Play Soccer, but Like Baseball Better

Their country is champion of the Central American isthmus at the imported game. Some of these Colegio Centro-América soccer players competed in the Central American Olympics held in El Salvador in 1943.

Kodachrome by Luis Marden

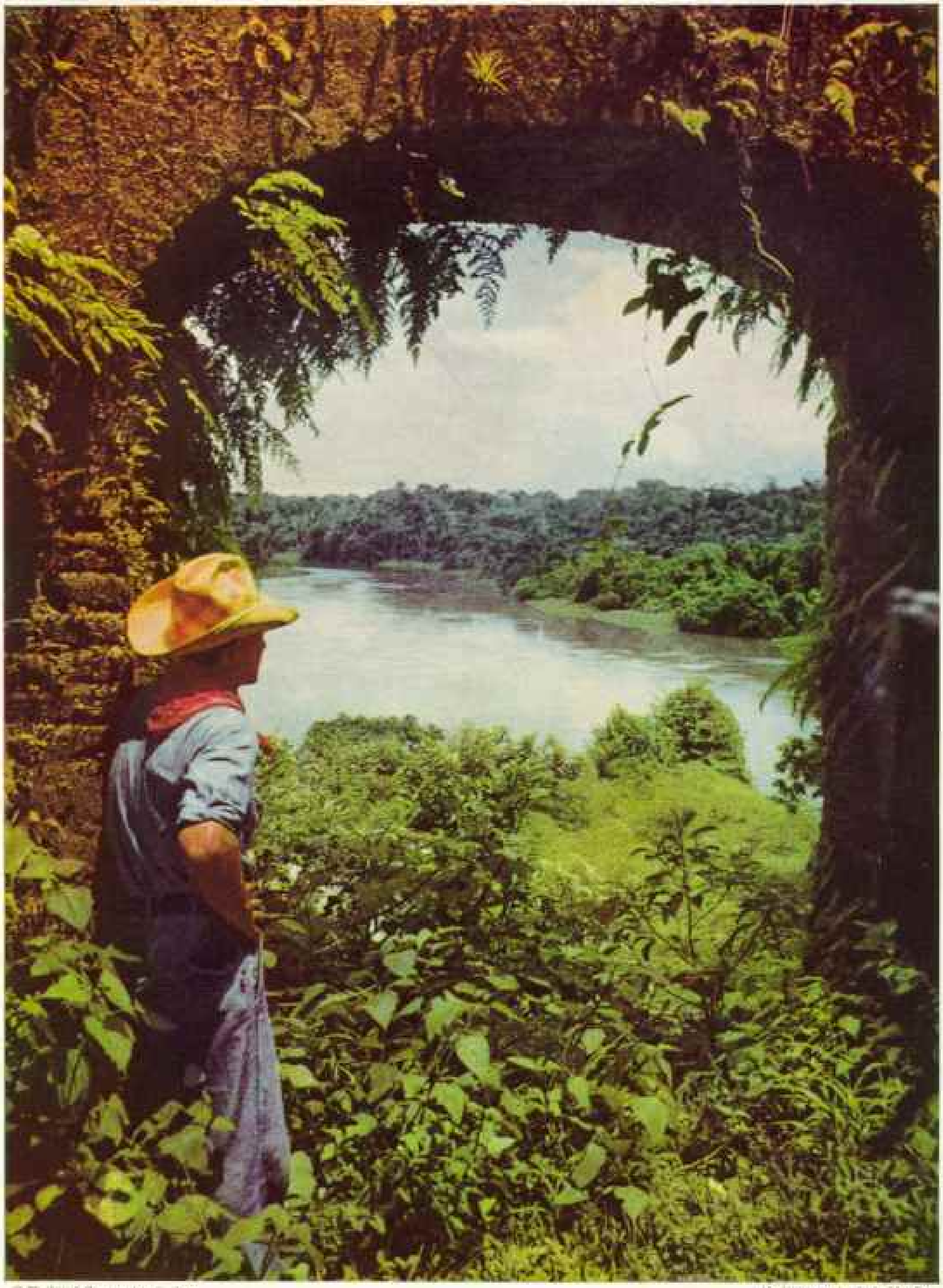
Where the Broad San Juan Mirrors the Setting Sun, a Canal May Come into Being

Many projects have been proposed for an interoceanic canal that would pass along the San Juan River, across Lake Nicaragua, and through 16 miles of intervening land to the Pacific. Nearly a century ago, gold-rushers headed for California were transported over this route in river steamers and stagecoaches.

Redrawn by Lois Darden

Torpedo Boats in the Raw Are These Mahogany Planks Drying in the Bluefields Sun

Curved marks show that the wood has been cut by a circular saw. Most mahogany is exported from Nicaragua in entire logs. Mahogany is valuable in making PT boats, aircraft plywood, and other war essentials because of its strength, resistance to rot, and smooth grain.



 Kodachrome by Luis Marden

Through This Moss-grown Arch Passed Rafaela Herrera, Nicaragua's National Heroine

Ruins of El Castillo Fort stand on a hill at a bend of the San Juan River. Here, in 1762, the 18-year-old daughter of the garrison captain repulsed English invaders. Extensive rapids at El Castillo are one of several bars to deep-draft navigation of the San Juan that would have to be dredged if a canal is built.

Women at Work

By La Verne Bradley

THE balance of power rests in women's hands. Literally.

Behind the whine of sawmills and roar of blast furnaces, the hammer of arsenals and thunder of machine shops—in shipyards, factories, foundries, slaughterhouses, and laboratories—women are manipulating the machinery of war.

They work the giant hydropresses and stamping mills whose heavy weights are constantly pounding, pressing, shaping, disgorging the materials of battle. They operate drop hammers, punch presses, turret lathes, milling machines. They hold rivet guns, blowtorches, drills, files, micrometers, templates, and test tubes.

For three years they have laid down blueprints, welded seams, and picked up battle gear, put it on wheels, and carried it for proving. Then they've inspected, tested, proved it, and delivered it for war.

At the same time, they've worked to keep their homes or set up new ones under makeshift conditions in strange places.

About a third of America's manpower today is womanpower. That's more than one out of every three women of working age in the United States. Of the millions handling the big tools and machines of industry, one-half are estimated to be there only because of the war.

Approximately one-fourth of the 16,500,000 women holding jobs in the spring of this year were not even interested in such work in 1940! Many had never seen a factory, never hammered a tack, never worked before at anything outside the home.

Reports of the Women's Bureau, Department of Labor, disclose the amazing variety of jobs women hold.

In Aircraft Production

A week before Pearl Harbor you could walk through the factory rooms of any aircraft company in the country and rarely find a woman on the production line. They were a fraction of one percent of the total labor force.

Two years later, 475,000 women made up nearly 35 percent of the industry. More than 45 percent of the workers for Douglas Aircraft are women. And in the first 12 months that the output of B-17's was doubled, nearly half the men at Boeing necessarily were replaced by completely inexperienced women.

"Long before there was a manpower shortage we began to employ women on the assembly line," said Glenn L. Martin, builder of famous fighting and patrol bombers. "We were one of the first aircraft companies to employ women in mechanical capacities.

"However, it was an eminently successful experiment. There will always be a place for the skilled woman worker in the aircraft industry. Many jobs she performs as well as men, and some she performs better.

"Today, approximately 35 percent of the productive workers building Martin combat ships are women. Soon we look forward to seeing this number vastly increased, as more and more of our younger men are called up for military duty.

"We have women helping design our planes in the Engineering Department, building them on the production line, operating almost every conceivable type of machinery, from rivet guns to giant stamp presses.

"The presence of so many women has had an excellent effect upon production. They have set production records that are a challenge to men, and there's something about a woman beating a man at his own machine that he just cannot stand" (page 198).

"Bombs Away, Beautiful!"

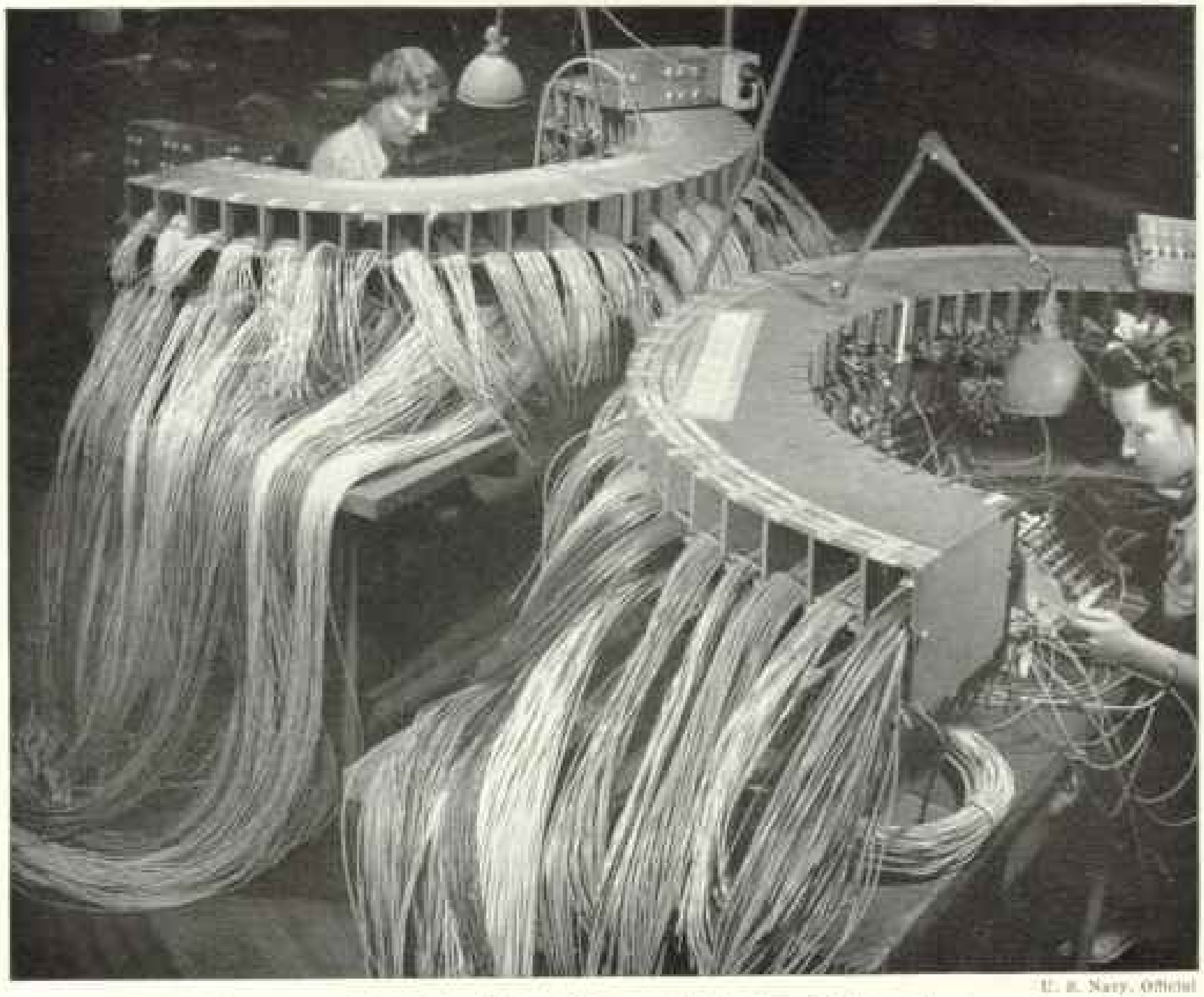
As I walked into the shop where the giant *Mars* was built and where great PBM-3's were lined up for final assembly, I heard a man's voice calling out from the cavern of a huge wing, "Bombs away, beautiful!"

Straddled over a truss in the bomb bay, he was checking shackle releases as a girl down in the depths of the ship fired an electric gun and kept tab on the panel flashing salvo signals—single bombs, bombs in sequence, wham, bombs away.

Usually two girls do this alone, calling back and forth by interphone from one remote end of the ship to the other. I watched them swing up through compartment hatches and scramble over spars and beams like cats.

Martin has also an all-girl test crew, which went into action for the first time on an icy morning this last December. They had put in months of training for one of the most crucial jobs in the business, the final ground testing and adjusting of every functioning part of a patrol bomber. Engine, instruments, controls—theirs is the final check before men take it aloft.

Through acres of bombers and chopped-up parts of bombers, silver, brown, and green, we made our way from one roaring assembly line to another. At one point we stopped



U. S. Navy, Official

Benches Like Pipe-organ Consoles Help Women Make Up Wiring Systems for Trainers

Consolidated Vultee uses this system for sorting and classifying the hundreds of lengths of wire required in the modern plane. Other workers place the wires in pigeonholes according to length and color. Then these women number the terminals and send them to the assembly line.

to speak to a small taffy blonde, wearing a blue hair ribbon and sitting in the midst of hammering machinery, her feet propped up on a bench, reading a book.

It was her lunch hour and the manual, *Pneudraulic Power Machine and Riveters.* One of half a million housewives who had never been in a factory, she suddenly figured a couple of years ago that maybe the talents of her toolmaker father might be developed in her. They were.

Occasionally you find a woman such as Anne Hollman, and you don't forget that she is 46 and helps make one of the hottest fighter planes in the Army. She is the only woman flash welder in the East. And she is an Amazon.

In the last war she was a machine operator in a knitting mill; then she did housework for 20 years. Now she is back, master of a difficult trade and proud of her skill, towering over her bench by the hour as she stands welding ends onto control rods for Republic Thunderbolts.

In one section the foreman had said, "When the first woman is sent to my shop, send my release with her."

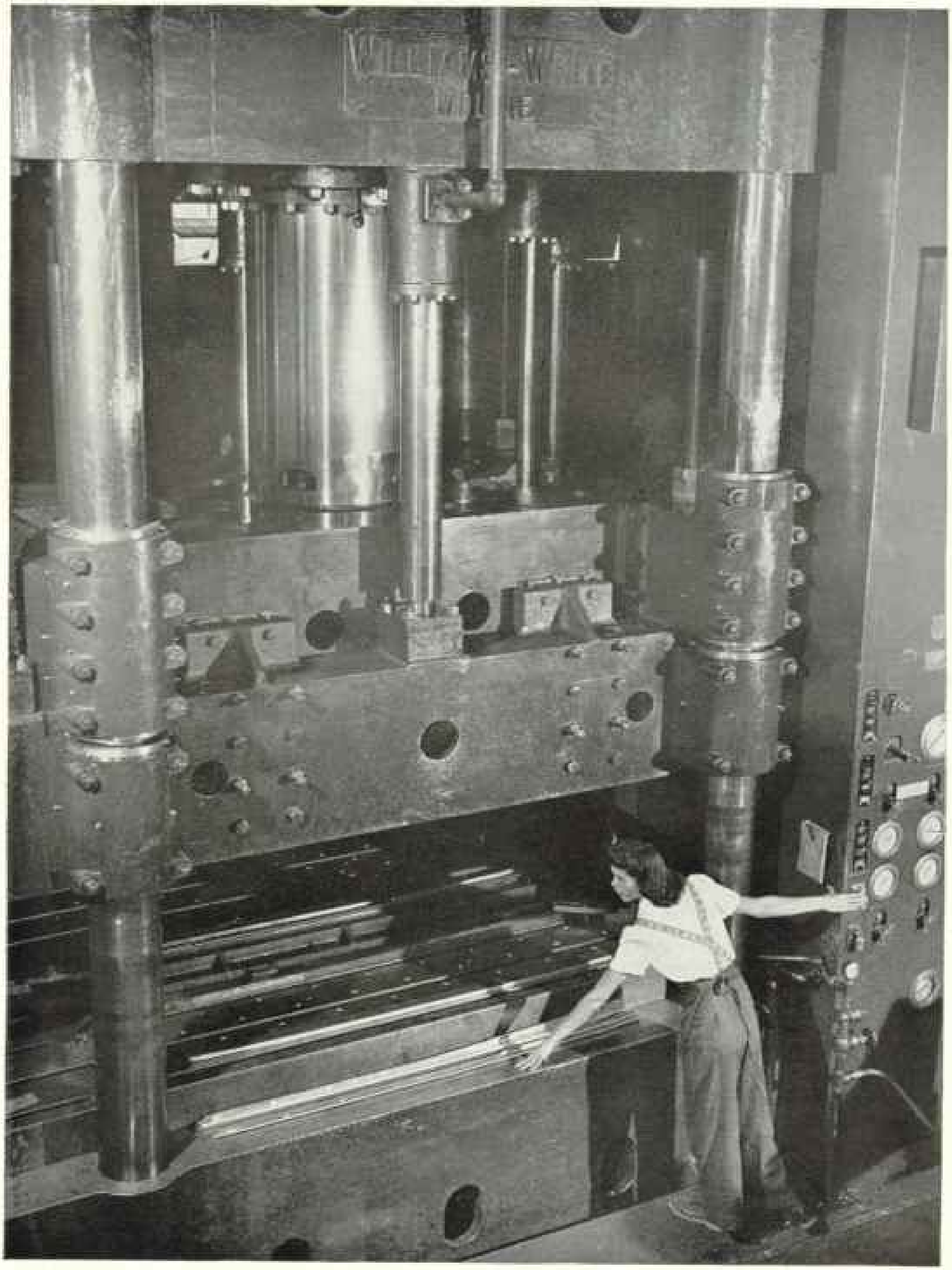
Some months later, I mentioned a few of the usual objections to women in industry—57 percent of man's strength, 68 percent of his resistance to fatigue, etc.—and this same foreman defended them hotly.

He specifically pointed out the girl who was turning out five assembly units to her male predecessor's two.

Womanpower in Shipyards

In 1939 there were 36 women employed in American shipyards.

Two years ago when I saw women working on destroyers and submarines and in the machine shops at the Mare Island Navy Yard and on tankers and other ships around San Francisco Bay, I was told that there were



At the Touch of Her Finger, This Monster Hydropress Molds Metal Liberator Parts

The inside underpart of the huge hydraulic press is hard rubber. As it comes slowly down, the rubber pad presses and shapes sheets of metal to the die at the bottom. The press is used only for mass-production jobs and can stamp out several different small parts at once.

The Distaff Arts Are Not Out of Place in the War Effort

Making sand cores, or molds, for magnesium castings is "easy as pie" for women used to kneading pastry dough at home. Fine, flourlike sand is painstakingly molded into precision forms, sprayed with oil, and baked. Pistonlike forms in background are finished molds of airplane parts (page 215).

jobs which women could never do—shipfitting, for instance, and chipping, and handling the big cranes.*

Kaiser put them on the big cranes and now they handle them with ease, swinging giant steel arms out over yards to pick up whole bulkheads or afterpeaks and lift them to the ways. Shipfitting and chipping, along with dozens of other all-male jobs, they've taken in stride (page 204).

Thousands of women are doing such things as welding and riveting. About the only thing they do not do is heavy lifting.

It is illegal in some States. But in many cases, even these operations have been broken down to permit women to handle them.

It took 175 tons of blueprint, 4,300,000 feet of welding, and 3,830,000 man-and-woman days to build the U.S.S. *Missouri*. Every Navy craft produced takes proportional figures. And enough preliminary and supplementary work to make you wonder if anything else is going on anywhere.

At the David Taylor Model Basin in Maryland, where the Navy experiments with new ship designs and tests scale models of both Army and Navy craft, I found Dr. Avis Borden working in the structural mechanics division developing methods of calibrating underwater explosion gages. She had received her degree in physics from the University of Michigan in 1938, but she had never had a chance to use it in such important work. Now her findings have been put to official use.

In another section women were taking readings on marine propellers in a variable-pressure water tunnel. In engineering and drafting rooms they were making drawings, calculating water and pressure effects, and performing intricate mathematical computations connected with naval architecture.

A Delicate Aquatic Test

Out in the damp, cavernous chamber which holds the 965-foot-long water basin, we boarded the big carriage which hauls ship models through the water channel at speeds from 18 to only 0.03 knots (page 203).

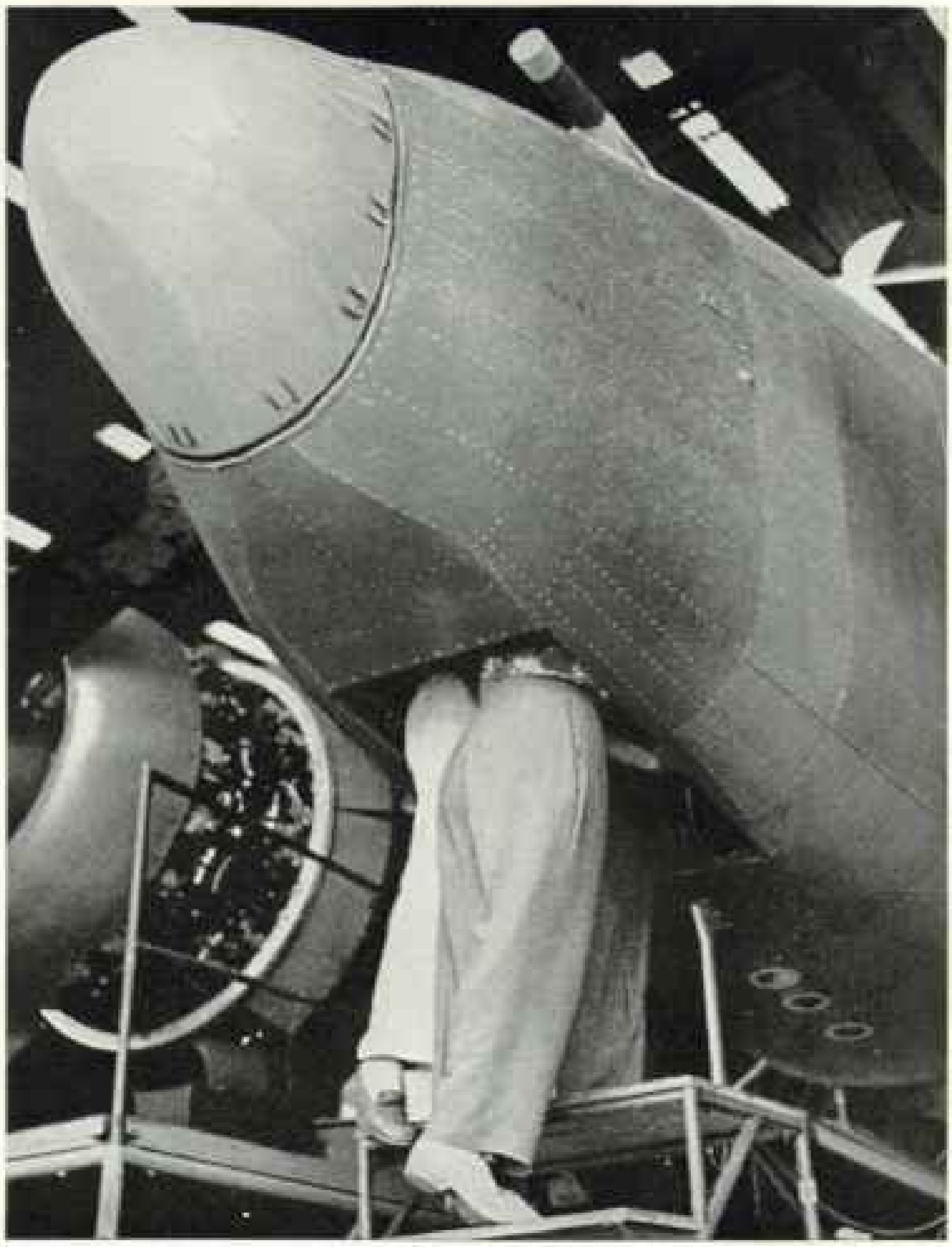
It looks like a small cantilever bridge moving through the air, but it is so delicately built that it can maintain any desired speed at a

*See, in the National Geographic Magazine, March, 1943, "San Francisco: Gibraltar of the West Coast," by La Verne Bradley.

constant value within one-hundredth of a knot while following the actual curvature of the earth. Two girls in blue jeans were driving it.

Results of runs for the 20-foot model of an aircraft carrier being tested were recorded on dynamometers and translated onto charts being plotted by other women at desks which ride with the carriage. These women aren't scientists. They are just average girls, trained swiftly to do vital jobs.

At a naval gun factory women at big profiling machines were turning out rotating pans for 16-inch guns. They were working light and heavy lathes, milling machines, drill presses, thread grinders; making sears, breechblocks, and hundreds of other gun mechanisms. They were greasing giant gun barrels and painting others for battle.



U. S. Navy, Official

Perhaps They Are Movie Extras Doing Their Bit on Swing Shift

Here girls in the Lockheed plant at Burbank, California, work in the bombardier's hatch of a Ventura. The bomb bay is farther back. This twin-engined bomber hunts subs, bombs ships and shore installations, and patrols vast ocean reaches for the Navy.

A Beauty Operator Takes to Machines

Dressed in blue safety slacks and caps and stepping over huge guns lying about on the floor, or linking arms together to go to lunch, they looked almost like Rockettes against a supercolossal stage set.

The shop supervisor, who has been with the big guns since 1912, had to be shown that slight girls, such as the former beauty operator on the Keller profiler, could handle these machines.

They are trained on the job here, and trained fast. One girl had two hours' instruction on a machine, went to work, and the next day in an emergency broke in another girl. There is little difference between an inexperienced woman and an inexperienced man in this work.

And there *are* some "natural" women mechanics. "Like Joan," said the supervisor, pointing to a girl working over a big hydraulic shaper, "who should have been a boy. Except that she's better than most of them." Joan was trimming a bore for a 6-inch anti-aircraft gun to a tolerance of .001. She said she had always loved machines, but never had had a chance to get her hands on anything like *this* before.

Women physicists and engineers in the Acoustics and Special Problems Division of the Naval Ordnance Laboratory at the Washington Navy Yard have come about as close as any women to going to sea with the Navy.

They've worked on ships tied at docks. They have also gone with officers and men on field

U. S. Navy, Official

No Time to Prink in the Mirrorlike Tail Assembly of a Liberator

About a third of the country's aircraft workers are women. Many jobs they do as well as men; some they do better (page 193). Riveting, a kind of needle point in metals, is one of women's standout operations.

assignments to Key West, New London, and Miami. They've knocked down many precedents, and their male co-workers have discovered an important thing—they get through red tape faster.

One yard officer almost let a girl go to sea to take recordings, but the ship's skipper wouldn't break precedent.

At Narragansett Bay two girls worked on the water front in a trailer laboratory, but for their offshore tests the Army had to take them to sea in Coast Artillery boats. At the Key West Sound School, Navy men would go out by day to make sea tests, and the girl physicist they took down from the Washington research group would wait and work with them over analyses at the base by night.

You Wash My Shirt, I'll Iron Yours

When they first reported to different naval stations for scientific research, listed, the way the Navy does, as A. Axon or G. Irish, women were usually met with astonishment. It was a crisis of accommodations unless there were WAVES * aboard. At one base A. Axon finally agreed to iron an officer's shirts if he would wash hers in the all-male laundry room.

* See "Women in Uniform," by La Verne Bradley in the NATIONAL GEOGRAPHIC MAGAZINE, October, 1943.

Women working in high explosives is not new, but it is still an electrifying thing to watch. At the Bellevue Naval Magazine, a healthy distance downriver from the Navy Yard, we found women in steel-barricaded rooms measuring and loading pom-pom mix, lead azide, TNT, tetryl, and fulminate of mercury.

Most of them were colored. They seemed delightfully blasé as they passed the stuff along. Some would wink or give a big grin as we poked in their booths. But they treat powder with respect. They know by training that any snip of it could blow them to flinders.

I asked the officer if their temperament—their lack of nerves, say—had anything to do with their being here in such numbers.

"No," he said, "they like that extra six cents an hour hazard pay. This is one of the few jobs in industry which has a waiting list of applications."

Different loading operations were strung along different weirdly grouped assembly lines. On one line they would be loading tetryl leadins for bomb fuses, or delay elements containing small cells of black powder, or mercury fulminate and lead azide for detonators.

In small steel booths others would receive an element through a hole in the wall, put in the measured milligrams of powder and pass it quietly through an opposite hole to the next booth for another cautious twist, or tap, or turn.

The workers are frisked every morning for matches. During smoking periods they walk way off from danger areas to where electric cigarette lighters are provided in safety zones.

The *Iowa* and women were launched the same day at the Brooklyn Navy Yard, when the first 19 came in as "mechanic learners." There are several thousand now, and many are rated machine operators, skilled welders, shipfitters, and supervisors.

One of the first 19 heads them all today. She took us through mold loft, fabricating sections, and shipfitting departments with the air of an old hand.

"It's really simple to build a ship," she explained. "You get your plan, cut out your pattern, prefabricate it, fit it together, and launch it. Men have always made such a job of it!"

She knew what each yellow streak on the big steel sheets indicated, where they would go, how they should be fitted. She explained air hammers, calking tools, and electrodes; how they burned out holes for pipes, cables, hatches; how they chipped off excess stock from steel plates, welded seams, flushed rivets.

Beginning in the mold loft, she had climbed around on hands and knees, working over blueprints, laying out templates, tracing patterns along body plans on the floor; then on through riveting, welding, shipfitting.

They used mostly college girls in the mold loft at first, until they found that almost any average girl has aptitude for pattern making. They're all over the place now, bending over plotting tables, crawling over loft decks, moving about in similar clothes like blue beetles.

In the great shipfitting department we walked in a world of giants. Everything was big—noise, and space, and parts of ships.

Blue oxygen flashes would light up remote corners to outline human figures bent like small parentheses around huge steel plates; or golden sparks would suddenly sheer out from a chipper's gun; or sprays of silvery molten metal would touch off another dark section until you could feel the very depth and height of it.

Stooped over acetylene torches or hidden behind steel helmets visored to protect them from the intense light of arcs, women in bulky leather pants and jackets labored feverishly over welds and seams.

A Variety of Army Jobs

Women are doing men's jobs for the Army, too.

For the Air Forces they teach cadets to fly, dispatch bombers and fighters at busy air bases, repair planes, and do sheet-metal work.

For the Army Service Forces, which alone employs more civilian industrial labor than any economic empire in the country, they manufacture explosives, load bombs, test parachutes, inspect war plants, and handle giant tooling machines, cranes, tractors, furnaces, compressors.

They mend shoes and tanks. They drive convoy trucks for the Signal Corps and locomotives for the Ordnance Department; they make uniforms for the Quartermaster Corps, and count fish for the Army Engineers.

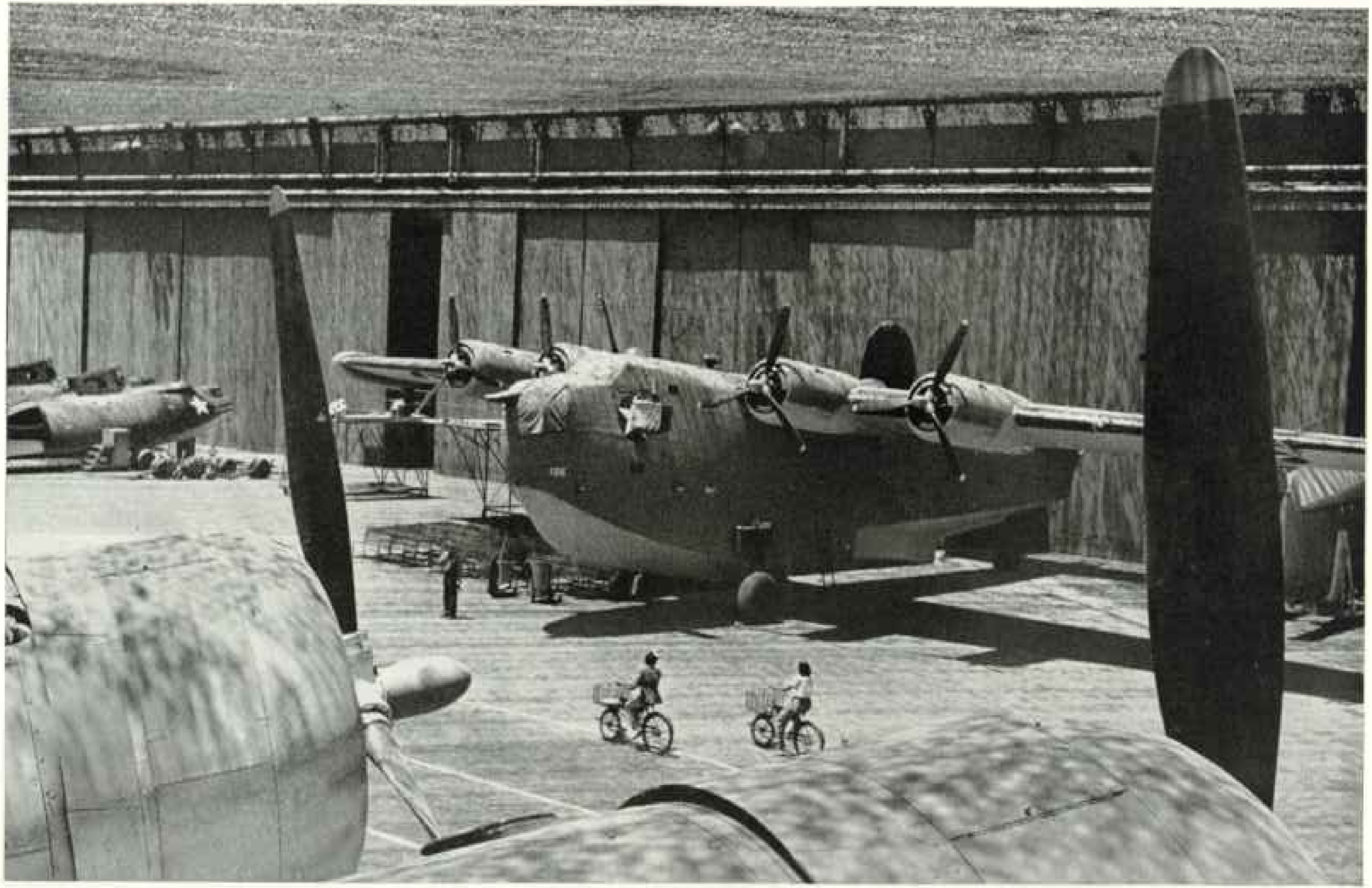
They are laborers, machinists, electricians, tinsmiths, pipe fitters, architects, chemists, surveyors, attorneys.

As the Army Engineers moved into combat work, thousands of women poured in to help with the jobs left behind—river and harbor work, navigation and flood control, surveying, designing, building—jobs formerly done only by Army engineers or their civilian male assistants. Today 29 percent of the 84,000 civilians behind the Army Engineers are women.

They have measured the depth of the Columbia River for charting and dredging; they operate radios to Mississippi River boats.

Soon These Barrage Balloons Will Float Above Invasion Fleets to Foil Enemy Air Attack

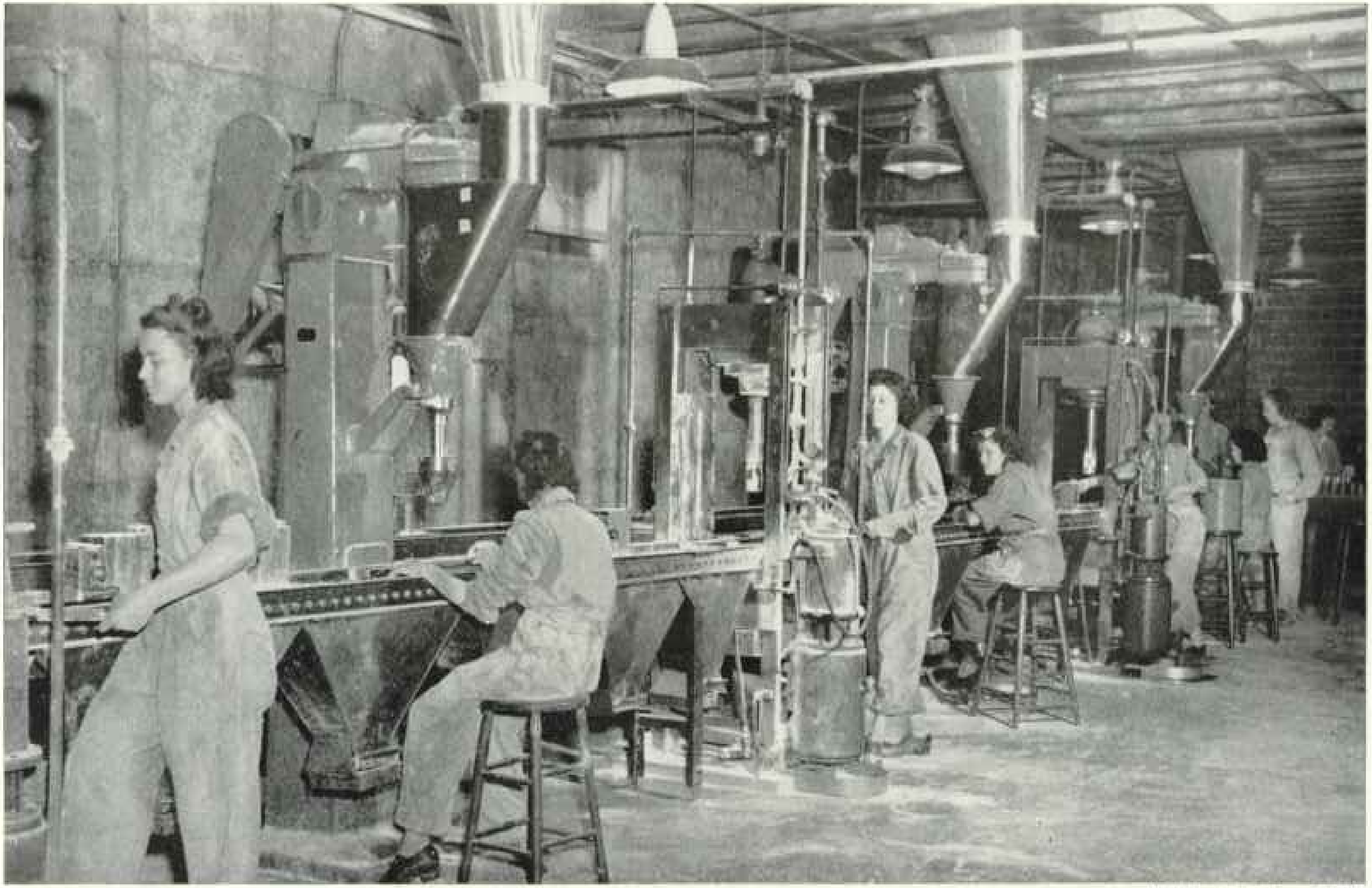
The new-type shipdeck barrage balloon is effective against dive bombers, yet a small crew can operate them. Here girls on the floor are cementing seams and checking for blisters. The six small bags are being test-inflated for leaks, as is the larger one in the background. These balloons can be flown with or without tails, depending upon the flight action desired. They give air protection for ships, beachheads, factories, and cities.



U. S. Navy, Official

War Birds Flock Together Under a Chicken-feather Camouflage Net at Consolidated Vultee's San Diego Plant

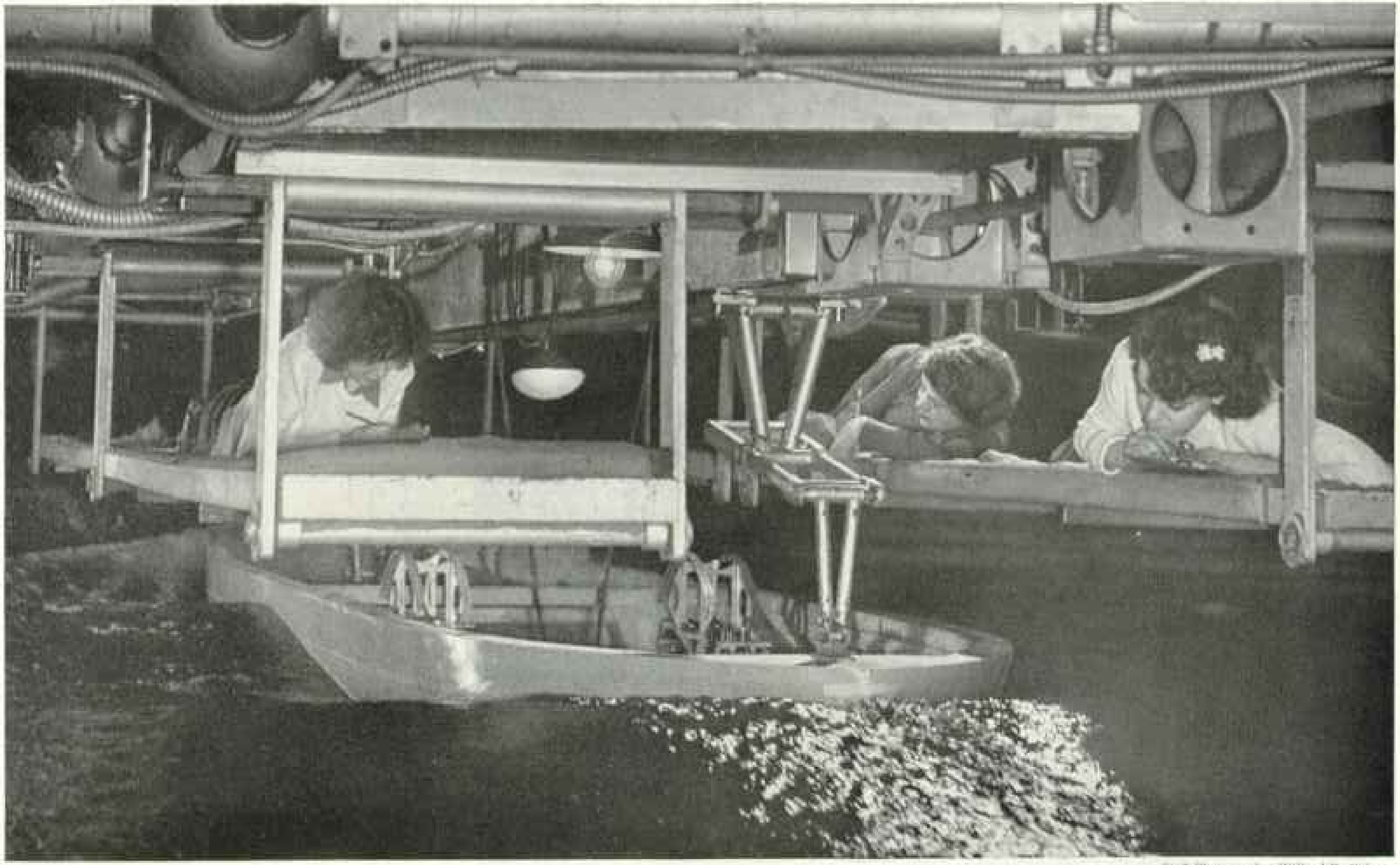
Girl messengers bicycle through the huge plant. The 33-ton Coronado patrol bomber will soon make transoceanic flights for the Navy. Speckled effect is from the camouflage net overhead. Varicolored feathers disguise the plant, making it look like the countryside, with houses and roads.



U. S. Army Service Forces, Official

Southern Belles Man an Assembly Line Turning Out Smoke Screen Powder for Artillery Shells—Huntsville, Alabama, Arsenal

Barrages of these shells hide tank movements and landing operations from the enemy. When the shells explode, moisture in the air turns the chemical into billowing smoke.



Staff Photographer Willard R. Culver

Boys Used to Play with Toy Boats; Now Girls Scientifically Test Warship Models

Here a miniature Maritime Commission tanker runs through the 965-foot-long David Taylor Model Basin, near the Nation's Capital, as girls jot down readings from automatic recorders. The picture, taken from a boat towed behind the testing carriage, shows the stern of the model. Efficient, fast hulls of the Navy's newest battleships were designed from scale models tested in this basin at Carderock, Maryland. Seen in a dry dock, bows of modern ships are hourglass-shaped—bulbous at the bottom, fine or sharp at the water line, and flared out above (page 196).

U. S. Maritime Commission, Official

For Women Sealers, Tin Hats, Respirators, and Coveralls Are Stylish

Here sealers go below decks to scrape rust from the interior plates of a Liberty ship at Sausalito, California. Respirators are needed to cleanse the dust-laden air before it is inhaled. In 1939, only 36 women were employed in American shipyards; today, more than 100,000.

They work with the Army in the field, computing soil erosion, levee seepage, silting; charting evaporation rates and wave action on breakwaters.

They have followed the Engineers almost everywhere except overseas. One girl has driven an Army truck for three years through all kinds of weather to run mail to them in Alaska.

Dr. Mary Engle Pennington, the Quartermaster General's consultant on food handling, has ridden in the caboose of refrigerator trains, in the bottom hold of cargo vessels, and waded knee-deep in eggshells studying improved ways to get food to the Army.

Women of the Transportation Corps handle more than 200 types of Army vehicles at the gigantic shipping pools at ports of embarkation. They check these vehicles mechanically, wash and drain them, pack parts in grease, tape and shellac others against sea spray. And they get the ships in shape to carry them. They weld, clean, paint, carpenter, plumb, and check electric systems.

They help move freight from trains to ships, run trucks down dark narrow passages of warehouses and piers, operate fork lifts to stack and unstack tons of equipment, manipulate big cranes to place tanks and guns in loading position.

Russell C. Aitkin

Pinch-hitting for a Man, a California Miss Shovels Sand in a 43-acre Foundry

The sand she and the men are sifting will mold the sternpost for a merchant ship in a Pittsburg, California, subsidiary of the U. S. Steel Corporation.

On a siding at the Aberdeen Proving Ground in Maryland, we found captured German tanks were lined up with other equipment returned from the front for testing. Yellow turrets and hulls were spattered with names, dates, messages from the boys who reached them first—"Cpl. J. Hanson—Naples—November 2, 1943." Then scrawled across a gun mount—"Why the hell don't you boys come over and pick up your own equipment?"

Aberdeen is the world's largest proving ground. All the fighting tools of the Army, and some for the Navy, are put to test here—bombs, shells, guns, bullets, trucks, tanks, even paints and lubricants.

There is a feel of war about it so thick it penetrates. If you forget it for a minute, a giant gun will boom in the distance, windows will rattle and buildings shake, and you'll feel it through the soles of your shoes. And flares will drop over in the next field from test planes whining high overhead.

A Mirror of Invasion

Equipment is lined up in such massive quantities you begin to think the invasion must have started from this side of the Chesapeake. Which it did.

It's like looking at mirrors in mirrors. Trucks and searchlights, emplacement guns, mobile guns, artillery and antiaircraft guns are telescoped down lines and over ridges as if

Even Grandma Finds Work Suitable to Her Strength and Skill

Here she oils the engines that drive a Cleveland, Ohio, blooming mill, that part of a steel mill where red-hot ingots are rolled into shape (page 213). Larger wheels than these, also kept spinning by women, power blast furnaces. About a third of America's manpower today is womanpower.

they had come out of the ground that way and were ready for harvest. Guns which rake the sky in front of you look like matchsticks at the far end of the line.

Do you know what a 16-inch gun sounds like? Or a 12-inch? Or even a 9-inch? Have you ever had it lift you up on your toes, and smash like a physical blow against your eardrums, and bring all your bones together until they scraped? Here at Aberdeen women work with these guns on the firing line!

And they fire machine guns and carbines and pistols, round after round, until the shells pile up like little brass mountains (pp. 207, 208).

They work with mufflers and heavy mittens in winter, and sweat under the heat of sun and hot metal in summer. They are great brawny women bulging out of tight overalls and youngsters from high school wearing the famous red and white bandannas which mark them as WOWS (Women Ordnance Workers).

One carbine tester is a grandmother. I tried the gun she handled so easily, and an officer had to back up against my shoulder so it wouldn't knock me down. A girl from North Carolina who used to drop squirrels from her front porch is testing tank guns.

We took a jeep over the "world's worst road," built that way for proving mobile equipment. There were mud traps and sand traps, 60° grades and 40° curves, tropical roads and alpine roads, and concrete roads with 6-inch washboard waves.

Aberdeen is called the brains of the Army because Ordnance research deals with some of the finest phases of science and mathematics, and because it proves them all.

In the Aberdeen ballistics laboratory we found scientists from universities and observatories all over America carrying on research in the art of gunfire. Dr. Edwin P. Hubble of Mount Wilson Observatory, whose photography made possible the mapping of 10,000 new universes, is here, among others.

J. Baylor Roberts

One Can Almost Feel the Heat and Hear the Bark of This Aircraft Gun Test

The girl pulls the rope trigger and stands away while a 20-mm. machine gun is given a breakdown test at Aberdeen (Maryland) Proving Ground. Composition wall blocks are sound-absorbent and fire-resistant. Girl fires until gun breaks down or the officer whistles (page 205).

"Astronomy is a twin science to ballistics," said Dr. Hubble. "There is peculiar affinity between the motion of heavenly bodies and the less heavenly path of projectiles. Knowledge of one is directly applicable to the other."

A large percentage of the staff is made up of girl astronomers, physicists, and mathematicians, who work in darkrooms, chemical laboratories, and firing rooms. They photograph the actual trajectory of bullets, compute tables of velocity, work over high-speed radiographic equipment, and analyze performances of both Allied and captured ammunition.

This is no routine testing. One gun may have a book of 86 pages, plus charts. An army couldn't function without it.

In one laboratory a girl was working over spinning shells suspended from balanced mechanisms of some sort.

"Measuring moments of inertia among other things," she explained, and showed the difference between a shell which might ride nose-high or drop nose-heavy and one which would go where it's supposed to go.

Music Amid the Noise

They said women's nerves couldn't stand the noise of the big guns, that their frames wouldn't take it. Women ordnance workers can stand anything.

In the shop at the Frankford Arsenal where casings for gun shells are made, the industrial crescendo of all America seemed to me to reach its peak. It was a different kind of noise from the big guns, but equally shattering. It was steady and penetrating and mixed—the thunder of giant stamping machines, the pounding of drop hammers, the whish of boiling water, and the ringing of bumping metal, all run together like the big, noisy climax of "Götterdämmerung."

"We have music, too," said the major. I couldn't hear it, though passing workers seemed to be whistling to something. After

J. Baylor Roberts

These 90-mm. Shell Assemblers Put the "Power" in Womanpower!

These Aberdeen Proving Ground workers have an average weight of 227 pounds. The shells they make are for test purposes. All fighting tools of the Army are thoroughly tested here (page 205).

picking noises apart, like going through apples, I finally made out the faint strain of a march, and then I noticed an amazing thing. Hands threw levers, loaded conveyers, and whipped from shell to shell in rhythm. It was fantastic.

Women work faster on these jobs than on any I saw anywhere in any industry. It happens to be that kind of work.

Mountains of flat brass disks would dissolve as they were grabbed and rolled under stamps and came out smaller disks; then under another press which stretched them to shell cases, and on through 25 operations in a matter of split seconds.

At the 40-mm. tapering operation, which gives shell cases that indented curve, long belts fed a chain of straight brass cylinders to the big press. Women would snatch them from the belt and slip them under the hammer, then grab them off and set them in moving conveyer cups, all in a single pendulum motion.

Hundreds of women were doing the same thing for different-sized shell cases on different-sized machines. Thousands of hands and fingers seemed to be in constant motion, back and forth, as stamping machines moved ceaselessly up and down, up and down. Soapy steam from scalding tubs filled the air with an eerie mist.

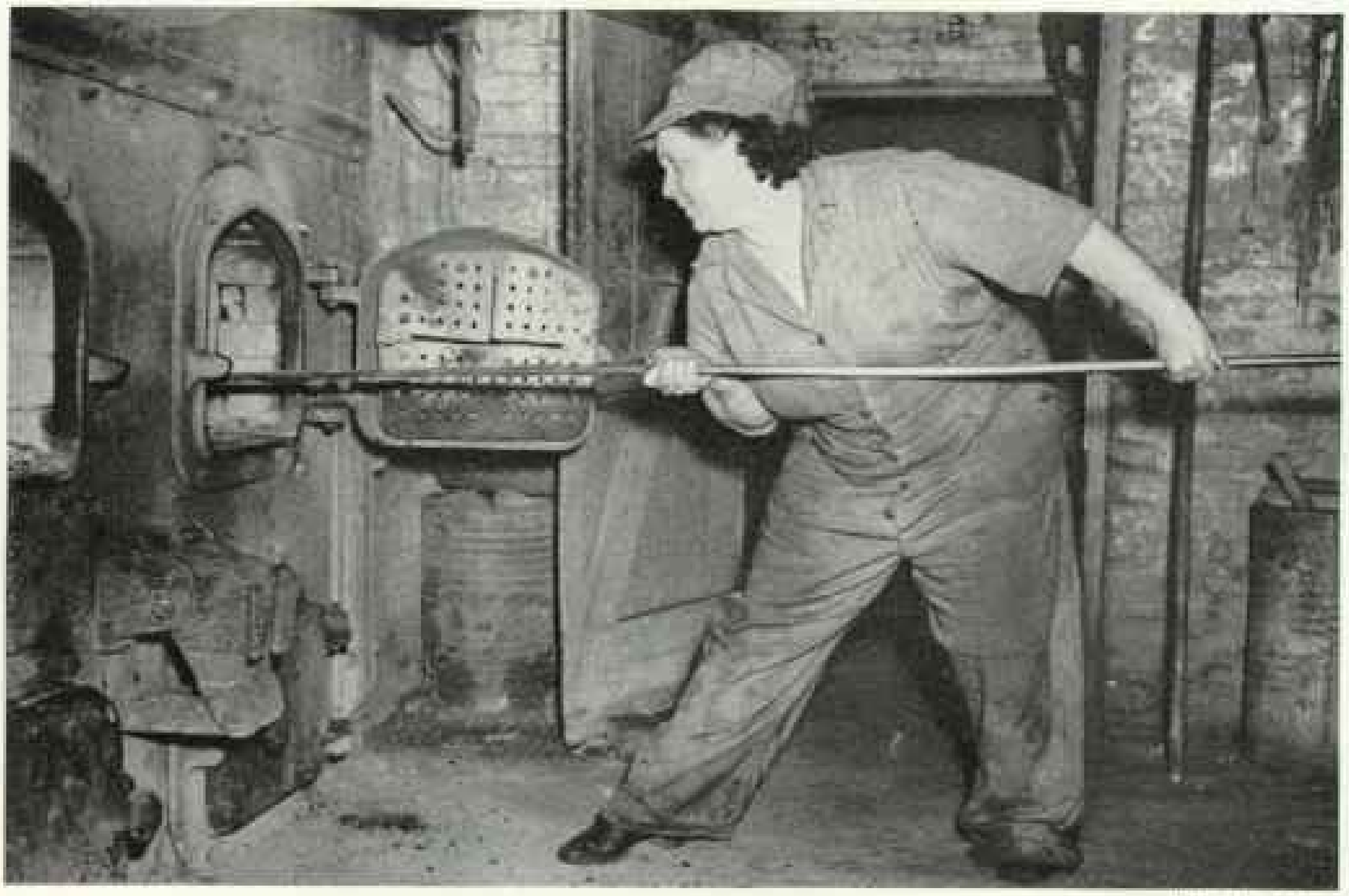
It seemed like pretty rough, hurried work for stuff that should be so infinitely accurate. They told me that a woman worker with a son in the Army had come to them recently with the same question. She had a shell case in her hand that had been dented somehow. They took her carefully through each department, past correcting machines, testing gages, and final inspections until she could return to her job with confidence.

Men said there were jobs that our women wouldn't do—hot, heavy, unglamorous jobs in steel mills and oil refineries and on railroads. They are in all of them today.

We saw women laying out sheet metal in a broiling summer sun, perspiration rolling down the dirty collars of their shirts. We watched them heaving sand on railroad tracks in temperatures below zero.

We sickened to the smells of chemical laboratories filled with women preparing medicines, anesthetics, explosives. I came away wondering how they could stand hour after hour under the screaming, thundering noise of assembly lines.

Hundreds of thousands of war-working women have taken their families to new homes, thrown up feverishly near aircraft plants, shipyards, arsenals, mills, and mines. Nurs-



International News

To This War Mother, Firing a Boiler Is "Easy and Not Tiring"

Members of the "weaker sex" usually take war jobs because they have a man—son, husband, or sweetheart—in the service. This stoker in Hyde Park, Massachusetts, kept her hard work a secret from her husband, also a war worker. Her son is in the Navy.

eries have had to be built for their children.

Employers have added work incentives and securities of ingenious description—counselors, nurses, gymnasiums, clubs, uniforms, rest periods, hot food, music. Some factories have become worlds of their own with "night finals" published by the plant for every shift.

This isn't always the case, of course, even in war. The sister of a famous author, working for a big company in New England, said, "It's still a long run on a cold day to the women's annex, tacked onto an all-male plant."

Flagpole Painters and Junk Sorters

In Kansas City a woman paints flagpoles; New Orleans has a couple of women trash collectors; Lawrence, Massachusetts, three junk sorters. And an appeal has been made to the women of Chicago "weighing more than 200 pounds who enjoy outdoor work and have no objection to the aroma of garbage."

Women in slaughterhouses are brain pickers, belly graders, stomach scrubbers, sweetbread pullers, and vein pumpers. They also have a spice girl.

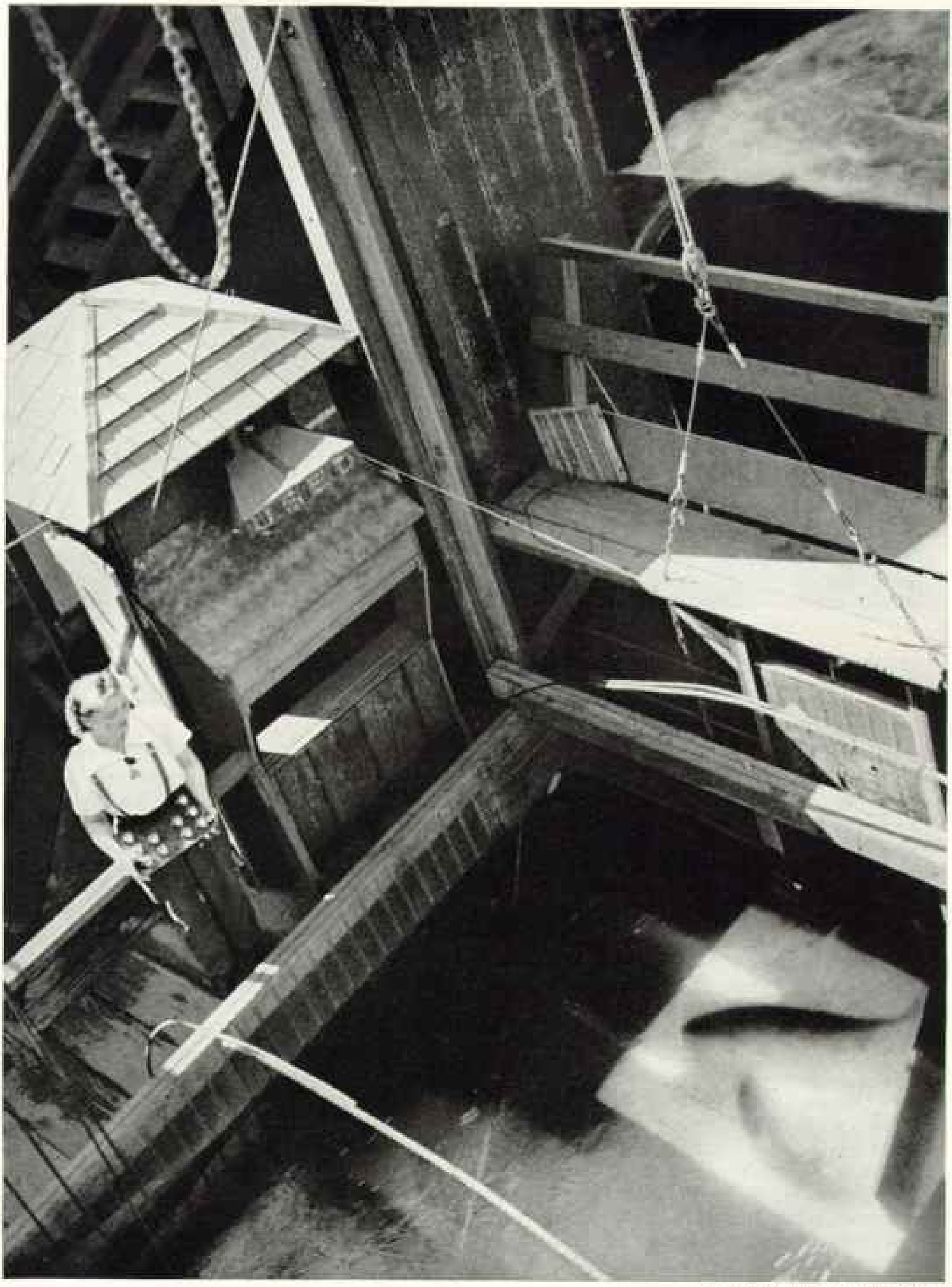
You've seen women cabbies, bus drivers, trolley motormen, and messengers. You've landed at airports and watched them load baggage, call flights, control traffic. In Denver a girl in the glass tower sometimes directs a plane a minute on the runways while monitoring four radio circuits, a battery of telephones, and the public-address system.

They are also milkmen, postmen, firemen, street cleaners, and traffic cops. Ten policewomen patrol the Boston Common and sections of that city's entertainment areas.

Thousands of newly trained women are keeping telephone lines open, working through the night, making quick decisions which may affect the heart of a home or a big war contract. It takes 12,000 calls to build one bomber, 87,000 to build a submarine.

These aren't the glamour jobs—but they're collateral to victory. As I write there is still a bus parked on a downtown street in San Diego with the grim sign: "Just one of many—idle for lack of drivers." And people crowd and struggle to reach the busy Navy docks and aircraft factories.

Into war plants and research laboratories have poured women geologists; physicists; meteorologists; aeronautical, radio, and electrical engineers. Women scientists are studying and experimenting with the headline materials of the age—cures for strange diseases,



U. S. Army Corps of Engineers, Official

Girl Census Taker Tallies Two Salmon as They Swim through the Bonneville Fishway

The white deck silhouettes the fish as they reach the top rung of the fish ladder around the dam. Successive pools, each higher than the last, form a water stairway for Columbia River salmon on their spawning runs upstream. As many as 100,000 fish a day are counted. The girl can identify 25 species.

Watervliet Arsenal, Official

Repairing a Scout Car—One of the Many Necessary but Unglamorous War Jobs

At the Watervliet Arsenal, near Troy, New York, one woman mechanic has spread a tarpaulin over the fender to protect it from grease. Most arsenals come under the jurisdiction of the Ordnance Department.

synthetic rubber, experimental lubricants, radar. Many are actively famous; others have brought their talents and learning out of retirement to apply them to war research.

At the University of Rochester, Dr. Frieda Robscheit-Robbins, who assisted in the research which led to the Nobel prize-winning discovery of treatment for pernicious anemia, has dropped her peacetime studies to work on a substitute for blood plasma.

In Plastics and Electronics

Women chemists, swathed in gauze masks, run tests in plastics and resins in the laboratories of the vast Monsanto Chemical empire. They have entered a no woman's land here in one of the biggest chemical companies in the world. The Hercules Powder Company has women Ph.D.'s experimenting with explosives.

At the Mellon Institute of Industrial Research, in Pittsburgh, the staff of women chemists has jumped 500 percent since 1941. The first woman to receive an engineering degree from Carnegie Tech is a metallographist for Westinghouse Electric & Manufacturing Company. Another Westinghouse engineer is a girl of 26 who is working in electronics research. She read her first paper last year before the American Institute of Electrical Engineers—"Skin Effect in Bimetallic Conductors."

Westinghouse is a conspicuous case of the need for skilled technicians, particularly in the field of radio and electricity, which has lost thousands of men to the Army Signal Corps. It is training dozens of women electrical engineers at Carnegie Tech.

RCA has sponsored 70 women engineering aides through Purdue to supplement its staff of graduate women radio engineers already working in vital international communications. Aircraft plants, shipyards, tooling industries—they've all set up schools for training women to replace skilled men.

In less than four years the Government alone has trained more than 2,000,000 women for war jobs. Working within industry, in schools, and on farms, it has taught them to build, design, analyze, plow. At the 200 colleges operating under the War Training program, 235,000 women have been trained for technical or professional jobs in war industries.

In the two years ending December, 1943, the

Mrs. H. J. Webb, an Electrical Engineer, Exemplifies America's Growing Group of Women Technicians

Only 26 years old, she helped write a paper on electric power transmission and is now doing vital research on war-needed electronic tubes. Here she works out a problem at Westinghouse's Pittsburgh, Pennsylvania, laboratories. Electricity has been her hobby since she became a "ham" radio operator at 13. Her husband is also an electrical engineer.

Army trained almost 500,000 civilian women for jobs with the industrial, maintenance, service and supply units of the fighting forces.

At war's end, the country will emerge with a vast pool of skilled, semiskilled, and professional women.

Now, More Women Needed

But this is the year of invasion!

Five million more women have gone to work since 1940. Almost 11,000,000 men are now in uniform and the number is increasing every month.

In certain areas, industry and civil life still need thousands more men and women, which means women, *apart* from those agriculture wants during the berry-picking, corn-husking, harvesting seasons!

War production is scheduled to reach its peak this year. Cutbacks in ammunition, small arms, and antiaircraft guns will be offset by such top-urgency articles as landing craft, trucks, radar, communications equipment.*

* See "Landing Craft for Invasion," by Melville Bell Grosvenor, National Geographic Magazine, July, 1944.

Aircraft production has hit a mighty stride. The big B-29's have gone into mass production. Plane output reached more than 9,100 in one recent month. But it took 1,000 people working 48 hours a week for a year to replace the bombers lost at Schweinfurt! And one Army division used up all its guns in one month in Italy!

In some areas they've launched a home-to-home canvass to tap the remaining available housewives of the community.

An Industry of "Spaces and Structures"

In the roaring infernos of the country's steel mills, I found hundreds of housewives, even mothers and grandmothers.

Steel is big. It's powerful. It's exacting. If you made cake the way they make steel, you'd count the grains. And you'd make it in a huge hall. You'd make it with ovens open and flames roaring and you'd have to stay right by it to test it every three seconds.

The steel industry is a thing of great spaces and structures—heat, and brilliant flashes of light, and noise. You get the impression of much plant, much equipment, few people. There is no look of an assembly line. Jobs are studied and have a place way off in this corner or that. Then they meet and mix and you have steel.

There was a man in the giant crane overhead. Another walking toward the furnace to help direct the crane ladle. A few others here or there watching.

"Do women handle those cranes?"

"They handle some like them, but not those. Watch it."

The big ladle of molten iron was swinging toward the mouth of an open-hearth, for pouring. "Women don't pour molten metal. Most of those men have been steelworkers all their lives. They are older, and highly skilled. It takes years of training and experience."

Below him a small cluster of people were working hard over a furnace. Women? We couldn't tell. We couldn't tell at six feet. They dress like men, and hair is pushed under caps; and, as with shipyard welders, clothes give no shape. "They're women," said the foreman. "They do most of that work now."

The women were dragging out the old burned-up bricks from the insides of the furnaces. Each of these interiors has to be torn down and rebuilt periodically. These women handled fire, bricks, mixing mortar, and masons' tools; and it was dirty work.

Near the thundering blast furnaces women were preparing the sand-lined runners which deliver the molten iron to ladles. In the adjacent building they were oiling the giant compressors, and the Gargantuan wheels spun between ceiling and floor and made them look like dolls.

In laboratories they were making chemical analyses and metallurgical tests, and out in the mill they were reading temperatures and testing samples of hot metal. Everywhere they were working with steel—mixing, testing, manipulating controls. They seemed ridiculously dwarfed by the size of the equipment and the work.

We found a handsome, middle-aged woman in one of the control pulpits perched up over the big soaking pits. Pulpits are the small booths filled with levers which control the movements of giant mill machinery. She had a cigarette in one hand and was using the other to shove a lever.

Split-second Control

"Watch," said someone, pointing down below to the hot pits. As she moved a lever, a big pit cover would slide back and giant tongs would swing in to drop a big steel ingot into the pit for heating or would remove it red-hot for rolling. By signals, she worked in split-second coordination with the craneman handling the ingots.

These are giant things. They weigh tons. When they go swinging through the air, blazing-hot like this, they are terrifying. They move with a rush of heat and a pained, quivering noise.

In the blooming mills they are raced over rollers in enormous hot chunks and pummeled and mashed and pushed and shoved on to be pummeled and mashed again. Walls come together with terrific force, and animals run up and down your spine as you imagine what it would be like to drop some small thing like a human in those works.

As a red-hot billet came off a line, it was raced toward new rollers and slides controlled by the hands of another woman.

This one had to catch the hot block as it landed on a steel brace almost at her feet. Throwing a lever at the exact moment of contact would send it along a new roller on a 90° path to her right.

One after another the blazing blocks of steel would hurtle toward us.

"How did you happen to take a job like this?" I asked, keeping one eye on those hot rectangles of horror.

"It was my husband's job. I knew the terms."

"Had you ever done it before?"

"No." She laughed. "I had never worked at anything. Except at being a housewife."

"How do you like it?"

New York Sun, Vincent Lopez

This Train "Man" Wears a Hat Created by Bonwit Teller, Inc.

After 10 days' schooling, she became one of the first women to take over the duties of trainman, a grade below conductor. She collects tickets, opens and closes outside doors, and knows how to operate airbrakes. There are few vacancies for women in this job as the men usually are over draft age.

"I'd rather be a housewife. And the sooner the better!"

In strip mills steel is rolled into sheets like pie crust and into special shapes. In the strip mill at the Republic Steel Corporation's plant in Cleveland, women were handling cranes to stack the big steel plates rolling off the line for ships. Women were crating one big shipment for Russia.

Women Work on Every Bendix Item

One woman in dirty old coveralls sweeping the floor was a grandmother. Mrs. Varkony, from Hungary. For two years she cleaned a bank building. This was better.

Do you remember the Bendix Aviation Corporation advertisement that appeared not so long ago showing a huge bomber covered with tiny white stars, indicating the equipment manufactured by the company?

We checked and found that women's hands had helped build every item marked—and thousands more.

At the Bendix Eclipse-Pioneer plants in New Jersey women were in the foundry, machine shop, assembly rooms, and research labs, working on everything from the casting of engine housings to the assembly of the tiniest gimmicks in precision flight instruments.

This was one of those fabulous places where

women seemed to make up a cross section of the whole feminine war effort.

Any of these plants is a story in itself. It's a city in itself. It becomes almost the whole life for the people who work in it. It builds most of their friendships, influences their home life, makes their existence revolve around those hours spent at work.

A few, particularly among the "duration crowd," put in their time and then chuck the whole plant atmosphere when they leave, considering they've done their job—which they have. But this isn't the usual case.

Nearly every girl we talked to in these city-like factories reflected the influence of the shop surroundings. It's one of the reasons many of the plants have developed new streamlined methods of securing and *hanging on* to labor.

Adventures in Morale

Some plants play music between shifts, music during work; they have organized riding or ball clubs, even glee clubs.

By departments and by shifts, workers are brought together until usually there gets to be an old-school-tie urge to outperform and outproduce the other team. And the types which get pooled into these groups are amazing. College graduates, salesgirls, society women, waitresses, beauticians, all finding a common bond in their daily tasks.

The Bendix foundries are the last word in modernized technique, with automatic air and temperature controls, together with a maze of conveyer systems to expedite handling of materials. On one side women were making cores much like mud pies—tapping, patting, shaping the soft white sand into precise forms which are then baked for magnesium and aluminum castings (page 196).

On the other side, and in comparatively heavy clothes, women of all sizes were burring, cleaning, and snagging—which means finishing up the castings—working with saws, grinding wheels and files.

Add all of this to the scream of band saws biting off chunks of excess metal and the clang of automatic vibrators jiggling the castings to rid them of sand; the rattle of tumblers bouncing around the small metal chills to knock off bits of scrap and the roar of a dozen or so oil-burning crucibles melting ingots of metal.

Up on the balcony three women, one per shift, work around the clock, continually checking the automatic recording and control instruments which operate the giant ovens. The heat control of every casting is timed to a minute—much like a recipe—apply more heat, gradually reduce temperature, let set, and presto, it is finished.

Ethel, of the Machine Shop

We moved from one noise to another.

Ethel, in the machine shop, was about five feet tall and a former model. Operating a turret lathe, each time she would start a new operation she would rock up and down on her tiptoes to peek into the whirling part she was machining. Then she would release a lever, make another turret swing, peel off another thousandth of an inch, and rock again.

All the while she kept up a patter about her job and seemed to handle the mechanical animal in front of her much the way Frank Buck handles tigers.

I asked her how she happened to get into this work. She said, "Oh, I don't know. I guess I just like working with my hands—crocheting, operating a turret lathe—that sort of thing."

Girls in pink sweaters with bows in their hair were bent over grinding, gear-cutting, and burring machines. Milky fluids poured over the cutting parts to keep them cool, and big pans caught the grease and oil as it sprayed out from fast-moving parts. But the women stayed clean.

Women don't wear pink sweaters on all machine jobs. Mostly they are dressed to safety standards.

They have come to know the difference between jigs and fixtures, taps and drills, sprues and risers. They tell you they work on a "J & L" or a "W & S," and that means a kind of machine, and *anybody* knows which kind.

In the experimental laboratories at Bendix, women physicists and mechanical and electrical engineers were absorbed in research on innumerable types of aircraft instruments and other automatic controls.

Suction and pressure gauges, sextants, compasses, de-icer controls, air and hydraulic pumps—women belong in this type of work. They are whizzes at winding coils, putting tiny gears in place, twisting delicate wires, following intricate patterns.

I found a dancer assembling gyros for drift-meters, a waitress inspecting tiny parts for precision instruments, a typist assembling wee pieces in an altimeter, and hundreds of others—housewives, beauticians, milliners, debutantes. Their small agile hands play rings around men in assembling tiny intricate mechanisms which make up most of the Bendix products built at this plant.

It takes six miles of wire for the electrical system of one Flying Fortress (page 194). Men used to install the wiring after the plane

Office of Defense Transportation, Official

As They Clean They Sing, "Children, I've Got Heaven on My Mind"

This job is not new for women, but they now represent nearly half of all railroad-coach cleaners. Cars are cleaned at the end of every run. By January 1, 1944, railroads had lost 227,531 employees to the armed forces, yet total personnel increased by twice that number (page 220).

had been assembled. Now a subassembly system breaks the installation into 26 units, and women do 75 percent of the work.

Western Electric has 43,000 women turning out tank and artillery radios, gun directors, aircraft instruments, microphones, teletypes.

At the Government-built Sperry Gyroscope Co. plant out on Long Island, nearly 50 percent of the production workers on compasses, bomb sights, gun sights, automatic pilots, and Klystrons are women. They could use 75 percent.

We wandered through one of the big assembly shops here, stopping every so often to watch women's fingers nimbly forming multicolored, spaghettilike rolls of wire into compact designs on cabling boards, or fitting small condensers, relays, and terminal strips into neat little patterns. They didn't always know why things went one way instead of another, but they seldom made a mistake.

In the engineering division women calibrationists were working the bugs out of many of the famous Sperry navigation instruments. In some ways, they are better than men at this. They have more patience and are more critical of imperfection.

Rosebud Yellow Robe

One of the girls was Rosebud Yellow Robe, the great-grandniece of Sitting Bull. She is a graduate musician.

Sperry has one of the greatest arrays of technical talent in America, and it uses women in every capacity. It has even opened its own engineering schools for them. They are skilled spectrometrists, microphotographers, metallographists, physicists. A 29-year-old woman doctor is the medical supervisor of their high-altitude laboratory.

In the engraving rooms of the Bausch & Lomb Optical Co., I watched women trace delicate lines over waxed lenses for gun sights to tolerances of plus or minus two microns.

International News

In a Chicago Freight Repair Yard, Women Pivot a Bad Boxcar Truck

A hard job even for men, they lift one end with a wheel stick and roll the other around it to the desired direction. The truck probably has "shelled" or worn treads and will be replaced. New or repaired trucks are on flatcar in background. Today some 100,000 women are employed by railroads.

Precision sighting on another instrument calls for a tolerance of within one micron—39 millionths of an inch!

There is an aiming circle in production at Eastman Kodak Company which is used with gun batteries to pick up enemy positions; when the information is received, guns are aimed through what is known as a panoramic telescope.

These are highly refined operations and instruments must be flawless. Each gun in a field artillery battery has its own panoramic sight, with one aiming circle for each battery.

Quick Changes in Inventory

At long tables stacked with drab-painted instruments, women were removing minute dust particles by vacuum hose. This is the last touch before final inspection—after other women have built the housings, made the gears and tiny parts, cemented the lenses, aligned the sights, assembled the complete units.

And now the Government has women inspectors here to give each item a final check before it goes to the Army.

Eastman makes 31 types and models of optical instruments for fire control, along with military and naval cameras and such curiosities as steel pontoons used in the construction of bridges, wharves, and dry docks for the Navy. It is an interesting example of the strange changes in inventory which war has brought to thousands of manufacturers and of the quick adaptation of old talents to new jobs.

We took a trip through some of the dim, spectral spooling rooms, just to get an idea of what women always have done in the way of repetitious jobs under strange working conditions. This is where those millions of rolls of film are turned out that you see stacked up in big yellow blocks in drugstores and camera shops all over the world.

It was a weird sort of working life, made to

U. S. Army Signal Corps, Official

Down Such Debarkation Nets Soldiers Swarmed on D Day

At Fort Mason, California, a former power machine operator and a saleswoman put the finishing touches on the mass ladders which are hung over the sides of transports during landing operations. They resemble the cargo nets the Navy has used for years and the "save-all" nets which were spread between sailing ships and piers to catch falling cargo.

feel subterranean by its windowless rooms and long, dark corridors. We felt our way through Stygian passages, pushing back heavy curtains and hearing voices all down the line calling, "Watch out—*watch out*—watch out!" A peculiar hum grew into a chattering roar as we seemed to near the machines.

"See those women over there? The green light means they are rolling panchromatic film. Red, in the next room, means Verichrome."

"Over *where*? *What* green light?"

Then I began to make out rows and rows of women, like ships coming out of mist, in white smocks and dustcaps, swinging their hands back and forth over machines, setting in spools, throwing a gear, taking them out.

I moved up close and watched them in fascination. Spool in, whir, spool out. What do they think about? What do they do after work?

The point is that they can do it—and millions of women can do it. If they couldn't, there wouldn't be enough rolls of film or bomb sights or aiming circles—or any of the other hundreds of thousands of things which take monotonous application to a single routine operation.

Women Take to Tall Trees

In the big lumber camps of the Northwest, women in high boots and checkered shirts have entered the big trees, a new world for women. The trade of the lumberjack was a hallowed one. Men of timber, like men of steel, are proud of their breed. Their jobs take strength. They live close to Nature and they are a manly lot. Their women have rarely reached within earshot of the crash of trees.

A few were flunkies in camp cookhouses, and some worked in the mills tying bundles, checking, marking, cleaning up.

Army Newspictures

Lady Lumberjacks Direct Logs through the Mill Pond with Peaveys and a Pike Pole

Five big trees must come down to provide building lumber and crating for every man in the service. These New Hampshire women, whose boy friends are in the armed forces, are helping supply the timber. This mill, near Concord, is operated entirely by women—a model of the gradual female encroachment in this hitherto 100-percent-male industry.

Today women are working by the side of the men of timber and in place of those who have gone. They ride logs down rivers, walk flumes, work over rafts in the booming and sorting grounds. They are "swampers," who log off the branches of felled trees with heavy axes—and this is tough work; and "whistle punks," who keep signals straight between men down in gullies or over ridges—and this is important.

They drive the big trucks which haul giant logs from the forests. They stand at the head of the bull chain which feeds logs from pond to mill, and they handle big timber—Douglas fir, Sitka spruce, ponderosa pine.

It takes fast action along the chain. Men bet they couldn't do it. They were nervous, and the women were nervous. Collisions between logs and head saws can be serious; setters, scalers, and "head doggers" who work along the line have to be strong to handle the peaveys and nimble to keep their feet free from the moving chains. Trimmermen have to think fast to work the right saws as the lumber goes by.

Women Handle Night Shifts Alone

Women handle the night shifts alone on these jobs now.

Timber is war-critical. For every man in service five big trees must come down to barrack him, furnish and crate his equipment, and get it to him.

Women are getting it to him. In southern mills they feed lumber to screeching ripsaws and band saws, butting saws and resaws; they stack, rack, stencil, load, and truck. Up in Concord, New Hampshire, one mill is staffed by women only.

On the windy peaks of the White Mountains, women "man" the Federal lookout stations for the first time. In western timberlands women

forest rangers in lonely outposts drive pack trains, cut trails, tote guns, and keep an alert for sabotage. Like almost all of the major industries which are using women for the first time, it's the women of the men the industry loses who go into it first. Usually they know what to expect.

All This, and Railroading, Too!

The very bigness and heaviness and dirtiness of railroading have kept it a man's business in this country. Like timber and steel, it was an industry of studied jobs which took skill, stomach, and usually strength. Men dominated them monastically.

It was one of the last to go over to the use of women in all-male capacities. The industry itself has always had a longer list of jobs which women could *not* do than any other.

One by one, they have entered every sacred precinct of yard and line. Old-timers have watched them with astonishment, sometimes with hostility. They are beginning to lay bets now on how long it will be before "some woman" takes $56 on its big run.

In this case, it will be some time. Locomotive engineers usually work up from firemen, and that's one job women aren't doing.

Grooming and servicing, this is mean work—but women are doing it. A big engine steams into its stall streaked with soot, grease, and smoke. They wipe it down like a lathery, muddy race horse. They put out the fire, remove the ashes, blast off the grease with live steam and chemicals, fill the sand dome, lubricate it, shine it.

Somewhere it has dropped off its grimy cars. Other women get these to clean and polish (page 216).

They pack journal boxes, operate turntables, and check cars, which means keeping track of all those numbers you see on freights (a mistake could raise havoc with a shipment of war goods); they paint, cut scrap, and handle signals and switches from coast to coast.

Those women you've seen along the track with shovels are section hands edging the ballast, burning grass and weeds, checking rails and ties. They grease switches, de-ice them in winter, and some I heard along a Pennsylvania track one January morning had even learned to speak the language.

There are women baggagemen in stations, and brakemen, flashing lanterns as you've seen thousands of men in pin-striped overalls doing all your life. Women trainmen are helping conductors (page 214); women cooks are in galleys where swaying trains and hot stoves have never permitted them before.

It takes all kinds of women to run a war. The women of the railroads are a good index of what literally keeps the wheels rolling. You'll find a tiny slip of a girl selling tickets or calling trains and out in the yards great husky Slavic women operating steam hammers.

You'll run across college-girl draftsmen, women lawyers and doctors, women telegraph operators and young kids at switchboards. You'll be surprised at the small women in tough jobs and big women in desk jobs.

You'll even find housewife drawbridge tenders and crossing flagmen.

They are all Americans, with as many races, creeds, and nationalities as there are jobs. And in this and every industry there are as many reasons for their taking those jobs as there are women.

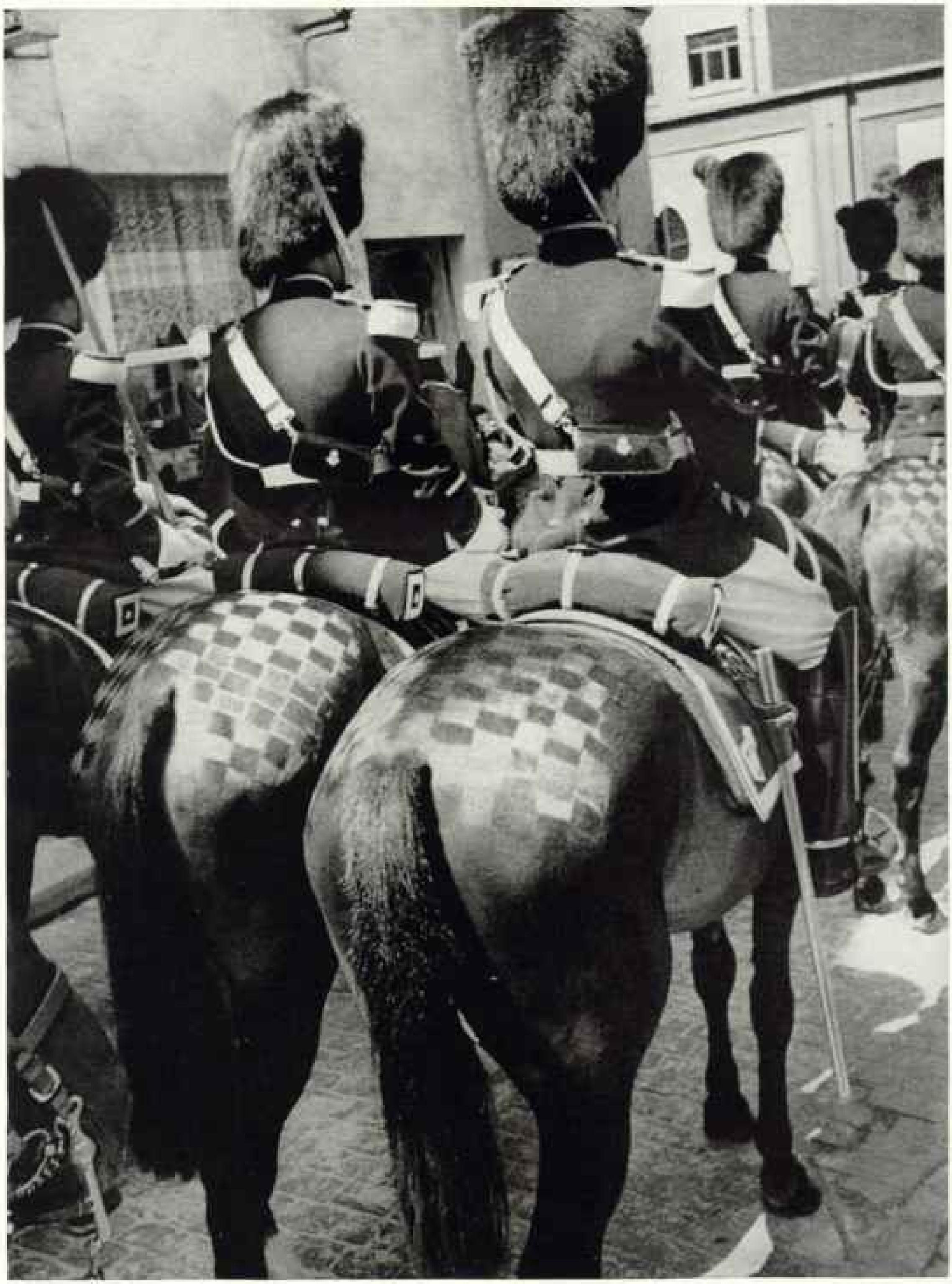
Many have found fields opened to their talents for the first time. Many are there for the money or to follow the crowds.

Many Replace Their Own Men Who Are in the Service

Mainly, however, they are there because there *is* some man in service. They are working to supplement that slim G.I. envelope. And they are fighting to keep the country running, to keep the world supplied, to get their man the stuff he needs so he can get through and get back.

Like the steel which goes from women's hands in this country to the hands of women in the Soviet. It's one movement with one idea. The same steel for men moving from the West and men coming from the East. And women to help get it there.

It all works together. And as the war goes on, the great feel of it and the great interdependence of it gather strength. It's a man's and woman's world.



© C. Anders

When the Netherlands Queen Visited the Belgian King Checkerboard Groups Stole the Show

During this meeting in 1939 the sovereigns of 17,000,000 people in the Low Countries made a final plea for peace. Their answer was the ruthless German attack of May, 1940. The following pictures show incidents in the occupation and the kind of country the Allies must retake. Gendarmes applied the checkerboards with brushes.

Keystone

Will World War II Add Another Monument to Belgium's Sandy, Mole-protected Harbor of Zeebrugge?

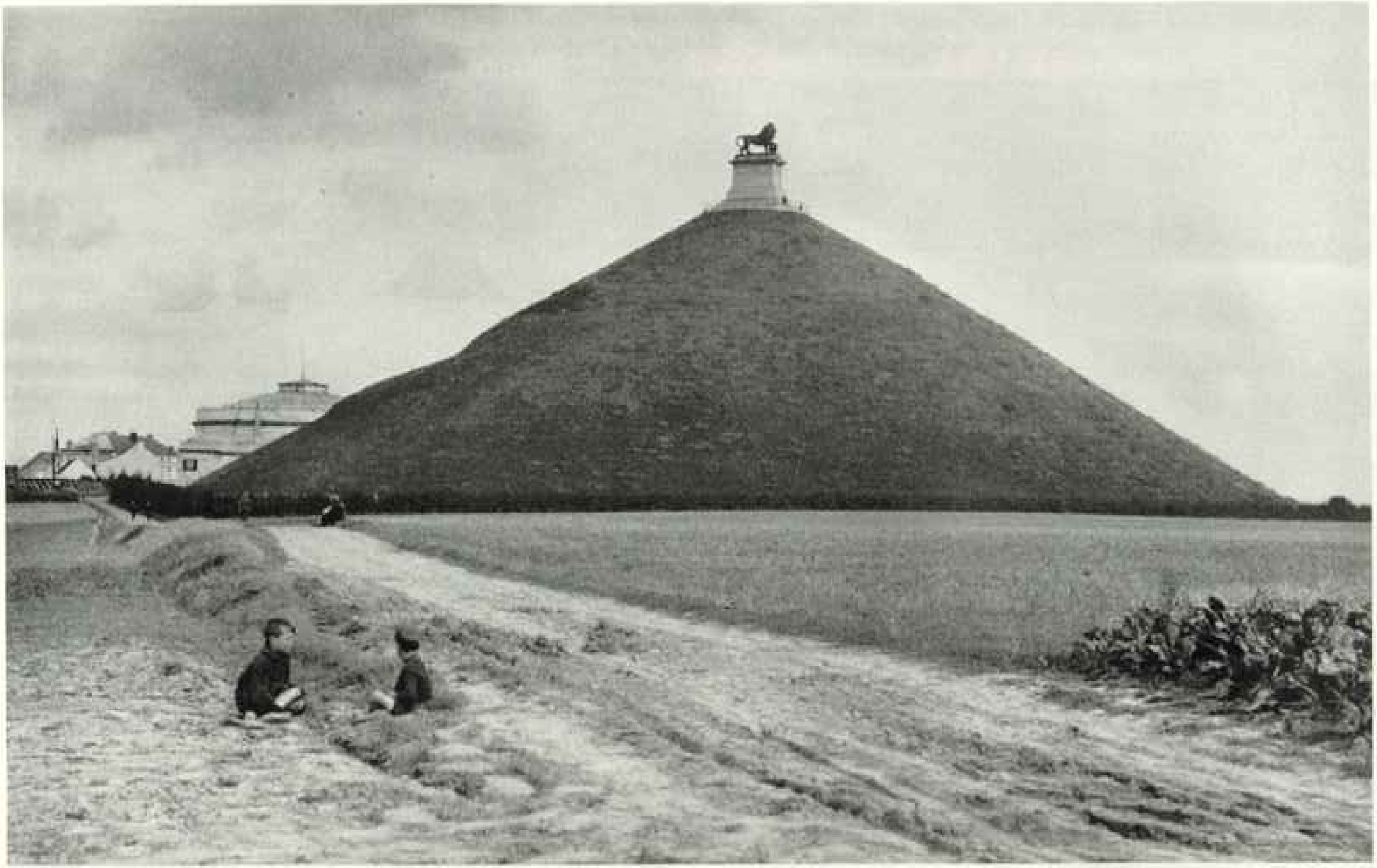
St. George slays the Dragon on the *Vindictive* Monument in tribute to a thrilling British naval victory. On April 23, 1918 (St. George's Day), a landing party from H.M.S. *Vindictive* captured this mole while two obsolete cruisers were sunk in the channel, bottling up German U-boats.

British Combine

Flying in a V for Victory, RAF Blenheims Hedgehop over the Netherlands to Hit German Shipping at Rotterdam

From an Ugly Scar on Belgium's Smiling Face Comes Cement to Build Roads, Seawalls, Fortifications

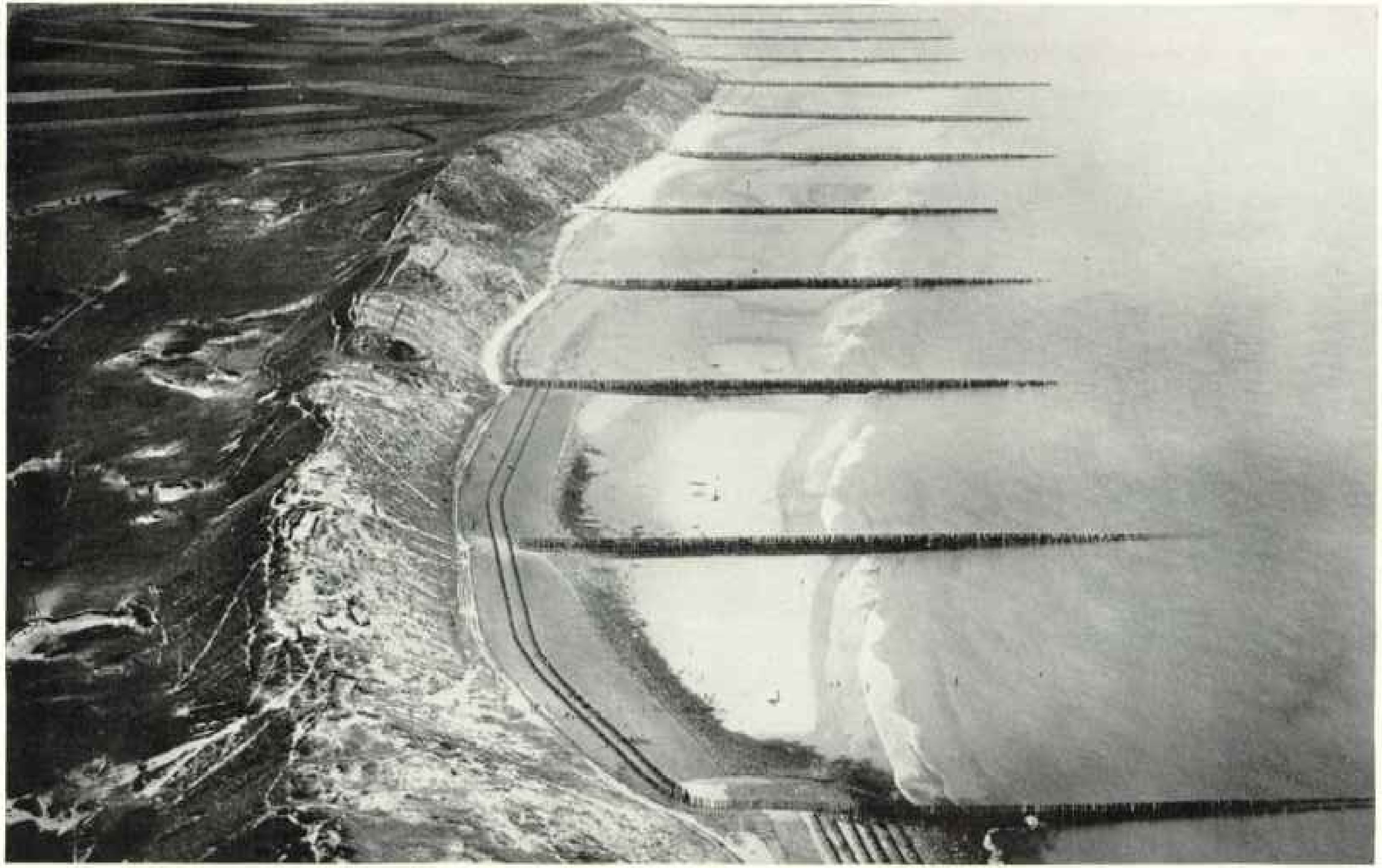
Cement from this combination quarry-factory at Harmignies, southeast of Mons, may have helped build the Nazis' vaunted Atlantic Wall. British and German troops first clashed in 1914 at Mons, near the French border. The city was retaken by the Allies on Armistice Day, 1918. This is the chief coal-mining region of Belgium.



© Donald McLeish

Will Hitler, Like Napoleon, Meet His Waterloo Somewhere in the Low Countries?

Here on the field of Waterloo, nine miles south of Brussels, Napoleon was defeated by the Duke of Wellington's allied army in 1815. The mound, 133 feet high, was raised over the spot where the Prince of Orange was wounded. On top stands the Belgian Lion, cast from the metal of captured French cannon. Belgians and Netherlanders fought together at Waterloo and for 15 years thereafter tried to live together as a nation.



Royal Dutch Air Service

Walcheren Dikes and Jetties Hold Back the Sea, but Landing Craft Could Beach on These Smooth Sands

Jetties might impede the charging craft, yet they would provide cover for debarking troops. A shoal parallels this beach a half mile out. Landing craft would have to time their approach with a tidal rise of 12 to 15 feet. Levelike sand dunes, pushed up by the sea, were anchored by grasses. Where broken by storm, masonry dikes bridge gaps. Walcheren, mostly below sea level, represents victory for the Dutch in the ceaseless fight with the North Sea.

Dover from Black Star

During Lunch Hour, May 14, 1940, the Luftwaffe Leveled This Rotterdam Business Area, Marking the Start of Total Air War

The 15th-century Groote Kerk points a blackened and accusing finger at the sky. Naked streets in foreground seem to pattern a swastika. Crosstown stragglers from habit follow Hoogstraat, once one of Rotterdam's busiest streets. Binnenstad, the area shown, was the old town and port, thick with buildings, bustling with crowds.

E. M. Newman from Wide World

Bicycle Clubs Made the Netherlands One of Europe's Best-marked Countries

Larger sign warns cyclists and motorists of type of cross traffic. The other at right indicates the sidewalk is a cycling track. These paths follow highways and dike tops all over the Netherlands. One-third of the people owned bicycles. The Netherlands Cyclists Association erected the signs and built the bicycle path.

© Dorse from Black Star

Just after the Fall of Liége, Citizens Receive Leaflet Orders from a German Soldier

From their expressions in this early photograph French-speaking Walloons, old enough to remember 1914, do not seem to realize what the occupation has in store for them.

© Anders & Co. for Wide

These Wartime Goodbyes at a Brussels Station Lasted Long; Some Were Final

Their husbands have just entrained for the front. Seventy-five thousand men captured in the 18-day campaign of May, 1940, are still, after four years, prisoners of the Reich. Eight thousand were killed.

Palms and Planes in the New Hebrides

By Maj. Robert D. Heinl, Jr., USMC

MY ACQUAINTANCE with the New Hebrides began without warning in March, 1942, when the ships' loudspeakers announced to our force of Marines that our destination was the island of Efate. All hands made for the nearest chart to consider the strategic aspects of our expedition.

During the spring of 1942, Japanese penetration of the Southwest Pacific was stabbing at American supply lines to Australia. Sweeping southward, enemy forces were attempting to conquer New Guinea. At the same time they were menacing the feeble defenses in Tulagi, still in friendly hands. Only a step to the south lay the New Hebrides.

Athwart the Enemy's Line

Thus the charts revealed our destination to be squarely athwart the enemy's line of advance. In fact, it was the last defensive position between the Japanese and our maritime life line through New Caledonia (map, page 233).

Of the islands toward which we sailed, we, like most of the world, knew virtually nothing. Our charts, while the best available, were based on long-past surveys, and the little they conveyed served only to raise our doubts.

Thus our only advance descriptions were of forbidding terrain, dense jungle, and ferocious islanders. An illustrated magazine on shipboard contained a photograph by a well-known explorer of what was described as a bona-fide cannibal feast in these very islands.

The full military import of our mission was not yet evident, nor would it be until we learned of the impending Solomon Islands offensive. Thinking of ourselves as a stopgap defense force thrown in to arrest the enemy, we had no realization that by our occupation of the New Hebrides we were screening the deployment of much larger forces which would soon be mustered for America's first offensive, a movement not only against the Solomons to the north but against the conquered Philippines and eventually Japan itself.*

As our convoy coasted along the shoreline of Efate after a dawn landfall, we saw land with towering, abrupt mountains, immense upthrust ledges of coral, and dense tropical growth which seemed to dispute the shoreline with long Pacific rollers booming against its reefs.

Overhead, instead of the blue sky of Technicolor, hung heavy clouds, portent of many a downpour to come. To a few old hands the shoreline suggested less hospitable parts of the coast of Panama.

Not a building or work of man was in sight—only dense, dripping jungle. Within an hour, however, as we rounded a conspicuous promontory topped by a half-size sugar-loaf hill, we came upon a harbor entrance guarded by several tiny islands and crowned by a completely unanticipated village on heights to shoreward. It was our first sight of Vila, which was to be our base for many weary months to come (page 255).

When American troops first landed, Vila was a tiny, white-walled, red-roofed town constructed around the twin hubs of the British and Fighting French Residencies—nuclei of the curious dual governmental system, called a "condominium," under which England and France exercise joint sovereignty throughout the New Hebrides (pages 230, 231).

Remote from Trade Routes

Remote as it was from ordinary trade routes, Vila nevertheless boasted a telephone exchange, electric lights, macadamized streets (a defense against bottomless rainy-season mud), and a few principal shops.

Padlocked were the remnants of a Japanese commercial system whose enterprises, shortly before the war, were out of all proportion to the economic rewards in Vila.

Built out over the water stood a tiny club which, with its Chinese attendants, tables covered with green baize, and shuttered verandas, might have been created by Kipling or Maugham. Except for one long main street parallel to the water front, the whole town clung to steep hillsides which rose from the shore to a commanding chain of ridges a half mile back.

To the eyes of our transport-weary Marines the sudden revelation of this tranquil harbor and neat little town was accented by the appearance of the sun and a sky which partly redeemed hopes engendered by Hollywood.

As if we were world-cruise tourists, our ship was soon surrounded by dugout outrigger canoes. They were handled with alarming carelessness by extremely black islanders whose hair, standing inches upright from their heads, was colored in disconcerting shades of red and yellow.

Efate is the chief, but by no means the largest, of a group of 14 principal islands.

* See Map Supplements to the National Geographic Magazine, "Japan and Adjacent Regions of Asia and the Pacific Ocean," April, 1944, and "Pacific Ocean and Bay of Bengal," September, 1943.

U. S. Marine Corps, Official

In Vila American Fighting Men Occupy the Palace of a Little League of Nations

Efate's Island Command hangs its sign on the residence of the retired president of the New Hebrides joint court. A neutral appointed by Spain, he sat as umpire between a British judge and a French judge. Government rests in an Anglo-French Condominium, so complex it is sometimes called "Pandemonium." Two kinds of commissioners, police, stamps, moneys, weights, and measures confuse the Americans (page 231).

These, and numerous smaller ones, stretch for about 550 miles between New Caledonia and the Solomons. Although named the New Hebrides by the redoubtable Captain James Cook during his second expedition, they had been first sighted and partly explored more than a century and a half earlier by Pedro Fernández de Quirós.*

Though a Portuguese, he was a Spanish subject, and this fact explains the odd Hispanic flavor of a number of place names, such as the islands of Espíritu Santo, Verao or Moso, or Havannah Harbor, an almost landlocked bay of great depth on the northwestern shore of Efate.

Like all the other islands, Efate produced sandalwood and large quantities of copra from seemingly endless groves of coconut palms, many as tall as five-story buildings. Avocados, tangerines and other kinds of citrus fruits could be had for the picking, along with any sort of enteric disease, the usual sequel to a meal of raw native fruit.

Wild Pigs Alarm Sentries

Cattle grazed at will under the palms and wild tusked pigs snorted through the jungle, much to the alarm of our sentries and nocturnal patrols. Islanders held their lands in common and lived in communal villages like that on Mele Island, in the bay. There, a half mile offshore by dugout canoe, several hundred

* See, in the National Geographic Magazine, "In the Savage South Seas," by Beatrice Grimshaw, January, 1908; "A Woman's Experiences among Stone Age Solomon Islanders," by Eleanor Schirmer Oliver, December, 1942; "Coconuts and Coral Islands," by H. Ian Hogbin, March, 1934; "War Awakened New Caledonia," by Enzo de Chetelat, July, 1942; "Treasure Islands of Australasia" (New Caledonia, New Guinea, and Fiji), by Douglas L. Oliver, June, 1942; and "Revealing Earth's Mightiest Ocean," by Albert W. Atwood, September, 1945.

All from Press Ass'n, Inc.

To Melanesians Our Smiling Negro Antiaircraft Gunners Were "Savage Indians"

When the Army's colored troops arrived on Santo, a waggish Marine spread the rumor they were fresh from scalping raids. For days New Hebrideans hid out. Later they referred to the soldiers as "American Indians."

blacks had a town of their own beyond range of mainland mosquitoes and flies.

Though somewhat softened by such modern improvements as white men's trade goods and implements, native life in the New Hebrides remained substantially what it had been for centuries. White men, mostly French, had their plantations, and English missionaries had clothed the black women in 19th-century Mother Hubbard dresses; but the islander was still much as he had always been, thanks in some measure to wise governing paternalism.

An Unusual Government

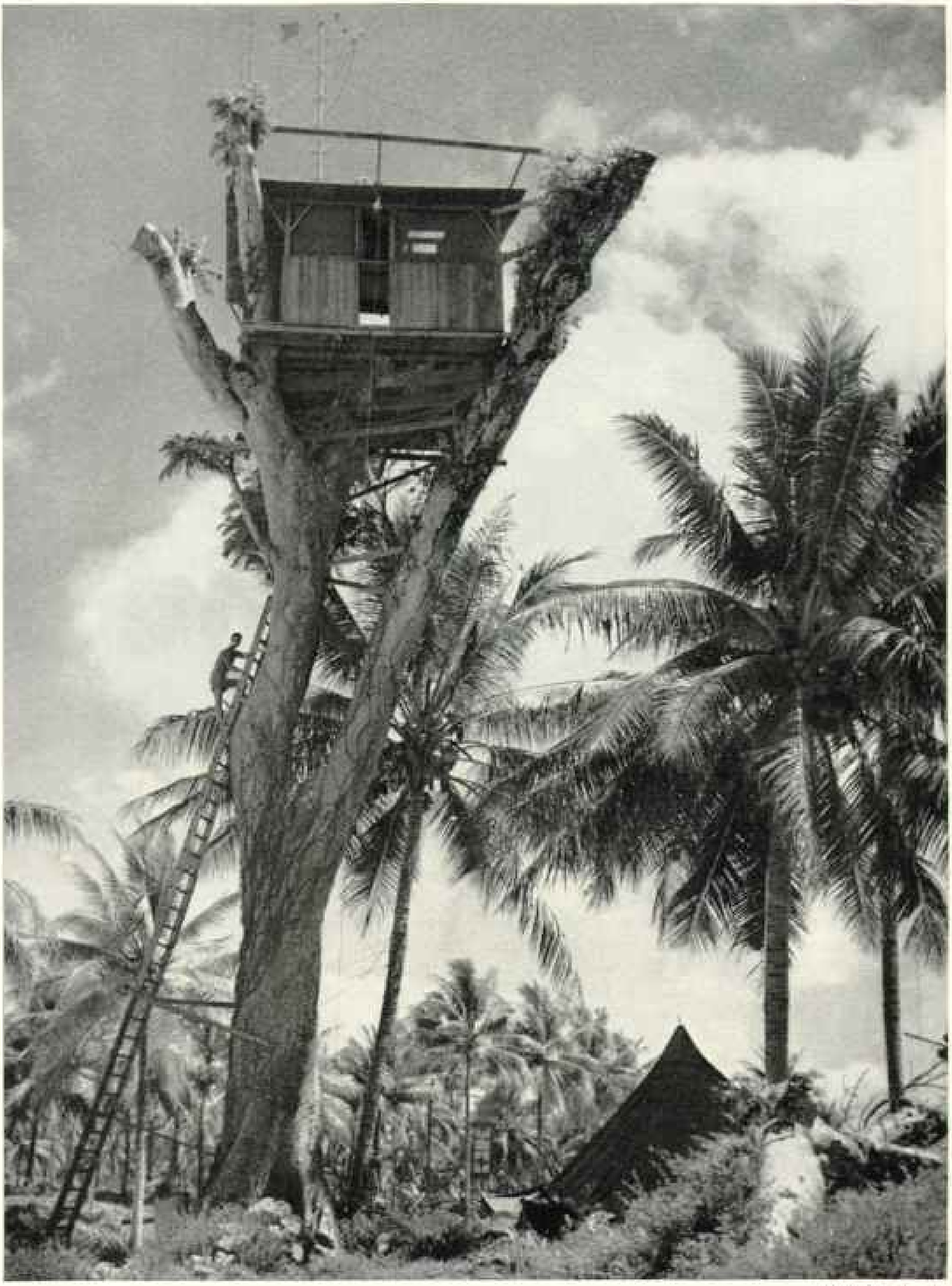
As a matter of fact, government in the New Hebrides was itself exceptional.

Historically, the condominium, whose complexity baffled our Marines, was an outgrowth of a century of bloody native uprisings, Anglo-French trade rivalries, and bitter hostility between missionaries and gun-running whiskey-smuggling traders.

As tension increased, British and French authorities in 1887 agreed on a joint exercise of police powers. In 1906, when economic rewards from the plantations were high, the two nations set on foot a joint government. A cumbersome high court was set up under the presidency of a neutral judge to be nominated by the king of Spain. Two separate island police forces were established.

Thus Americans were treated every evening to two distinct military ceremonies when the respective flags came down: a British guard of islanders stomping up to Government House to the deep, almost raucous, notes of short British bugles; while, on the other side of town, black poilus, still armed with the long old Lebel rifles and sword bayonets of France, rendered their own honors with clarion French trumpets.

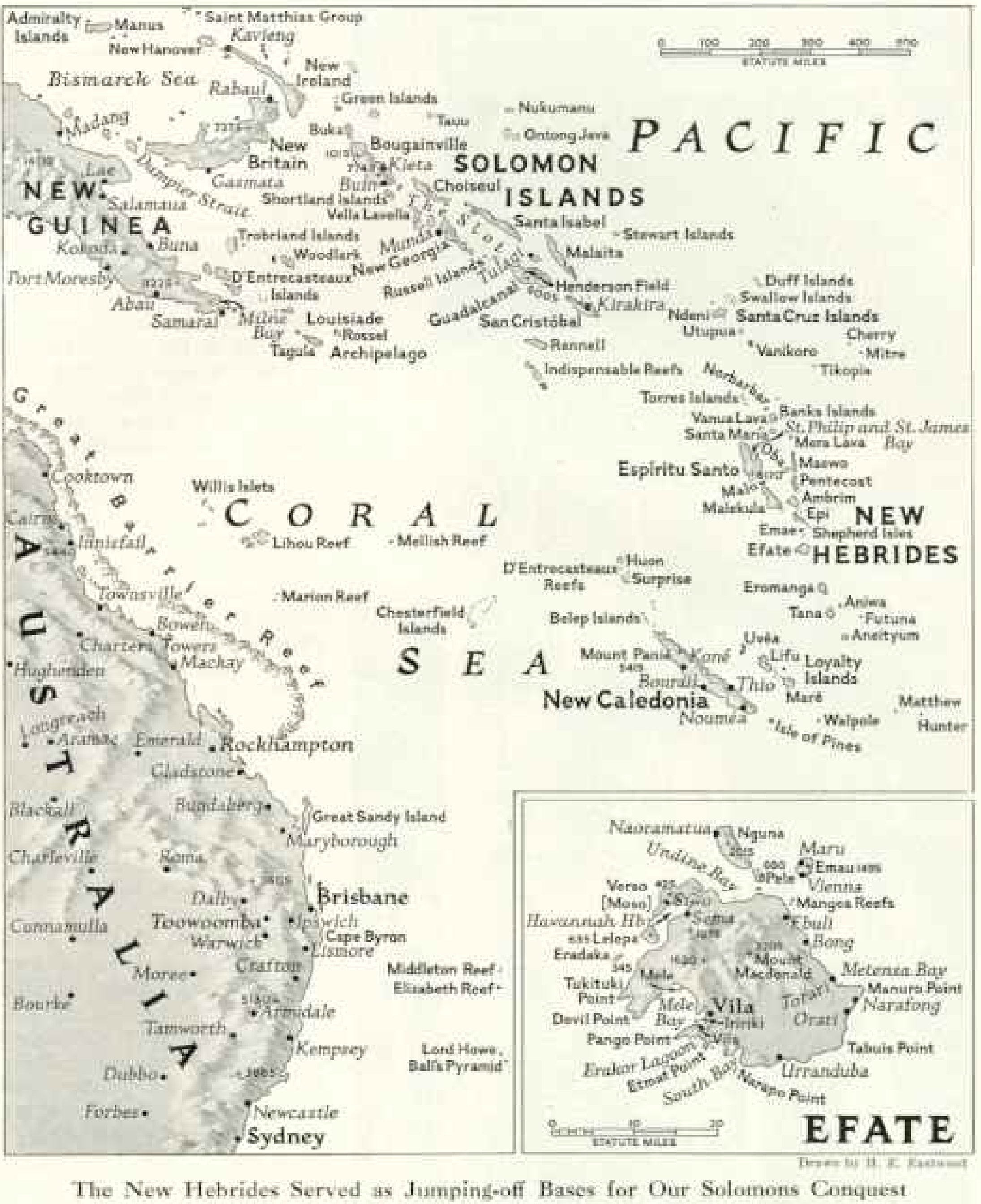
Even here, however, Britannia ruled the waves; for the British Resident, who kept feudal state on a tiny island in the middle of the harbor, had two members of his constabulary uniformed in Royal Navy clothing



U. S. Navy, Official

Tarzan, the Aerographer, Climbs His Perch to Observe Santo Weather

An aerographer is a Navy and Marine Corps weatherman. Aviation and artillery depend on his findings, since wind, temperature, and barometric pressure affect both planes and shells in flight. Units "in the air, on land, and sea" will be guided by this Marine Corps corporal's readings.



Drawn by H. R. Raymond

The New Hebrides Served as Jumping-off Bases for Our Solomons Conquest

as the boatmen of his immaculate brass-bound dinghy.

That the condominium turned out to be rather inefficient was a discovery which became apparent just as New Hebrides planting passed its zenith. Thus our "pioneers" (engineers), often tracing their way through the jungles along the rusting tracks or crumbled embankments of formerly ubiquitous narrow-gauge railroads, sometimes encountered the ruins of what had been, two decades earlier, prosperous and ample plantation houses. A former large settlement at South Bay, on Efate, now was a jungle ghost town.

Jap Radio "Welcomes" Marines

The vast, drafty building erected at Vila in 1910 to house the joint court and other condominium functions was converted into a field hospital for the Marines. Its yellowing

U. S. Navy Official

A Lofty Palm Makes a Living Pole for a Power Line

The lineman's belt replaces the boatswain's chair for this Seabee hammering the final spike into the cross arm. Palm trees make ideal enemy sniper posts. Often they are betrayed by telltale marks of climbing irons. Cattle grazed on the undergrowth of this old coconut plantation where parks of palms stretched for miles.

records, painfully recorded longhand in two languages, were moved aside to make room for American victims of malaria.

The Marines' welcome to the New Hebrides came neither from colonial civilians nor cannibals, but from Japan—via radio. Incessant enemy propaganda broadcasts signalized our arrival by announcing that invincible Nippon would give the Americans 72 hours in which to clear out of the New Hebrides.

Later we were informed from the same source that our installations had been "heavily bombed," an occurrence which had not yet come to our attention. Nevertheless, as our shore parties disembarked from their landing boats, many a Marine expected to be under enemy attack within a matter of hours. Initial bivouacs ashore were located well under cover from enemy observation.

Our first task was to unload the ships, no slight feat in a harbor the previous capacity of which had been limited to trading schooners or the S.S. *Morinda*, an interisland tramp whose periodic visits aroused the same local excitement as the daily train on a village branch line.

Since Fleet Marine Force units are trained to do their own stevedoring, designated working parties were soon on the job, covered by hastily established antiaircraft batteries. They were assisted by pioneers who reinforced rickety wharves, improvised jetties, or blasted underwater channels through shelving coral.

It was a miraculous sight not only to the civilians ashore, most of whom had fully expected to see before long the same work progressing under Japanese control, but even more so to the natives, who had never before known how hard white men could work.

To supplement the sweating Marines, who worked three relentless shifts with no extras

U. S. Marine Corps, Official

Efate Native in Castoff Campaign Hat Gets Rich Quick Doing Marines' Laundry

A bucket, a bar of soap, and American muscle sufficed the initial landing forces. Later, natives were persuaded, for modest sums, to do the week's wash. Soon they learned to charge all the traffic would bear.

U. S. Navy, Official

One Hand Gloved, the Other Free for Balancing, Navy Boxers Strive for a "Knock-off"

This shipboard sport, usually played on a boom over water, is a shore game on Espiritu Santo. The sailor felling his opponent is "king of the boom" unless he has committed a foul with the ungloved hand.

U. S. Navy, Official

Amid Santo's Palms, Avengers Fold Back Their Wings Like Birds—Such Space-savers Almost Double a Carrier's Striking Power

Originally, this airfield was an immense coconut plantation. A flat piece was lined up with the prevailing winds (planes land and take off into the wind) and cleared with axes and dynamite. Bulldozers covered it with crushed coral, packed hard as concrete. Some are floored with steel mats.

U. S. Marine Corps, Official

In Military Headgear and Grass Skirts, Efate Dancers Do the South Seas Fling for USMC Guests at a Wedding

Sailor caps and marine helmets are favorites. One native (right) has adorned a campaign hat with a woven band. The flashlight has caught the middle guitarist in a startled expression. A white woman in a borrowed helmet sits in left background.

U. S. Navy, Official

Rope Climbing, Workaday Chore for Men of Sail, Is Off-duty Fun for Lads of Steam

At a Thanksgiving picnic on Santo, sailors risk blistered hands to see who can "shinny up" farthest and fastest. As a rule, there is little need of rope climbing on modern ships. Believing this island was the legendary Southern Continent, Quirós named it Austrialia del Espiritu Santo on its discovery in 1606 (pages 230 and 249).

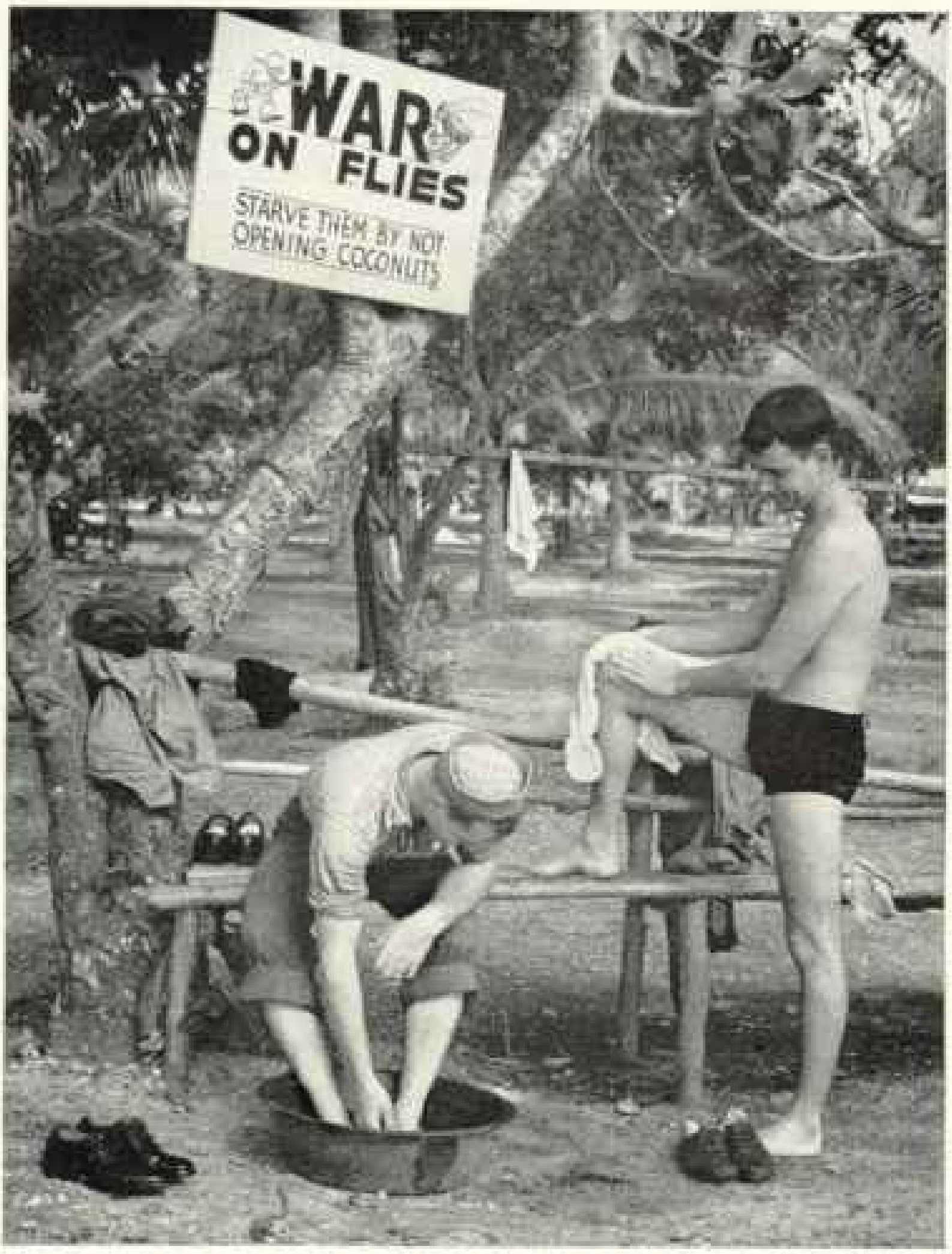
for overtime, gangs of indentured islanders were marshaled. They were led by black policemen arrayed in immaculate brass-buttoned khaki, green pillbox caps with scarlet pompons, and no footgear whatsoever!

Our men speedily learned that the sole of a Melanesian foot could outlast government rawhide.

Our arrival unfortunately coincided with the latter part of the rainy season, the unhealthful humid period which in past years had sent many white men to tropical graves.

Mosquitoes and mud were discovered as the Marines' worst enemies, with stifling heat a runner-up. But there were roads to be constructed and field fortifications to be erected.

Not immediately recognized, but soon to strike with overwhelming force, was the added blight of malaria. We had entered one of the worst endemic malarial regions in the world. Before our occupation had long continued, we had reason to be thankful for atabrine, the yellow coal-tar derivative which today largely takes the place of quinine, now scarce because of the Japs' seizure of Java early in the war.*



U. S. Navy, Official

To Prevent Athlete's Foot, Bluejackets Bathe Feet in a Chemical Solution

Says the sign: "War on flies—starve them by not opening coconuts." The author comments: "Though a plague in themselves, flies were secondary. Open coconuts collected water in which malarial mosquitoes bred" (page 249).

As our emptied convoy set sail, together with the protecting naval force which had screened the landing, we took stock of the island.

Like most others of the group, it was of fairly recent volcanic origin, as its frequent minor earthquakes and steaming crevices indicated. In many jungle streams it was possible to find a hot bath warmed by subterranean springs.

Just under a fertile layer of topsoil lay tenacious strata of coral at a depth which prevented foxholes or emplacements from being really deep unless excavated with much effort.

The islanders, despite cannibalistic traditions, were genuinely friendly and incredibly eager to help any Americans. One notch above the tribesmen, most of whom spoke pidgin English, were the Tonkinese, diminutive men and women recruited by the French Government in remote Indochinese villages and indentured to serve abroad for specified terms of years.

* See "Healing Arts in Global War," by Albert W. Atwood, NATIONAL GEOGRAPHIC MAGAZINE, November, 1943.

Their distinctive costume was invariably black trousers and white shirts or blouses, topped off by carefully whitened pith helmets. One never knew for certain how many enemy eyes peered from beneath the Tonkinese headgear.

In industry and agricultural prowess they were matched by the few Chinese, who, true to their customs, staggered along jungle trails to market under heavy poles bending with loads of hand-cultivated vegetables.

The white population, most of whose women had been evacuated, was divided between French planters and Australian townsmen, principally traders or technical personnel, such as the engineers who operated the local radio station.

Some months before our landing the French had run up the Croix de Lorraine, flag of Fighting France, which now floated just beneath the Tricolor in front of the French Residency. The New Hebrides, in fact, were the first colonial area of France to pledge support to the new Free French government.

Marines Take Over Jap Store

Such Japanese as the New Hebrides had previously harbored were now in Australian prison camps. One of the first acts of our occupation was to take over the store of the government-subsidized Nanyo Boeki Kaisha, or South Sea Trading Company, one of Japan's principal agencies for imperialistic expansion, both in the mandated islands and elsewhere.*

This establishment in Efate was conveniently located just on the water's edge, with a capacious warehouse and concrete ramp. The latter gave not only access to the main highway but also an unobstructed view to seaward of the entire harbor.

In one of its desks, rummaging Marines found a carefully drawn map of the Caribbean area, some 8,000 miles distant, with all titles and distances (usually running between labeled strategic points) printed in Japanese. The last vestige of the Nanyo was its Japanese-English sign, which for many months afterward hung as the principal sign on the Marines' post exchange (page 250).

As our forces dug in, we had more leisure to observe the repercussions of our arrival. The first and most apparent was, of course, a handsome rise in all prices, as well as a scarcity in such consumer goods as jackknives, Australian ale (consumed warm from quart bottles), native souvenirs, and cooking utensils usually stocked by the traders for native barter.

The tribesmen rapidly became accustomed to our presence, especially because we hired large parties to assist us in such work as road building or general labor about the camps. They were accomplished natural musicians whose singing of some familiar hymns reminded many a southern boy of the Negroes of his homeland (pages 252-3).

It was a short step from hymns to American secular songs, and I shall never forget one morning's sight of a native gang tramping to work to the harmonized chant of "God Bless America." The strains echoed feelingly through the jungle long after they had passed. Another favorite was "The Marines' Hymn." This became a tribal favorite, although many natives still had to learn just what a Marine was.

Despite the absence of fixed agreements on monetary matters, United States currency became the chief circulating medium except among a few die-hard English who continued their affairs in pounds, shillings, and pence.

Although the Americans brought with them more than a quarter of a million dollars in silver, an unanticipated shortage of American change arose.

The mystery of the disappearing quarter million was unsolved for weeks until we discovered that the islanders were collecting this new "hard money" and burying it with their treasures.

Our first six weeks in the New Hebrides came to a close with exciting events.

The famous U. S. carrier *Enterprise* brought Marine Corps pilots for our new base, and the great Coral Sea Battle was fought and won literally next door.

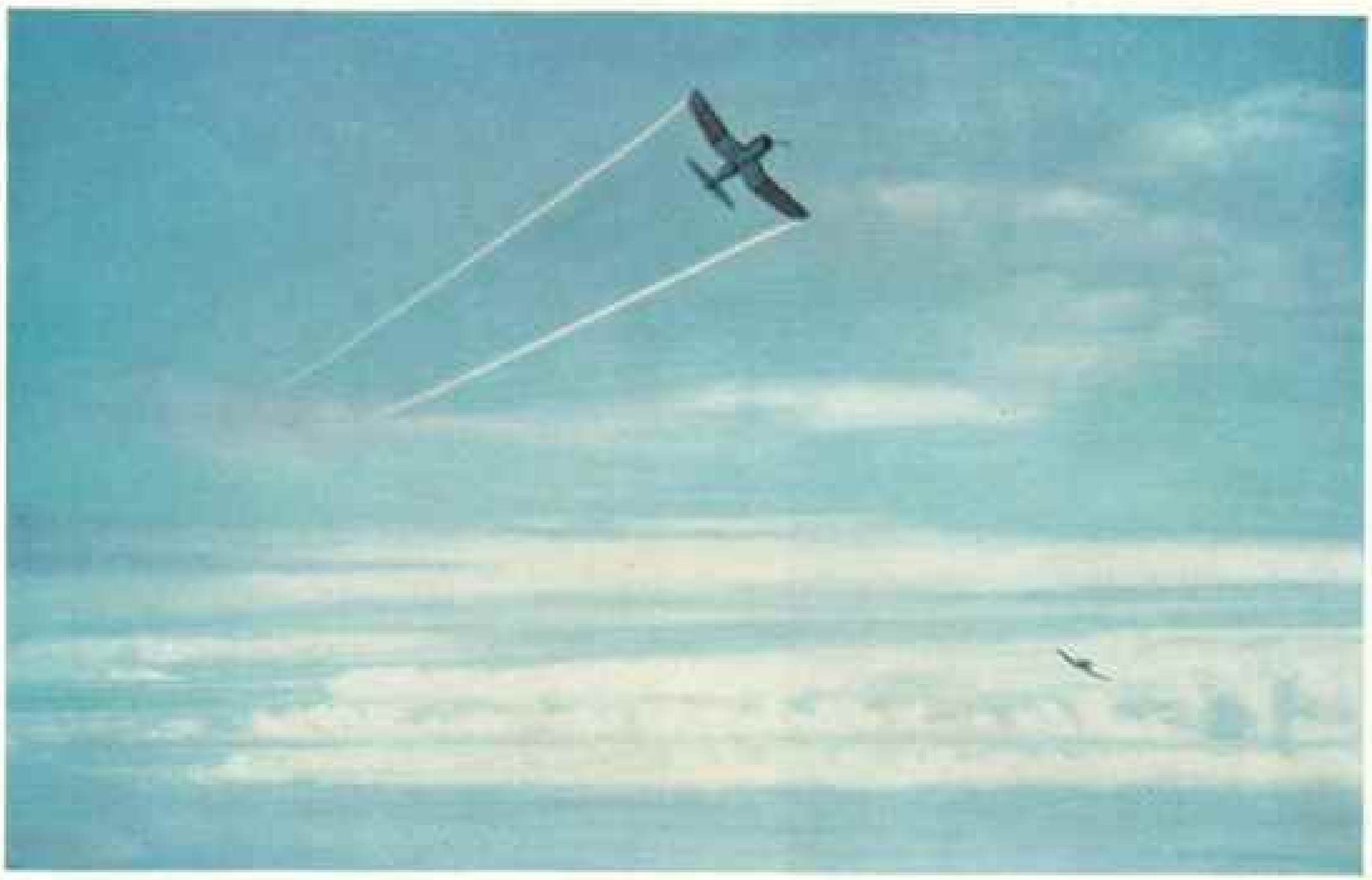
"Down-under" Winter Sets In

Having been in action at Pearl Harbor, our Marines were under no illusions as to Japanese air power, and the sight of friendly aviation aloft in force was one to gladden all hands. With the Japanese Fleet routed and the rainy season dripping to a close, our outlook for the "down-under" winter (June-September) was encouraging.

Less heartening were rations, post-exchange supplies, and mail. As an overseas expedition destined for an advance base beyond the usual range of provision ships, we had been supplied with ample food for subsistence and health, but all in canned or dehydrated forms.

Our daily fare ran about as follows: (1) corned beef; (2) luncheon meat; (3) Vienna sausage; (4) canned salmon—all nourishing, no doubt, but try them yourself for a few months on end.

* See "Japan and the Pacific," by Joseph C. Grew, National Geographic Magazine, April, 1944.



Trailing Vapor, a Navy Corsair Makes Tracks in the Blue Pacific Sky

As the fighter climbs in the substratosphere, moisture condenses behind its wing tips. Rapidly these lines grow into billowing cirrus clouds, a telltale for aviators searching for enemy planes.

Kollaborators, U. S. Navy, Official

Are Jap Fighters Hiding Behind That Big Cloud? Rear Gunners Wonder

Ever watchful, they crane their heads from side to side and up and down, looking for intercepting Zeros. These Dauntless dive bombers have just left their carrier's deck and soon will be dropping 1,000-pound bombs on Wake Island (Plates II and III).

Smoke, Coral Dust, and Flames Rise from Wake Island as Bombs Burst and Cruiser Shells Explode

Kosheverova, U. S. Navy, official

Burning Fuel Tanks and Exploding Ammunition Dumps Mark Wake Island after a Smashing Strike by a U. S. Carrier Task Force

Wake lies all by itself far out in the Pacific, 1,185 miles from Midway and nearly 2,000 miles southeast of Tokyo.

Kodachrome, U. S. Navy, Official

On This Mid-Pacific Island, a Bird Paradise, Mechanical "Man-o'-War Birds" Lay 1,000-pound Eggs of Destruction

Nine years ago Wake was uninhabited except for colonies of hermit crabs, rats, frigate birds, sooty terns, red-footed boobies, and other ocean birds. Then Pan American built its base on Peale Islet (foreground) where giant clippers came to rest in the green lagoon. Next, the Navy developed air bases on Wake, which Marines so valiantly held against overwhelming Japanese forces.

Kodachrome, U. S. Navy, Official

Props Turning Over and Men Standing by Wheel Chocks Indicate Planes Are Ready for Launching

Hellcat fighters with square wing tips (foreground, left), fat Avenger torpedo bombers (right), and Helldivers with rounded wing tips (background) spot the flight deck, awaiting their turn to blast Wake Island (Plates II and III). Wings are quickly spread as planes roll up to take-off position (opposite page).

Kodachrome, U. S. Navy, Official

Hellcat Fighters, with Wings Spread, Flaps Down, and Extra Gas Tanks Slung under Bellies, Pause for the Take-off

"Sight-seers," or officers and men off watch, look down at the busy scene as pilots and mechanics give planes last-minute inspection. The growing might of the United States Navy, with its carrier fleet approaching the hundred mark, makes possible these "hit-run strikes" and the recent invasions of Pacific Islands. Our carriers, supported by fast new battleships, cruisers, and destroyers, bring massed air power to unexpected spots, giving cover for our landing forces (see, in the NATIONAL GEOGRAPHIC MAGAZINE, "New Queen of the Seas," July, 1942, and "Cruise on an Escort Carrier," November, 1943, both by Melville Bell Grosvenor).

Kodachrome, U. S. Navy, Official

Firing Madly, an Essex-type Carrier Knocks Down a "Kate" as It Tries to Slip in a "Tin Fish"

Two balls of fire, smoke streak, and mighty splash mark the end of this two-engine Japanese torpedo bomber which almost got through the antiaircraft barrage. Three planes in all were knocked down by the AA fire of this carrier during an operation in the Marshall and Gilbert Islands.

Rear Gunner's View of a White Geyser in the Blue Pacific

A Douglas Dauntless dive bomber has just let go a depth bomb on a suspicious target. It may be a submarine—or it might even be a whale! Depth bombs are dropped on actual "contacts," rarely in practice.

Rodebrunner, U. S. Navy, Official

A "Jeep Carrier" Fires Her Antiaircraft Battery

The flight deck of this big carrier was jammed with hundreds of jeeps being ferried across the Pacific. The vast expanse serves many purposes, from football field and parade ground to parking lot and air strip.

Hosing Down a Gull-winged Mariner, Home from Antisubmarine Patrol

PBMs must be washed with fresh water after every flight to reduce corrosion from salt water. Patrol bombers have played a big part in the Navy's drive against submarines in the Atlantic.

 Kodachrome, U. S. Navy, Official

To Attract Rescuers, This Downed Pilot Paints the Sea Green

From his emergency equipment container, attached to the life raft, he has taken a can of fluorescein dye. Sprinkled on the water, the bright-orange powder quickly makes a splash of green. Flyers can spot the verdant patch from miles away.

Dehydrated potatoes were our particular aversion. Although the mess sergeant was a virtuoso, formerly having cooked for secretaries of the Navy at Camp Rapidan, and an eager experimenter to boot, never in eight months did he devise a really palatable way of preparing those dehydrated spuds. Vienna sausage was in much the same class (p. 251).

Post Exchange Supplies Dwindle

Post-exchange supplies (cigarettes, candy, gum, toilet articles, and the like) presented another problem despite energetic attempts at a solution. On an isolated island, with no place to spend money, and a diet of expeditionary rations, our men cleaned out the exchange in short order.

What had appeared to be more than ample quantities of beer, candy, and fruit juices turned out to be barely sufficient, particularly when delays in shipping or priorities prevented supplies from getting to us.

As stocks went lower and lower, an ingenious Army-exchange officer decided to augment his declining revenues by the sale of chilled coconuts. These were eagerly purchased by soldiers who, on an island where every second tree was a coconut palm, would have scorned to pick one from the ground.

But coconuts, in less amusing aspect, aggravated our most serious problem, malaria control. Lying half rotted or split on the ground, the shells filled with rainwater and became a breeding place for *Anopheles* mosquitoes (page 239).*

Mail was the worst lack of all. Average traveling time for letters from the United States to the New Hebrides averaged between six and eight weeks. For some reason, never well understood, return mail to the States traveled much faster, often requiring but a fortnight.

As each ship stood in, the first question would be, "Any mail?" If the blessed "Yes" came in reply, it inaugurated an impromptu holiday, regardless of the day or hour. Curiously, V-mail failed to arrive any faster than the rest, and many marines preferred standard letters to the half-size photostats.

As the "winter" wore on, it became evident that stirring events were in the making. The Japanese had occupied Tulagi and were busily hewing an airfield from a coconut plantation on Guadalcanal.

To stop this advance, we sent a detachment of Marines to create an airbase out of the tough jungles of Espiritu Santo.

Largest of the group, this forbidding island, called "Santo" by people in the New Hebrides, lay only 500 miles southeast of enemy bases in the Solomons. Discovered in 1606 by Quirós, it affords a magnificent natural harbor in the great St. Philip and St. James Bay.

Fighting malaria, dysentery, and the rainy season, these Marines won a construction race with the Japanese by finishing their airfield just nine days before the August 7, 1942, attack on Guadalcanal. Despite tropical diseases, intense heat, and a shortage of rations, the gigantic task was completed without a single loss of life from illness (page 255).

At the time of our arrival, Santo was the least civilized spot in the New Hebrides archipelago. While cannibalism was something of a laughing matter to units in the southern New Hebrides, it was anything but that in the north. As recently as the 1920's, white men had been ambushed and slain. To our relief, though the natives reckoned "long pig" a delicacy they preferred native meat.

Marines Win Airfield Race on Santo

Nevertheless, jungles in other days and in other hemispheres had been braved by United States Marines. With the traditions of Haiti, Dominican Republic, and Nicaragua well in mind, a detachment departed for Santo, there to construct and defend an advanced airbase, a feat which afterward was to become one of the minor legends of the Southwest Pacific.

If Efate was wild, Santo was doubly so, though the natives seemed to have quite as much respect for American troops as we had for their stew kettles. They wore ceremonial loincloths, and little else. As with many primitive peoples, women did most of the work, while the men lazed in a sort of fraternity house or lodge hall, where periodic rites of some kind were celebrated.

Only one event during our stay was reported to have unnerved them. Upon arrival of a contingent of U. S. Negroes, an imaginative Marine spread word that the newcomers were American Indians fresh from scalping forays on the plains and thirsting for more (page 231.) It was hours before some of the Hebridean cannibals could be induced to come within reach of our Negro troops. Within a few weeks, however, amity prevailed. Homesick Negro boys had already adopted pickaninny mascots from neighboring villages.

With our growing defensive strength on all islands came a remarkable network of roads penetrating every jungle fastness.

The usual technique in such highway proj-

* See "Saboteur Mosquitoes," by Henry H. Stage, and "Life Story of the Mosquito," by Graham Fairchild, NATIONAL GEOGRAPHIC MAGAZINE, February, 1944.

U. S. Marine Corps, Official

Natives Help with the Clerking in Vila's Post Exchange, Once the Japanese Club

They speak little English, but most of them can make change in American money. In this Army PX, chilled coconuts were popular with the men, though every other tree on Efate is a palm (page 249). The native at left uses his tight curls to hold a pencil.

ects was to decide from map or personal reconnaissance the general trace of the road, and then send out a bulldozer, followed usually by another tractor and a couple of cross-country trucks, with orders to bore a path straight through the jungle.

This technique was practiced with particular success by one hard-bitten Nicaraguan veteran, whose road building—"smashing" might be a better term—astonished even the Engineers.

Once this officer disappeared with a bulldozer into supposedly impassable jungle for several days, to reappear many miles away among the astounded outposts of an isolated garrison which until then had been in communication with the rest of the island only by sea.

U. S. Route No. 1—Extended!

In time, American road builders encircled Efate with a practicable motor highway which was promptly dubbed "U. S. Route No. 1." Not content with the verbal designation, homesick Americans painted regulation black and white shields, exactly like the familiar U. S. highway markers of the homeland, but neatly labeled "Efate, U. S. No. 1," as if the New Hebrides had been Ohio or California.

Carrying the play still further, short cuts or side roads were marked as "alternate routes" or "by-passes," and in the vicinity of camps there rose billboards and roadside signs, usually advertising mouth-watering delicacies or equally mouth-watering blondes.

"Victory gardens" were another pastime, especially on outposts remote from the metropolitan fleshpots of Vila. At one battery position a leathery Marine Corps gunnery sergeant turned farmer acquired a few chickens from a near-by native village and enjoyed an independent income from the sale of breakfast eggs (usually as common as radium) to his battery commander.

On August 5 and 6, 1942, our observation posts made out large convoys steaming north, well to seaward, and our speculations were answered with the dawn of August 7, as we learned that our comrades were at last landing in the Solomons.

Alerted against enemy counterattack, we manned not only our weapons but our radios, and were rewarded by one of the unique play-by-play broadcasts of history. By pure accident one of our radiomen chanced upon the frequency used for air-ground communications in the Guadalcanal-Tulagi area.

U. S. Navy, Official

On Thanksgiving Day, Globe-girdling Turkey Meets a New Hebrides Receiving Line

"This was a far cry from what we had in the early months," says the author, admittedly envious. "All our turkey came from cans labeled 'Vienna sausage' and 'corned beef.' Dehydrated potatoes were tiring fare. Try as he would, the mess sergeant was unable to camouflage them" (page 249). Note the bearded sailors.

U. S. Marine Corps, Official

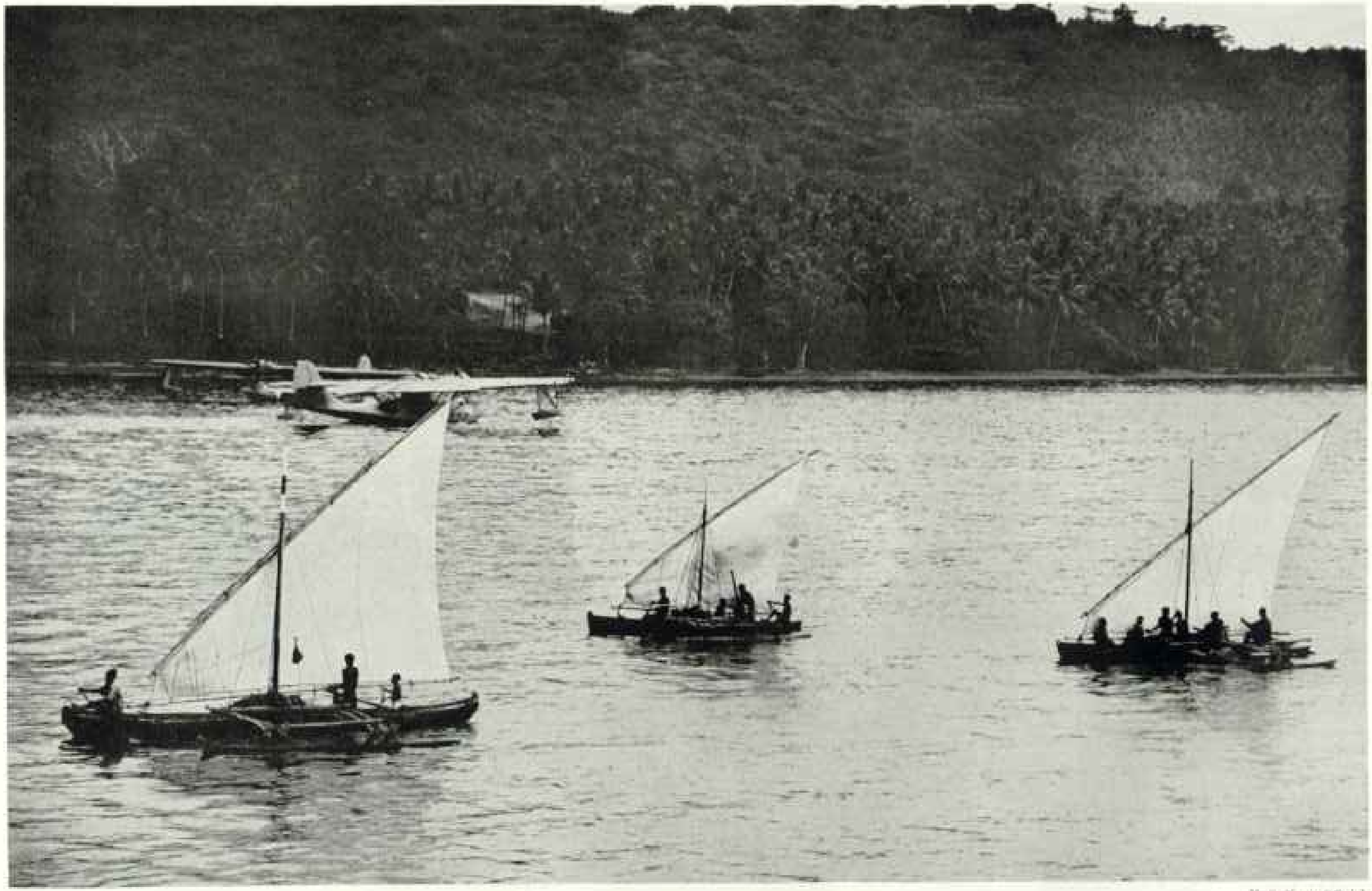
A Melanesian Minister, as Dignified as a Negro Preacher in the Deep South, Reads the Gospel at a Presbyterian Service

Beneath his table-pulpit are slates on which mission children learn to read and write. His congregation, living on Mele Island, commutes by dugout to work in Vila (page 230). Hundreds of natives live on this island because prevailing winds make it mosquito-free, something novel in the New Hebrides.

U. S. Marine Corps Official

On Hard Benches, the Mission's Congregation Is Divided, Men to the Left, Women and Babies to the Right

Like the rest of the world, natives wear their best clothes to church. Women favor "trade goods"—bright prints, brilliant silks, pastel rayons, and velvet. They and their menfolk worship earnestly. Bible, hymnal, and prayerbook are translated into the native tongue.



U. S. Navy, Official

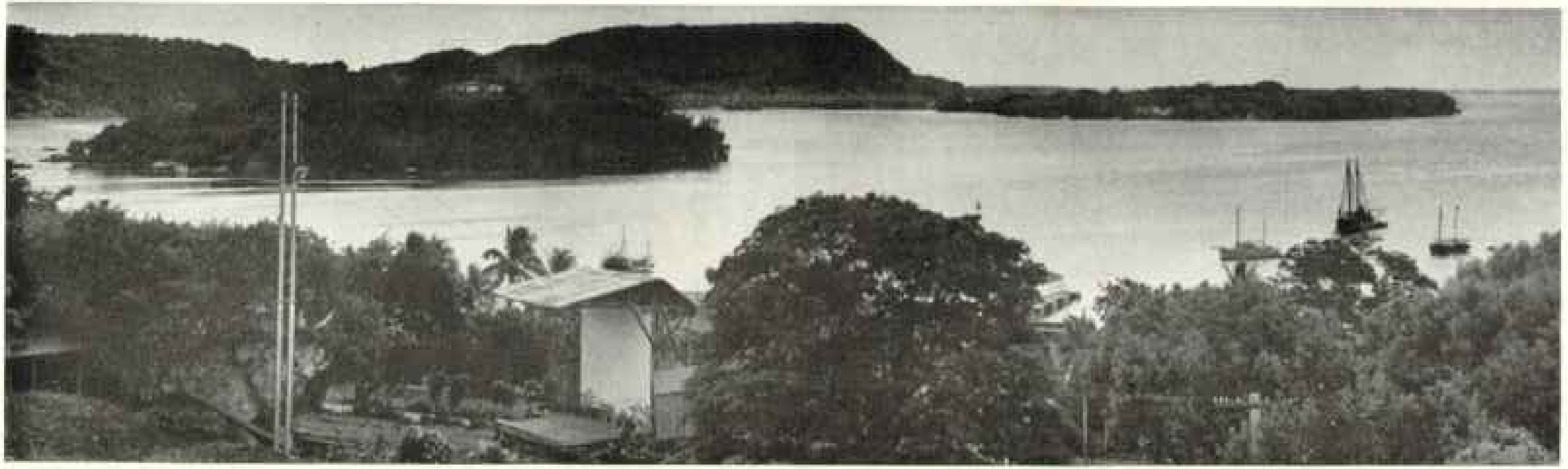
Scooting Past Two PBYs, Santo Natives Hope for Customers Among the Aviators Who Might Like a "Real Thrill" in an Outrigger

Most New Hebrides canoes are flimsy. "These are pretty ambitious specimens," the author remarks. "Most that I saw would hold two persons, if perfectly balanced and not breathing." Marines and sailors, learning to sail them, took frequent spills (page 256). Bringing mail and news, the Navy flying boat is a welcome visitor.

U. S. Navy, Official

On Espíritu Santo, a Marine Corsair Glides Down a Coral Arrow Aimed at Guadalcanal 500 Miles Away

A race against time and the Japanese was won when Seabees, Marines, and soldiers completed this strip on schedule to support the Solomons invasion August 7, 1942 (pages 249, 256). It served as base for the famous Marine Fighting Squadron 212.



U. S. Marine Corps, Official

Vila, Capital of New Hebrides, Was the Front Line of Our Defense Against the Japanese When U. S. Marines Landed in March, 1942

The movie screen in foreground is for patients in the former French hospital taken over to house malaria-ridden Marines and wounded from Guadalcanal. To Irtriki Island (left) the British Resident is rowed daily by his native crew dressed in British Navy uniforms.

As the day wore on, we heard continuous reports and messages detailing the progress of our forces. Once came the thrilling order from a bombing-squadron commander who launched a devastating attack simply by the radioed command, "All right, boys, *excavate* that hill!"

When 40 enemy bombers swept over Guadalcanal next day, a staff officer, apparently carried away by the excitement, continued a running description of the raid, à la Ted Husing, into a live microphone: "One . . . two . . . five . . . we're shooting them down like flies! I *personally* counted 12 down from that last wave. . . . Oh! Oh! Here they come again! I'm signing off and going under a table!"

With this inspiriting introduction to the months of suspense which were to follow while the conquest of Guadalcanal hung in the balance, we found ourselves to a certain extent "behind the front," though occasional enterprise by enemy submarine commanders or long-range aviation served to remind us that Tojo still kept the New Hebrides on his visiting list.

Hospital Planes from Guadalcanal

What served even more dramatically to point the tenseness of the period were the daily hospital planes. They evacuated Guadalcanal's wounded, usually haggard, unshaven, and in the clothes which had served them for past months.

Efate had the first base hospital to which the wounded Marines and Navy men were brought, and Santo was the last aviation base south of embattled Henderson Field.

As the Navy regained control of the perilous seas of "The Slot" (as the narrow strait between the Solomons is known), its hard-hitting ships, many of which showed scars of close combat, put into Vila.

But the sea fights of November and December, 1942, brought an end to the suspense, and the Guadalcanal battle, to which we in the New Hebrides had contributed vital but unsung assistance, came to its mopping-up stages.

Not only the Marines of Henderson Field but those of Efate and Santo would shortly be relieved by the Army for rest and then for greater battles to come.

With the capture of the Solomons, our many months of work had come to fruition. For the first time since the preceding March we were more than three hours as the bomber flies from hostile bases. To think of the New Hebrides as a rear area seemed a little strange.

Active war had come and gone in these far-away islands. We had found a tiny agrarian civilization, such as it was, encompassed by lonely ocean and jungle well-nigh as trackless. The number of automobiles as well as miles of motor roads in the group probably would have totaled less than fifty until our arrival. Now hundreds of additional miles of highway were ceaselessly traversed by American motor convoys and patrols.

Island boys, who once wore gay trade-goods loin skirts, now appeared in castoff American military caps or other articles of uniform. Colonial civilians had learned the use of American goods and money, and read our month-old newspapers. One island attendant in an officers' mess became a regular reader of the New York Times!

On the other hand, Marines and sailors had learned to weave palm thatchwork. They also learned, after many tribulations, to sail outrigger canoes. Usually the first cruise of a novice includes at least one capsize (p. 254).

Bows and arrows, once exclusively tribal weapons, appeared in such frequency on our outposts that the commanding officer deemed it necessary to forbid their use or possession by any Marine.

Encampments had struck their tents and moved into thatched native-style huts definitely advantageous for camouflage. Strange Australian idioms and songs, such as the immortal "Bless 'Em All!" were blossoming on American tongues. A few hardy gourmets had even tried to French-fry taro root in a fruitless attempt to by-pass dehydrated potatoes.

"By the time another outfit comes to relieve us," was the prophecy, "we'll all be swinging from the tree limbs with bones in our ears."

But relief did come.

Under Three Flags

In the winter of 1943, the New Hebrides Marines rolled their packs, slung rifles, and embarked in transports which had brought soldiers to relieve them.

The change from front line to teeming rear-area base was complete indeed. Mail would begin to arrive fortnightly, jungles would be cleared to make way for miles of stacked munitions and supplies, and, if transports laden with combat troops appeared on the horizon, one could be certain that they were not a hostile invasion convoy, but probably coming for a practice landing on the beaches of Mele Bay.

Thus the New Hebrides, veritably a last frontier in the Pacific, have been transformed into an American bastion of defense over which the Stars and Stripes, the Union Jack, and the Tricolor share their watch.

NATIONAL GEOGRAPHIC SOCIETY

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To carry out the purposes for which it was founded fifty-six 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, 1930, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

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 cooperated 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.

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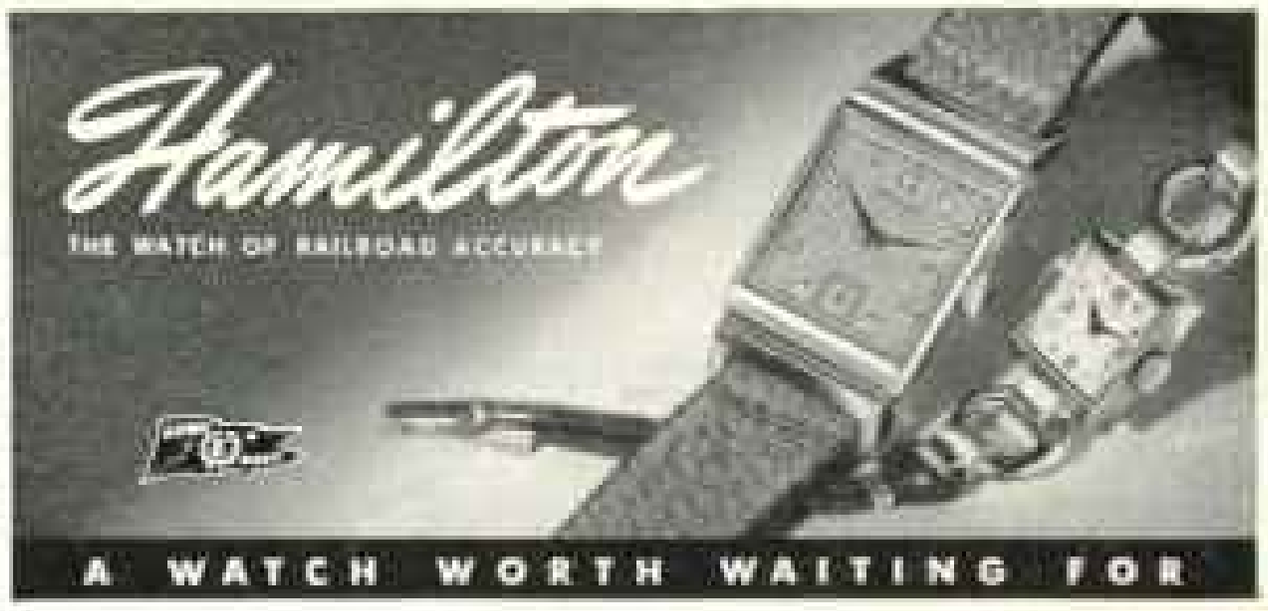

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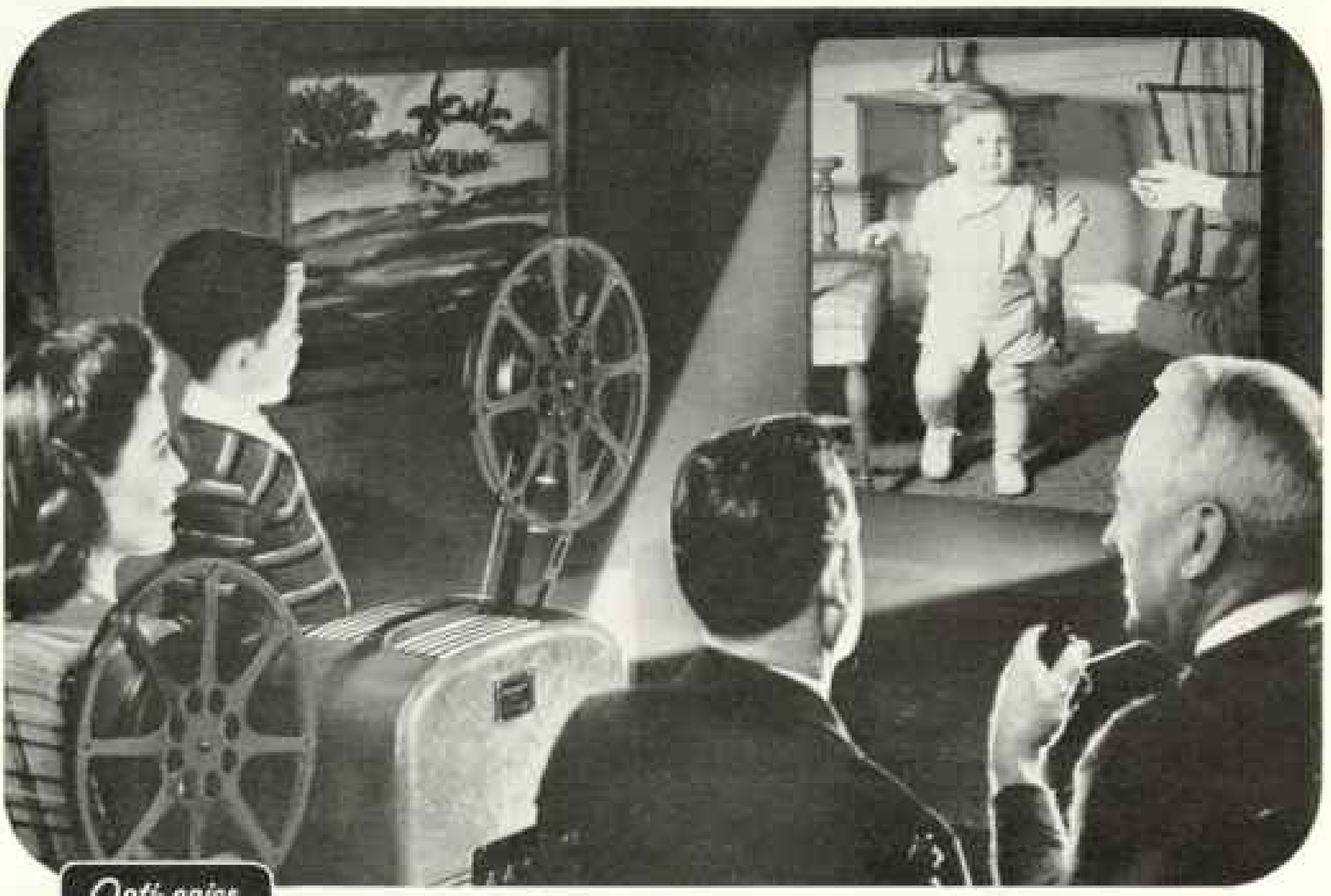

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One of a series of incidents in the lives of unmitted composers, painted for the Magnavox collection by Walter Richards

How America's best loved folk-songs were inspired

His family frowned at his "devotion to musick." So, in 1846, young Stephen Foster was packed off to Cincinnati . . . to work in his elder brother's steamboat agency until he outgrew his "strange talent."

But there was melody in the air of that Cincinnati waterfront of a hundred years ago—*music of the South* on the lips of the Negro roustabouts who manned the gorgeous Mississippi River steamboats from Memphis and New Orleans.

Dutifully, the twenty-year-old boy kept the books of "Irwin & Foster, Agents." But in his spare time he would jot down verses in Negro dialect—and tunes to go with them inspired by the colorful new environment in which he found himself.

Soon, this young Northerner was composing folk-songs that seem to have been born and bred in the old romantic South—*Suwanee River* and *Old Black Joe*, *Camptown Races* and *My Old Kentucky Home*. In the words of Alexander Woollcott, they "are now, and for generations yet to come will be, an enduring part of American life."

Today, when wartime tension seems hard to bear, why not summon back the peaceful past by listening to one of the mellow songs of Stephen Foster as rendered by a Magnavox radio-phonograph? So faithfully, so beautifully does this instrument reproduce the world's great music that it has been chosen above all others by such famous masters as Kreisler and Rachmaninoff—by Ormandy, Beecham and Horowitz. The Magnavox Company, Fort Wayne 4, Indiana.

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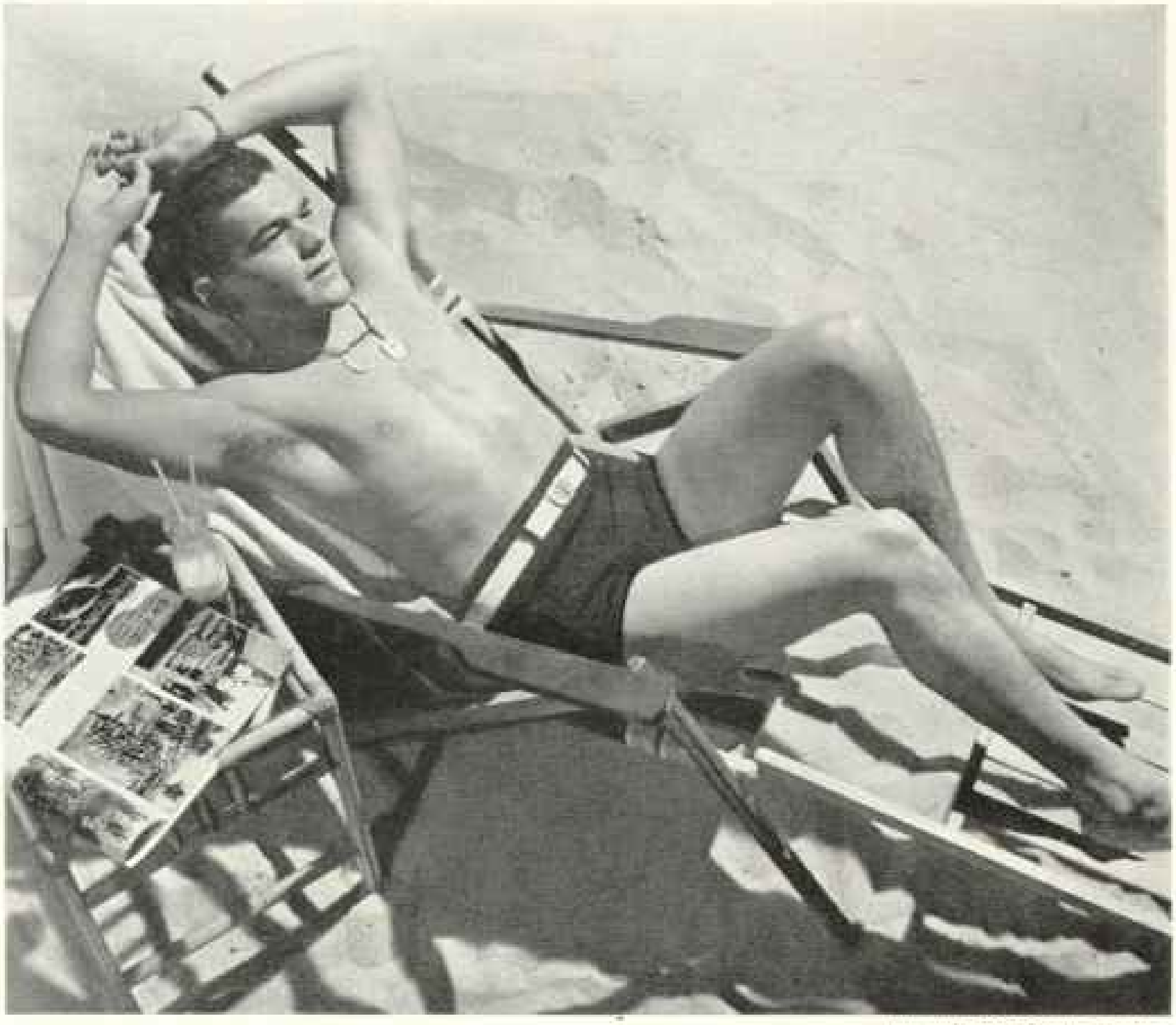

BUY WAR BONDS AND STAMPS

Sure cure for a fagged flier

Eddie doesn't wear his Purple Heart and his Air Medal on the beach. He's trying to forget them—trying to untie the tangled, jangled nerves that come from many combat missions.

Eddie's at an Air Forces Redistribution Station—where sun, sleep, fun and food are the medicines that make worn men well again—fit to fly or fight or teach. And milk is an important part of the program.

Most such men are eager for milk—remembering how rare it was in England—recalling Pacific outposts "where fresh milk, if there had been any, would have been more precious than champagne." Many a flier's first act on reaching America is to order a jumbo chocolate milkshake!

Milk, of course, is fine for battle-weary men because it is nature's most nearly perfect food. It appears on regular Army menus for the very same reasons—with butter, cheese, ice cream and other milk products.

While you share some of your milk supply with men like Eddie, we at National Dairy are working ceaselessly in our laboratories—to improve the production and processing of milk—to develop nutritious new foods from milk—and so help the health of the nation.

Dedicated to the wider use and better understanding of dairy products as human food . . . as a base for the development of new products and materials . . . as a source of health and enduring progress on the farms and in the towns and cities of America.

"Dis pella someting belong wuh-name?"

"What's this?" Joe's asking.

"Paw-paw!" says the native, naming the fruit of the tropical tree.

It's Melanesian Pidgin-English that they're speaking, a "language" described in the War Department's Pocket Guide to New Guinea as:

> "... *a mixture of words from English, native tongues, Chinese, Malay, German and other languages put together with a minimum of grammar and liberally sprinkled with the salty oaths of early seafarers.*"

Joe's pretty good at pidgin, thanks to the 19 pages of common words and phrases in the Pocket Guides issued to his outfit. And it's lucky that he is, for, as those Guides say, it's the *custom of the country* to use Pidgin-English:

> "... *not only between whites and natives, but also between natives who speak ... many different little local languages and dialects.*"

That's something new—one of many foreign customs our boys learn as they keep on the move.

There's an *American* custom that's just as new to many boys whom war keeps on the move *before* they go abroad. It's our custom of *traveling in comfort*—which troops in training do at the rate of 30,000 every night.

The thrill of *going Pullman* is new to lots of those boys *now*. But no newer to *them* than it will be to *you* when you step aboard two *new-type cars* that Pullman plans to operate when the war is over.

The duplex-roomette is one—a car in which you'll have a completely equipped *private room* for little, if any, more than a lower berth costs now.

The coach-sleeper is the other—a car in which Pullman comfort and convenience will be yours for *less* than the present rate for a berth in either standard or tourist sleeping cars.

When Pullman introduces these new cars, you'll get a new conception of the comfort that has made *going Pullman* the *custom of the country*.

* * *

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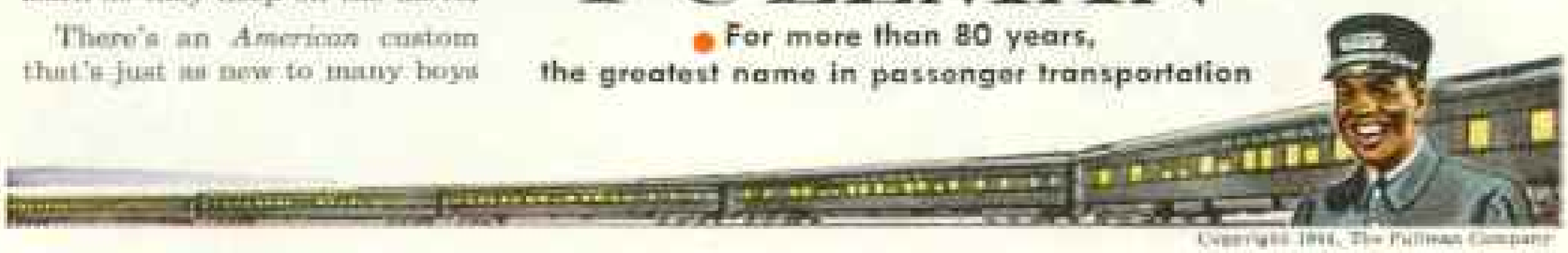
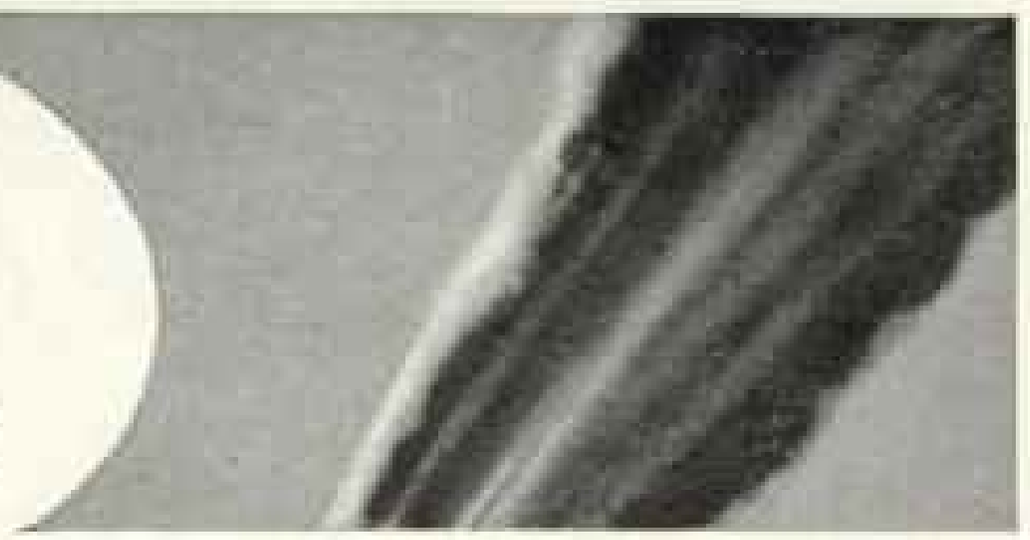


Plastic Bubble

It's the MARTIN Aircraft Gun Turret!



—one of the most destructive weapons of the war

BROOMSTICK: Thrust a broomstick from the window of a car doing 60 miles an hour and you'll have some idea of what aerial gunners were up against before the advent of power-operated gun turrets. With a wind of from two to three hundred miles an hour pushing against their gun barrels, accuracy was almost impossible.

FIRST: Realizing that lack of accurate defensive fire made our bombers vulnerable, Martin engineers, in 1937, developed America's first power-operated gun turret, a hydraulic powered model for the Navy's PBM-1 patrol bomber. Accurate, responsive to the slightest touch, it mounted machine guns. It's doing a job for the Navy!

MUST: Then in 1940 General Arnold, Chief of the Army Air Forces, proclaimed powered turrets a "must" for Army bombers. Again Martin was first to respond, introducing a completely new electric powered turret. Mounting two .50 machine guns, it is one of the war's most lethal weapons. With it, Army bombers pack a potent punch!

3500: Blasting the Axis on every front, Martin electric turrets are mounted on Martin Marauders, Liberators, Martin Baltimores, A-20 Havocs, a series of Flying Fortresses, Vega Venturas. Allied gunners in Martin electric turrets have shot down an estimated 3500 enemy aircraft and are adding to the score every day!

MIGHTY: On bows and decks of Martin Mariners, PB2Y4 Coronados, PBM-1's and PB2Y3's, the Martin hydraulic turret is in action the world over. German subs have felt its blast, Jap ships set afire or sunk, enemy installations raked, Axis aircraft destroyed. This accurate hydraulic gun turret is one of America's mightiest weapons!

TODAY: The same engineering skill that produced these great gun turrets, also gave America the world's largest flying boat . . . the 72-ton Martin Mars. Now in regular trans-Pacific service with the Navy, this giant transport will soon be joined by 20 even larger sisterships. She's the plane of tomorrow, flying today!

Martin

AIRCRAFT

Builders of Dependable Aircraft Since 1909

THE GLENN L. MARTIN COMPANY, BALTIMORE 3, MD. THE GLENN L. MARTIN-NEBRASKA CO.—OMAHA

NAVIGATORS OF THE NEW HORIZONS

Oceans provide no barrier and distance fails to hamper the mind of the true navigator. By sea or by sky, he is the joiner of the near and far, the trusted guide of travelers in trackless space. Since the days of sail, Matson has followed the navigator's calling, beating the ocean track that has joined Islands and Mainland in closer understanding. When war has been swept from this world, Matson will return to its peacetime task of escorting friends to pleasant, far-away places. Hawaii and the fascinating region which centers about it will be brought within reach by the most modern modes of transportation known to man.

Matson KNOWS THE PACIFIC

MATSON LINES TO HAWAII AND THE SOUTH PACIFIC

SAMOA • FIJI • NEW ZEALAND • AUSTRALIA

GM Diesels—because they are smaller in size, lighter in weight—propel boats farther, and for longer periods, with less fuel. They'll handle the catch, supply power for the refrigeration, and hasten deliveries—all with marked savings. Under the impulse of war, production has so advanced that this dependable low-cost power will be available for greatly extended use in peacetime.

HOW AIRFIELDS GROW ON MUCK, ON SAND, ON TUNDRA

On world-wide battle fronts America's planes are taking off on missions against the enemy—taking off from desert sand, jungle muck, or Aleutian tundra.

In a matter of days, bulldozers shove aside the muck or level the sand. And giant cranes lay steel landing mats that are bolted into a landing strip.

Look at the engines in these bulldozers and cranes. You'll find familiar friends—the same friends that power tanks and trucks, landing barges and patrol vessels, tractors and auxiliaries—General Motors Diesels.

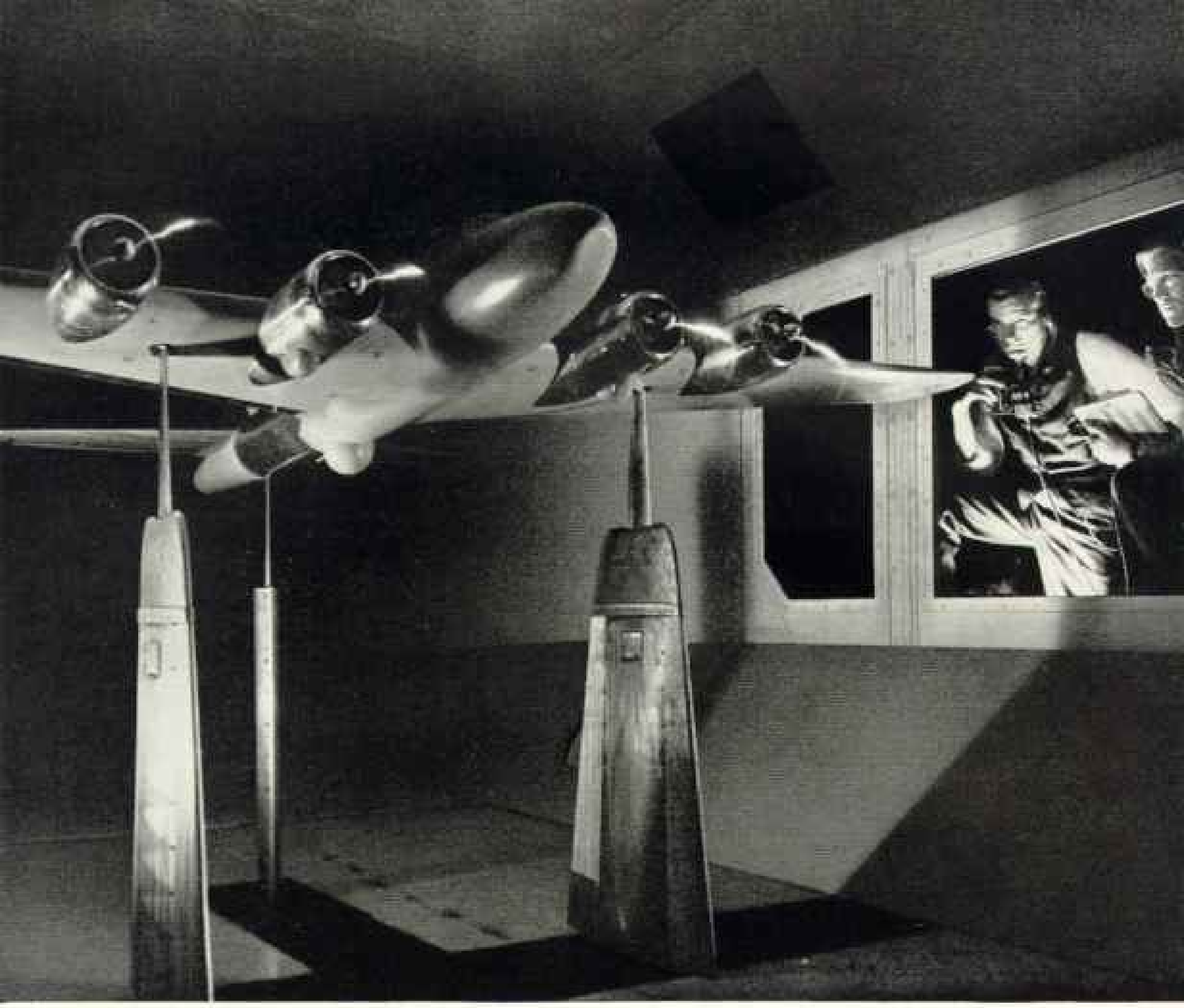
And in these rigorous jobs of war, a promise is being written—a promise of plentiful, dependable, easily maintained, low-cost power for America's needs in the peacetime days ahead.

GM
GENERAL MOTORS
DIESEL POWER

ENGINES *15 to 250 H.P.* ***DETROIT DIESEL ENGINE DIVISION,*** *Detroit 23, Mich.*

ENGINES *150 to 2000 H.P.* ***CLEVELAND DIESEL ENGINE DIVISION,*** *Cleveland 11, Ohio*

LOCOMOTIVES ***ELECTRO-MOTIVE DIVISION,*** *La Grange, Ill.*



Buy War Bonds — to Have and to Hold

Hurricane in Harness

Poised on knife-edged supports, the ten-foot scale model of a Boeing Flying Fortress rides the screaming gale. Engineers, tense at their control panels, watch and check every reaction of the sturdy airplane. In an hour they can learn more about the flight characteristics of a new wing or a new tail design than would be revealed in months of actual flying.

The Boeing wind tunnel, in the recently dedicated Edmund T. Allen Memorial Aeronautical Laboratories at Seattle, is capable of speeds in the 700-mile-an-hour range, approximating the speed of sound—four or five times faster than a Gulf hurricane or a typhoon.

A gigantic 16-bladed fan, 24 feet in diameter, funnels the air into the "throat" of the test section. Power from a rated 18,000-horsepower synchronous electric motor is transmitted to the fan through the largest magnetic clutch ever built.

But speed is only one of the features that make this huge structure an exceptional contribution to the advancement of aeronautical science.

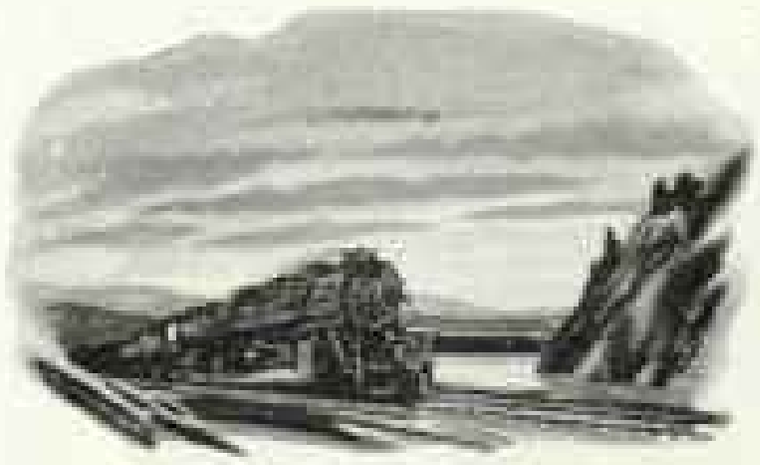
Boeing-designed balances of extraordinary accuracy measure the airplane model's performance. The forces of lift, drag, yaw, pitch and roll at any given air-speed are registered on instruments that record variations from fractional ounces to 10,000 pounds.

The tunnel provides greater accessibility, utility and ease of operation than has ever before been possible. Instantaneous automatic recording of all data in numerical form permits immediate computation and analysis.

• • •

The Boeing wind tunnel is now ready to help speed the day of Victory. When the war is won, it will mean much to increased comfort, speed, safety and economy in air transportation. As in the past, Boeing leadership in design, engineering and manufacturing will set the pace in aeronautical development of peacetime aircraft products.

DESIGNERS OF THE FLYING FORTRESS • THE NEW B-29 SUPERFORTRESS • THE STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**



THROUGH THE DARKEST HOUR

The railroads are part and parcel of the vital service of supply on which fighting men depend. They know first-hand the darkness of the hour before the dawn. • *They follow the progress of the war by the nature and urgency of the burdens they carry—burdens that never lighten through the whole 24 hours of the day.* • *So through sunshine and shadow, railroad men serve the needs of war. Short on help, short on time, they know the value of every hour and every car. They know that a fighting nation counts on them to deliver the goods that Victory is made of—and doggedly, devotedly, they are sticking to that job.* • *Some day the dark hour will be behind us. Then our nation will look back on the courage and the will with which we faced it and judge our fiber as a people.* • *The railroads are working now so that when that day dawns they can, in clear knowledge of a job faithfully discharged, look forward with confidence to finer things to come.*

BUY MORE WAR BONDS

ASSOCIATION OF
AMERICAN RAILROADS
ALL UNITED FOR VICTORY

"LET ME TELL YOU HOW IT WAS . . ."

"It was a nightmare.

"They came in wave after wave. And their bullets splattered like rain on our deck, and the big guns sounded like doors being slammed in a hall in the sky and the pounding of A. A. guns was like guys pounding to get out again, and over it all the high, thin scream of the bombs.

"We thought for a minute they had us . . . we thought maybe our number was up . . . that we were through, finished, done for . . .

"*And then . . . the thunder of our planes came down and shook the world!*

"I tell you, they swarmed in the sky and shut out the light like a cloud . . . planes and more planes than we had ever seen before. They swept down and struck like the vengeance of God, and the enemy fell in clusters of flame, and the air was filled with the sound of their going and the water was littered with planes and men. And they died in the sea.

"That's how it was . . . that's how it was in the Coral Sea . . . that's how it was at Midway . . . that's how it was at Truk . . . that's how we know it will be . . .

"*Because out here, we've seen the power of America at war . . .*

"And we can see that this same power can be the power to build a new and greater America than we have known before. An America where there will be new homes . . . new towns . . . new opportunities to work, to dream, to invent . . . to live as free and individual men, the lives we want to live.

"That's how we see it . . .
That's how it will be . . .
That's how it *must* be when we come home."

. . .

After Victory we must convert the full force of America's vast productive capacity to production for peace. For only in this way can Victory be made real . . . only in this way can America continue to grow . . . only in this way can the hopes of all of us be realized.

Today, we're building 2,000 h. p. Pratt & Whitney supercharged aircraft engines for the Navy's Vought Corsair and Grumman Hellcat fighters . . . Hamilton Standard propellers for United Nations bombers . . . readying production lines for Sikorsky helicopters for the Army Air Forces.

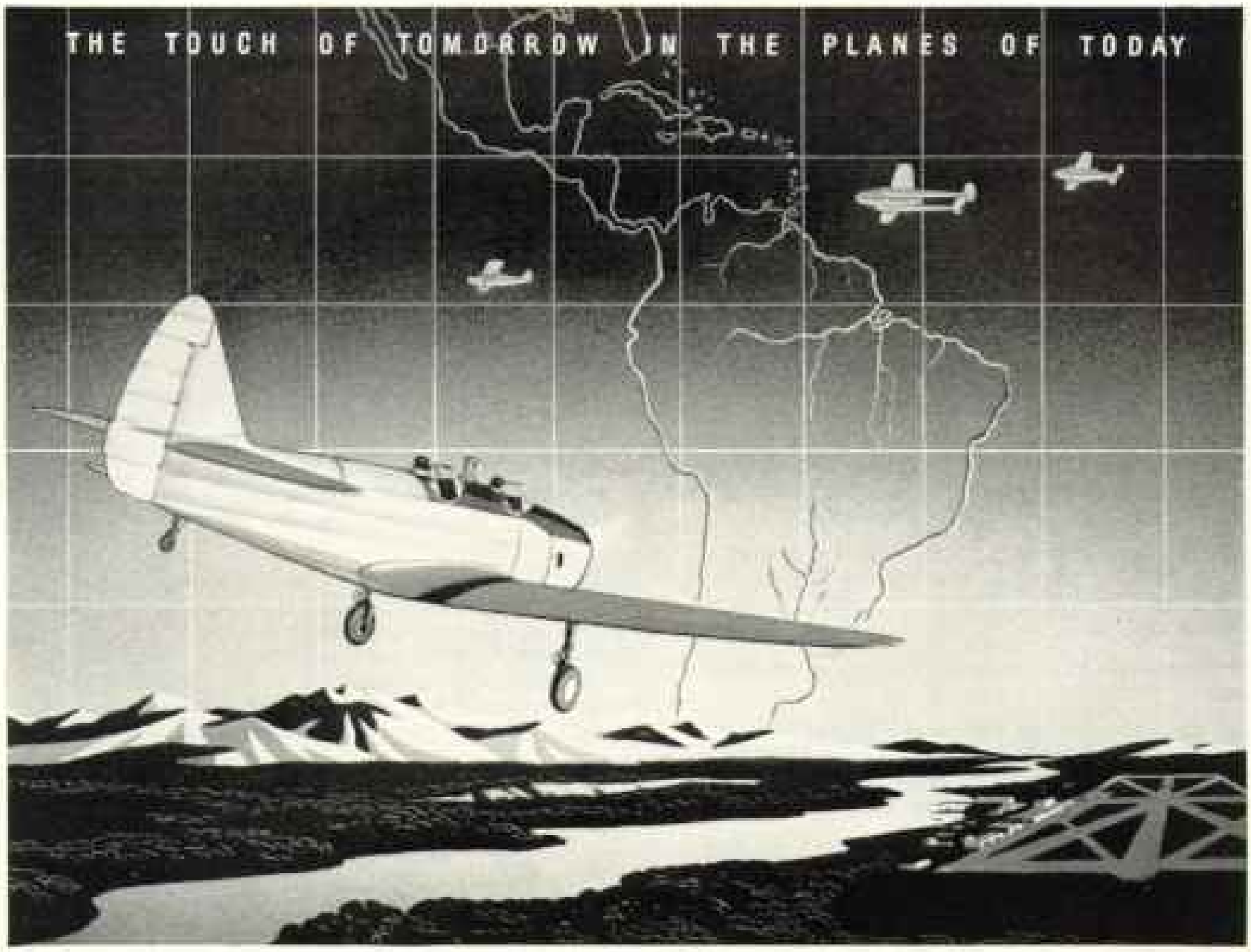
The Army-Navy "E" awarded to Nash-Kelvinator Corp., Propeller Division.

But the progress of Nash-Kelvinator before and during the war will not stop when war ends. Every new skill, new method, all our new knowledge will be applied to the building of better automobiles, refrigerators and electrical appliances than have ever been built before.

NASH-KELVINATOR CORPORATION
Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

NASH N·K KELVINATOR

BACK THE ATTACK WITH WAR BONDS—BUY MORE THAN BEFORE



Flight Plan for New Frontiers

Swift progress is in the air . . . both figuratively and literally . . . for our neighbors to the South.

Vast land areas—far reaches of the interior—fabulously rich—beckon our vigorously air-minded amigos. Air trails already web the maps.

Fairchild planes play a vital role in the ambitious plans of the Latin American nations. They have long been familiar sights in the skies above Brazil, Chile, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Paraguay and Uruguay. Colombia and Peru will see them soon. Fairchilds ply the Amazon trade routes for *Panair do Brasil*. Many are used in private flying.

Hundreds of Fairchild PT-19's train military pilots of these nations. Still others serve as military taxicabs for air force liaison. Keen interest is being shown in the multi-purpose Fairchild AT-21. And still greater attention follows the development of the revolutionary new Fairchild all-metal Cargo plane.

Today, in her own factories, Brazil is turning out Fairchild planes and soon will be building Ranger engines. From Fairchild and Ranger engineers she is acquiring the knowledge and engineering data necessary to produce them in quantity.

Whatever the direction of their aviation activities, these nations have had the friendly, interested cooperation of Fairchild's experts, backed by the full resources of an organization whose credo it has always been to build "the touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

FAIRCHILD ENGINE AND AIRPLANE CORPORATION

30 ROCKEFELLER PLAZA, NEW YORK

Ranger Aircraft Engines Division, Farmingdale, L.I. • Fairchild Aircraft Division, Hagerstown, Md. . . . Burlington, N.C. • Duramold Division, New York, N.Y.
Subsidiary: All-Pla Corporation, New York, N.Y. • Affiliated: Stratos Corporation, New York, N.Y.

WESTERN FIELDS

that feed a Nation at War

LOOK TO THE WEST, AMERICA, and fill your eyes with the boundless expanse of American fields—symbol of Freedom's Food.

Today, on our western prairies, our golden fields of war are working hand in hand with our black smokestacks of war industries.

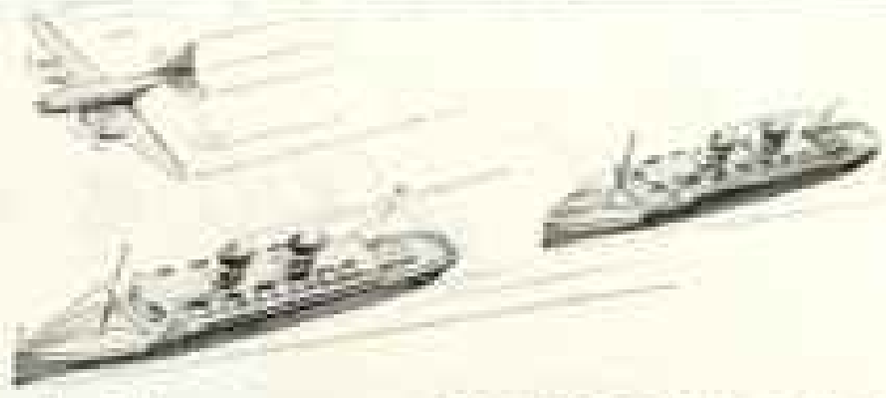
And under the plow, the drill and the combine, the Good Western Earth is turning out the precious food that peoples live on, armies fight on, wars are won on.

Could there ever be a prouder time for an American farmer?

SANTA FE SYSTEM LINES

ONE OF AMERICA'S RAILROADS—ALL UNITED FOR VICTORY

Bridge of ships to our good neighbor, MEXICO



There's a $170,000,000 trade with Mexico in peacetime years . . . and AGWI SHIPS have helped to carry it for half a century.

Say "Mexico", and most North Americans will conjure up visions of fiestas and colorful scenery. Few realize the importance of peacetime trade with Mexico, yet it comes "close to home", both sides of the border.

To the Mexican citizen it means machinery, cars, radios, tractors, and many other articles manufactured here.

To the business man in the States, it means vital metals—copper, lead, zinc . . . as well as oil, rubber, fibres, and vanilla for his wife's baking, wax for her floors, coffee for her table. And where would our popular chewing gum be, without Mexican chicle? Great steamship organizations have been built up to serve this peacetime trade . . . *fleets of ships, modern docks, warehouses, and shore personnel, known and trusted by Mexicans engaged in every phase of the complicated export-import business.*

* * *

For more than 50 years ships of the Cuba Mail Line have engaged in the carrying trade between our country and Mexico. Today these ships are on war service. But when victory is won, they'll return to their old routes, helping to promote that mutual prosperity prophesied by the Presidents of both countries at their historic meeting at Monterrey.

CUBA MAIL LINE

Foot of Wall Street, New York 5, N. Y.

HELP CRUSH FORTRESS EUROPE
BUY MORE WAR BONDS

There and then . . . the assembly line was born

EARLY in 1913, Henry Ford had his technicians try a new production idea which had come to him as he inspected a watch factory. Instead of having a single group of men make the entire assembly on each flywheel magneto, the unit was moved from one worker to another. The result was a 50% saving in time!

"Why not test this idea on the whole chassis?" Mr. Ford next suggested. So now, along elevated greased rails, each chassis was being pushed by hand as workers added the various parts in sequence. *There and then, the assembly line was born!*

A chain-driven line was soon operating. And the 14 hours once required for a chassis assembly were cut to 1 hour, 33 minutes.

Before 1913 ended, over 100,000 Ford cars had been built, breaking all records for the industry.

This achievement meant more than a saving in time, more than creating new methods for all industry. To Mr. Ford and his associates, this was another step to make life easier for millions.

From the first, the assembly line technique of production eased working conditions. Along with other modern advances, it helped to increase the life span of workers. At Ford, it soon made possible the 8-hour day. And with unskilled labor in many places earning as little as $1 a day, Ford basic pay was raised to $5.

The assembly line also brought price reductions on Ford cars, placing them within reach of more people. Sharing production savings with the public is fundamental with Ford.

Today, in the creation of equipment vital to victory, Ford men continue their search for better ways of doing things. What they are learning is bound to be reflected in the improved Ford transportation of tomorrow.

FORD MOTOR COMPANY

GREAT NORTHERN RAILWAY

BETWEEN GREAT LAKES AND PACIFIC

One of the steps in cheese-making. Fine cheeses come from the milk of fine cows in Great Northern territory.

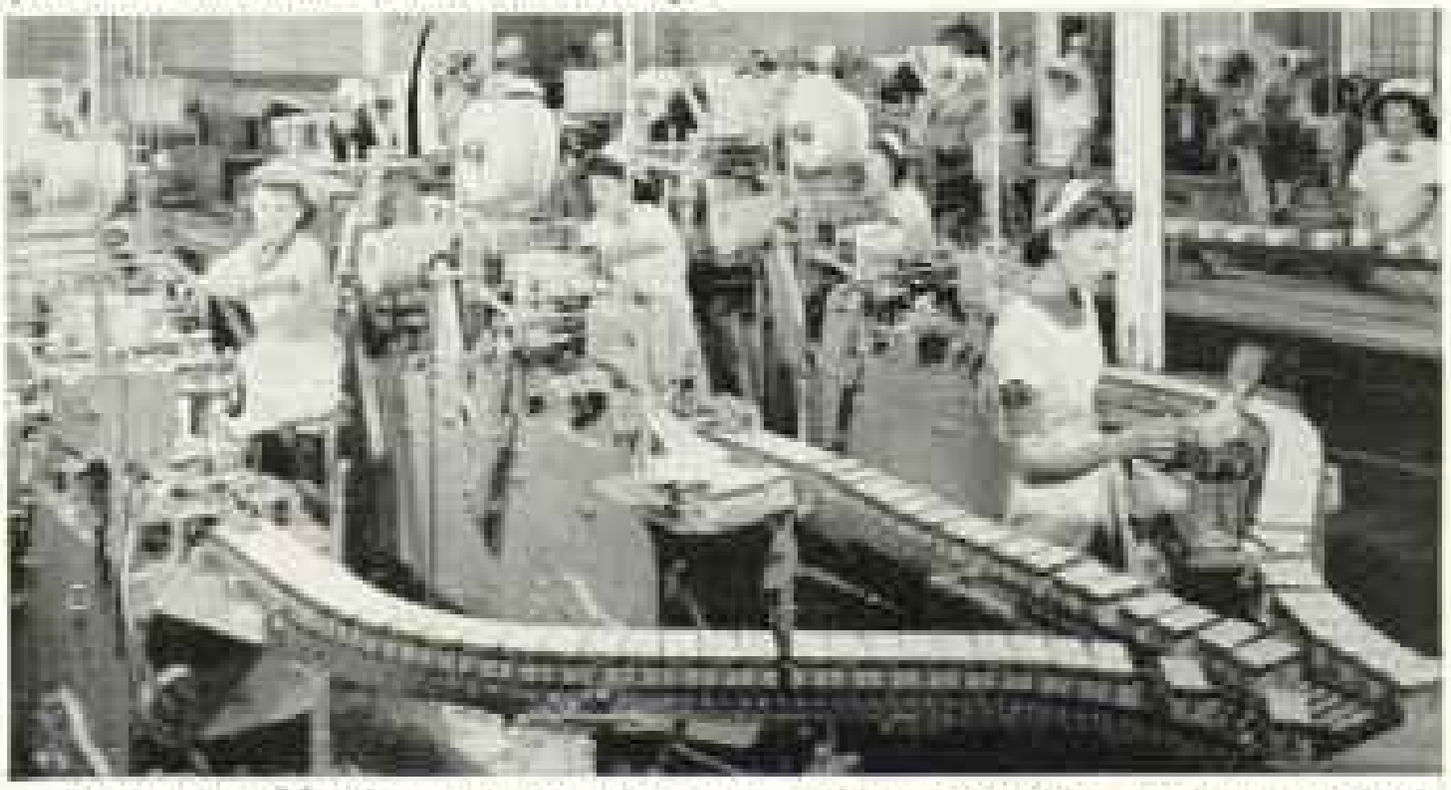
DAIRY INDUSTRY IN G. N. TERRITORY SETS PRODUCTION PACE FOR NATION

Foresight of Railway's Builders Helps Feed America Today

As the tracks of the Great Northern Railway were pushed westward from Lake Superior to the Pacific Ocean, the system's management planned for settlement and development of the Northwest empire and sensed quickly the necessity for broadening the agricultural base of the region. They knew settlers could not prosper on wheat ranching alone, so they encouraged diversification. From that encouragement grew today's great Northwest dairy industry.

In recent years Great Northern has encouraged development of industries utilizing milk. Throughout its territory are hundreds of plants devoted to production of top quality butter, condensed and powdered milk, and a variety of cheeses.

Such territorial service is one of the many things which make Great Northern great. And it explains why Great Northern transports, dependably, a large volume of the Northwest's dairy products.



Packaging Northwest butter for your table. Scientific, sanitary methods protect high quality standards.

One of the many high-producing dairy herds which thrive on the Northwest's rich grazing lands.

Dried milk is shipped in G. N. cars. Dependable transportation by rail is vital to the dairy industry.

AGAIN, ZENITH MAKES HEARING AID HISTORY!

Brings New Smartness and Style at No Extra Cost with the

New Neutral-Color Earphone and Cord

ZENITH made hearing aid history by bringing fine precision *quality* within reach of all. Now Zenith follows through—makes history again—brings you, in its complete production, an entirely new standard of hearing aid *smartness and style!*

After years of research—Zenith now does for the hearing aid what modern styling did for eyeglasses! Now America's hard of hearing can wear an aid with visible parts that are *scarcely noticeable*, because they blend with any complexion.

This smart new Zenith ensemble brings an attractive new "look of youth" to the hearing aid. You'll notice it immediately when you look at yourself in the mirror. Now, no one need feel self-conscious about wearing a hearing aid.

See the proof of this today. And *hear* the proof of excellence in performance that has made America swing *overwhelmingly* to the New Zenith Radionic Hearing Aid. Visit the Zenith-franchised dispenser nearest you. Or, for complete information by mail, use the convenient coupon below.

THE NEW EARPHONE

- Smart, modern, scarcely noticeable! Pleasingly neutral in color so that it blends with any complexion.
- Soundly constructed of beautiful, long-wearing plastic.
- Comfortable to wear because it's feather-light in weight.

THE NEW CORD

- Translucent plastic—looks well with any apparel. Greatly reduces friction or clothing noise.
- Slender, light in weight, more comfortable, lasts longer.
- Perspiration-proof . . . water-proof . . . kink-proof . . . washable. Will not tear. Wipes clean with damp cloth.

THE NEW ZENITH RADIONIC HEARING AID

Accepted by American Medical Association Council on Physical Therapy

$40 COMPLETE, READY TO WEAR

With New Neutral-Color Earphone and Cord—Crystal Microphone—Radionic Tubes—Batteries—One Quality, Zenith's Best.

BY THE MAKERS OF

ZENITH RADIONIC RADIO

RADIONIC PRODUCTS EXCLUSIVELY—WORLD'S LEADING MANUFACTURER

GOOD NEWS FOR CANADIANS

The New Zenith Radionic Hearing Aid is now available in Canada—*direct by mail only*—at $40 complete (Canadian currency) with no additional charge for transportation, duties or taxes! For particulars write our Canadian distributor, Dept. NG-5, Zenith Radio Corporation of Canada, Ltd., Guaranty Trust Bldg., Windsor, Ont.

Mail Coupon for Free Descriptive Booklet

Zenith Radio Corporation, Dept. NG-5
P. O. Box 6940A, Chicago 1, Illinois

Please send me your Free descriptive booklet on the New Zenith Radionic Hearing Aid.

Name _____

Address _____

City _____ State _____

☐ Physicians check here for literature.

ZENITH RADIO CORPORATION, CHICAGO, ILLINOIS

Jewels of Today

ARGUS EYES FOR VICTORY

argus

Cameras and Optical Equipment

ANN ARBOR MICHIGAN

Cutaway view of the Argus "Spotting" Scope which is now as well known for military use as it formerly was among sporting riflemen . . . From the big objective lens thru the fine prisms to the eyepiece, the rays of light are speeded to the eye with a maximum of brilliance and clarity . . . This same fine precision work will again make Argus Cameras leaders in their field.

ARGUS, INCORPORATED • ANN ARBOR, MICH.

TRAVELING SURGERY

This operating room is mainly for dressings. But it is fully equipped. In an emergency, New York Central Representative would have train sidetracked, and an operation could be performed here.

THEY WEAR THE CADUCEUS

Enlisted men of the Medical Corps aid doctors and nurses. Their emblem, the staff and serpents of the Caduceus, is among the Army's proudest ... with a tradition of brave and selfless service.

SHE RATES A SALUTE

The Army Nurse rates a salute . . . not only because she's a Lieutenant . . . but for her superb, often heroic service. The Army urgently needs 2,000 more trained nurse volunteers each month this year.

DIETS FROM KITCHEN CAR

Tasty, strengthening meals, prepared by Army cooks, are brought from the Hospital Kitchen Car. Men on special diets get trays first. When Ward Cars are on a regular New York Central train, the dining-car crew prepares and serves this invalid fare.

AN M. D. IS THE C. O.

Train Commander is a physician of the Army Medical Department, usually a Captain or Major. His orders control every person and every detail of life aboard this traveling hospital.

Trains in White

How Army Hospital Trains speed wounded fighters homeward over the Water Level Route

MILE AFTER MILE, these travelers drink in each new picture framed in the windows of their Ward Dressing Car. It may be the scenic Hudson River, the rich fields of the Mohawk Valley, or the blazing furnaces of some war production center. But always, it's *home* . . . "the good old U.S.A."

This is the last lap of their long, long journey . . . a journey that may have begun on a stretcher, under fire, but is ending now amid the care and comfort of a modern "hospital on wheels."

In this supreme service, New York Central is proud to share. Special schedules fit Medical Department needs. Speeds are planned for maximum comfort, and engineers exert all their skill in smooth train operation. For aboard these "trains in white" ride America's most honored passengers.

YOUR WAR BONDS HELP BUILD ARMY HOSPITAL CARS

REPRESENTS THE RAILROAD

A New York Central Passenger Representative rides each Hospital Train. He acts for the railroad, aiding Train Commander with transportation, supplies and many other matters.

DITTY BAGS GO HERE

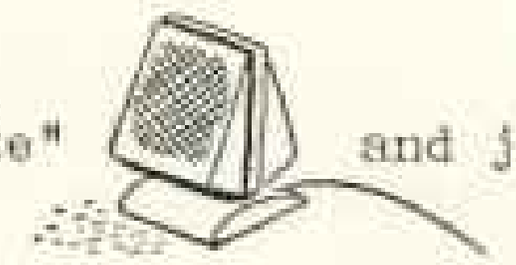
Patients' personal "Ditty Bags" go under bunks. Other luggage goes in baggage car, forward. Many New York Central baggage cars are on military duty. That's why you are asked to travel light.

NEW YORK CENTRAL SYSTEM

New York Central

WHEN YOU'RE APPALLED by a full calendar plus a deskful of paperwork

and at last you relax and settle down

behind your new Electronic "Mike"  and just start talking

your work away . . . and your secretary is protecting you from all

but important phone calls  and when one of them

comes through, you record both ends of it and

that deskful of work melts away like an ice cube on a hot August

day  and mistakes and alibis are eliminated because all

your instructions are on record . . . Eureka! Mr. Vice President,

. . . that's **DICTAPHONE**

Electronic Dictation

A pre-war development, tested and proved in high-priority offices, and now available for essential uses, Dictaphone Electronic Dictation brings new facilities for both executive and secretary in getting things done. Each works independently, more effectively, under less tension. Write for illustrated descriptive booklet—free.

NOTE: Standard Dictaphone dictating machines, without electronic amplification and telephone recording, are currently being produced and offer outstanding value for general office dictation.

DICTAPHONE CORPORATION, 420 Lexington Avenue, New York 17, N. Y.

COPPER SERVES...EVERY MINUTE...EVERYWHERE

COPPER is unique among metals. It serves you every hour. It is symbolic of the American way of life . . . the means of substituting electricity for the muscles of men . . . of providing comfort . . . and leisure . . . *and learning.*

There's copper in the miles of condenser tubes in the power plant that makes your electricity as well as in the generating and distributing equipment . . . in every ship on the seas . . . every locomotive and railroad car . . . every plane. Every means of transportation and every power-driven machine requires copper.

And, there's copper in your radio . . . copper and copper alloys in your refrigerator, plumbing and heating equipment . . . your plated silverware, clocks, fixtures and hardware.

For copper and copper alloys combine to best advantage the properties of strength, workability, high electrical and thermal conductivity, resistance to corrosion, freedom from rust.

That is why these dependable alloys are fundamental to so many industries. Metal workers know there is nothing like copper alloys for rapid, accurate production and that their uniformity contributes to lower costs and greater overall values.

When the red metal gets the green light

Copper, of course, is indispensable for mechanized war. But as soon as conditions permit, copper will resume its place in peacetime industry . . . will help make possible many of the better postwar products we all expect. Anaconda Copper, Brass, Bronze, Nickel Silver will be ready to do their part.

THE AMERICAN BRASS COMPANY

Subsidiary of Anaconda Copper Mining Company

General Offices: Waterbury 88, Connecticut

In Canada: Anaconda American Brass Ltd., *New Toronto, Ont.*

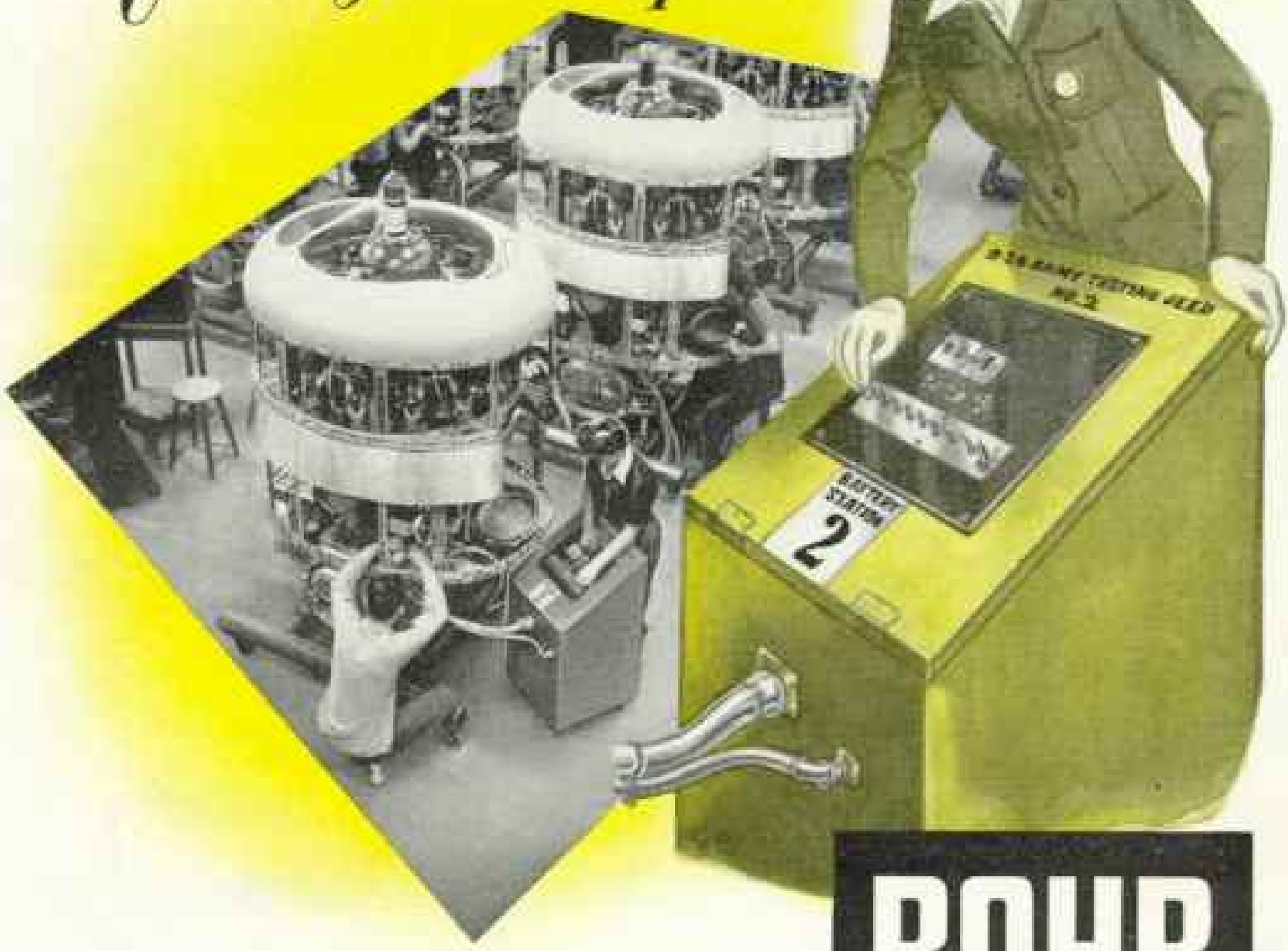
The Army-Navy "E" pennant flies over all of The American Brass Company's U. S. Plants. The Canadian plants also have established outstanding war production records.

LET'S ALL BACK THE ATTACK...BUY MORE WAR BONDS

ANACONDA

Anaconda Copper & Brass

Calling Dr. Jeep!...



"Dr. Jeep" is one of the busiest fellows on the Rohr Production Line, wheeling up alongside of every motor nacelle and supercharger assembly for a new kind of final inspection. He makes the most thorough and accurate pre-flight check-up yet devised. ★ Rohr engineers developed several "Dr. Jeep" models, each for a specific task, to help Rohr Production Fighters maintain the efficiency of their skills, even while working at top speed. They are used to "okay" Liberator and Constellation motor nacelle assemblies and complicated supercharger installations. ★ These mechanical brains work rapidly, accomplishing with swiftness and certainty tasks formerly requiring thirty individual inspections with a variety of equipment. ★ "Dr. Jeep" is symbolic of developments in war plants throughout America, where engineers labor to give American bomber and fighter crews airplanes of maximum dependability and in great quantity. ★ Today we are "on the job to finish the job." After the war, this same American capacity to solve problems must be given a full opportunity to create the jobs that will win the peace we fight for.

ROHR
AIRCRAFT CORPORATION

Buy More Bonds . . .
Hold them till maturity.

ROHR AIRCRAFT CORPORATION, CHULA VISTA, CALIF. • HELPING TO WRITE THE STORY OF TOMORROW

Some mistaken beliefs about *Cancer*

✕ Misbelief #1 . . . THAT CANCER IS A HOPELESS DISEASE

Far from it! Many more people are being cured now than ever before. This is the result of greatly increased knowledge and skill among doctors . . . of better facilities for diagnosis and treatment . . . of greater public realization that *successful treatment depends largely upon early recognition.*

✕ Misbelief #2 . . . THAT ALL LUMPS AND GROWTHS ARE CANCERS

This is not true. The symptoms that *may* indicate cancer are often due to other causes—only a doctor can decide. A leading cancer clinic reports that, of the women examined for suspected cancer, only 11½% had it. The important point is that *all* of these women received immediate attention and avoided needless worry.

✕ Misbelief #3 . . . THAT CANCER CAN BE CURED WITH MEDICINE

It cannot! Beware of quacks who promise quick cures. *The only known methods of treating cancer effectively are X-rays, Radium, and Surgery,* alone or in combination. These methods are successfully treating cases which, not many years ago, would have been judged hopeless. Getting to the doctor early is *important.*

✕ Misbelief #4 . . . THAT CANCER STRIKES WITHOUT WARNING

Cancer *does* give warning! Everyone over the age of 30 should know these common signs of cancer:

- Any unusual lump or thickening, especially in the breast.
- Any irregular or unexplained bleeding.
- Any sore that does not heal, particularly about the mouth, tongue, or lips.
- Loss of appetite, or persistent, unexplained indigestion.
- Noticeable changes in the form, size, or color of a mole or wart.
- Any persistent change from the normal habits of elimination.

Send for "A Message of Hope About Cancer."

Metropolitan Life Insurance Company

(A MUTUAL COMPANY)

Frederick H. Ecker,
CHAIRMAN OF THE BOARD

Leroy A. Lincoln,
PRESIDENT

1 MADISON AVENUE, NEW YORK 10, N. Y.

Metropolitan Life Insurance Company
1 Madison Avenue, New York 10, N. Y.

Please send me a copy of your booklet, 84N, "A Message of Hope About Cancer."

Name_____

Street_____

City_____ State_____

"Those engines sure have the power!"

THE brother of a waist gunner on a Boeing Flying Fortress wrote Studebaker quoting him as saying: "Those Wright Cyclone engines that Studebaker builds are really dependable and sure have the power."

Comments like that are fully appreciated, of course. But Studebaker men and women know that what count most are the accomplishments of stout-hearted air crews and rugged ground crews of our country's warplanes and the achievements of our fighting forces everywhere.

Whatever satisfaction the Studebaker organization may derive from the extent and consequence of its war work is always tempered by the realization that Studebaker is only one unit in a vast American fighting and producing team on which everyone's effort is important.

Awarded to Aviation Division ARMY-NAVY E AWARD *of The Studebaker Corporation*

UNSUNG HERO OF OUR NAVY

Aerial radio gunner in a Navy dive bomber! One of the toughest jobs of all! Let's show him we're for him and

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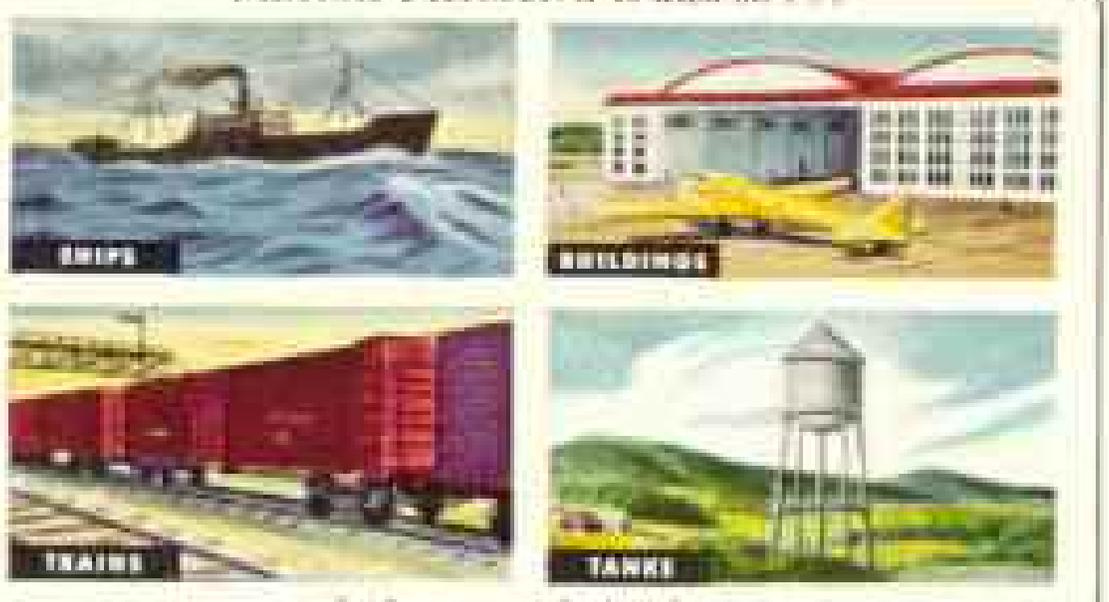

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