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# THE NATIONAL GEOGRAPHIC MAGAZINE

MAY, 1944

Liberated Ukraine

With 22 Illustrations and Map

EDDY GILMORE

Nigeria: From the Bight of Benin  
to Africa's Desert Sands

With 17 Illustrations and Map

HELEN TRYBULOWSKI GILLES

Kano, Mud-made City

10 Natural Color Photographs

Coal: Prodigious Worker for Man

With 20 Illustrations

ALBERT W. ATWOOD

The Isles of Greece

With 11 Illustrations and Map

20 Natural Color Photographs

RICHARD STILLWELL

Ascension Island, an Engineering Victory

With 21 Illustrations

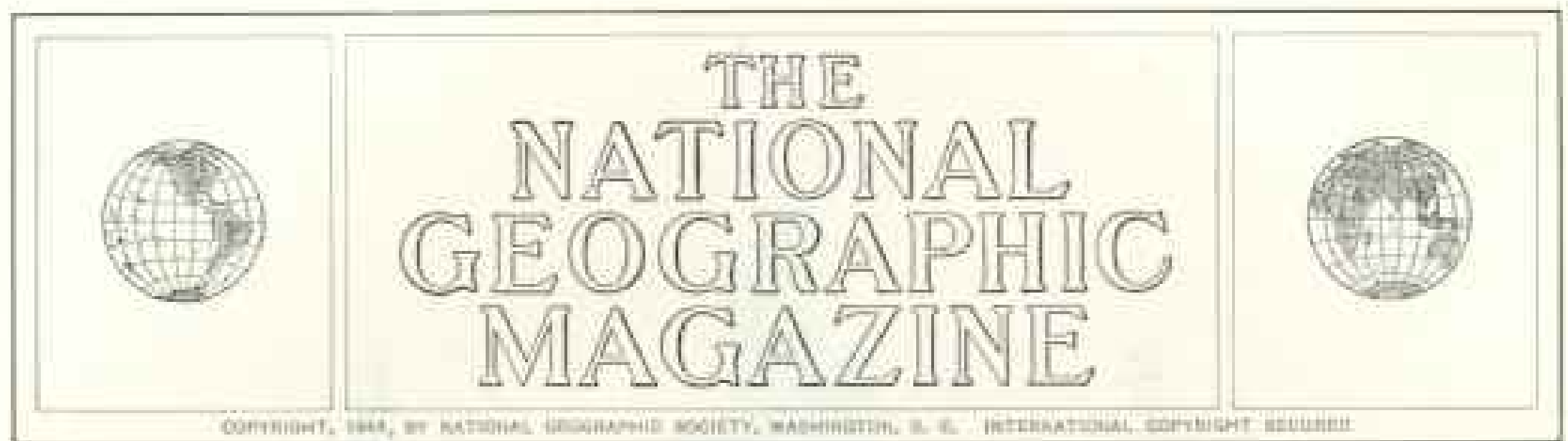
FREDERICK J. CLARKE

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## Liberated Ukraine

BY EDDY GILMORE

**T**HE room was big and bare. Light from four fat candles tried to fight its way through the gloom, but could get no farther than the little mellow circle around Leonid Lebedev and his three associates, who sat about a plain pine desk, the room's only piece of furniture.

Outside there was a constant low rumble as truck after truck rolled west of Kiev, capital of the Ukraine, toward the front (map, page 516). Every few minutes this rumble would be broken by the high-pitched roar of a tank rumbling by. And then there would be the slug, slug, slug of the hard boots of the soldiers trudging off to fight and die for liberation of the Ukraine.

Lebedev, chairman of Kiev's new City Soviet, a blond, smiling young man who looked surprisingly like Jack Benny, stopped what he was saying and listened. From down the road came those unmistakable minor tones of Russian song, tones that always seem so Slavic and melancholy to me. This was a song of soldiers, and out there in the cold night they were singing as they marched off to battle.

I stepped to the window and peeped from behind the blackout. The night was dark, but there was a faint moon, its rays highlighting the tips and sharp edges of the soldiers' bayonets as they swung by in song. I turned back to Lebedev. He raised his eyes and smiled a proud smile.

"You say that sounds sad," he said. "Well, it isn't. Those soldiers are happy. Why, it's even a happy song! Those soldiers are happy because they're liberating the Ukraine."

Every Russian seems to love the Ukraine. It's their land of romance, of southern skies, guitars, soft music, and girls with honey-colored hair and bright-blue eyes. But the Ukraine is more than that. It has much of the

richest agricultural land in the Soviet Union. It has fine cattle and hogs, and its mineral wealth is far from being fully explored.

Lebedev and his comrades, Zinovy Serdiuk, Alexei Davidov, and Vasili Chervonov, were all young men. While their army fought on up ahead, they stayed here and built as others liberated.

There is work to be done in the Ukraine—millions of man-hours.

### Rebuilding Cities and Villages

Kiev once had close to a million people. Now it has about 70,000. Throughout the other parts of the Ukraine which the Red Army has freed in its brilliant autumn and winter campaign, it is almost the same story.

Hundreds of the Ukraine's pretty little villages have been burned or blasted from its rich earth. Thousands of head of cattle have been removed to Germany. Enough hens to stock the farmyards of a State in our Midwest have been shipped west by the invaders. Factories have been smashed, set fire to, or blown sky-high with dynamite.

All of the fine bridges that spanned the great Dnieper—water artery of the Ukraine—have been torn down or scattered in its waters by explosives. The mighty Dnieper Dam in the Dnepropetrovsk sector is ruined (page 531). The apartment houses and the once stately public buildings of its cities have been wrecked. What was once a land of proud beauty has become one of the most desolate places in all of vast Russia.

Thousands of collective farms have been robbed of their tractors and of the mechanized farming equipment installed at such great price, labor, and sacrifice by the Soviets.\* I

\* See "Roaming Russia's Caucasus," by Rolf Singer, NATIONAL GEOGRAPHIC MAGAZINE, July, 1942.



Dr. Vera Demichloff

### Of Peacetime's Monks, Many Are Slain or Enslaved, and Their Monastery Is a Ruin

Decorated outside with mosaics of holy figures, this church was a part of the *Lavra* (monastery) in Kiev's Petchersk, or Cave Town, section. Its catacombs preserve the bodies of ancient saints. German invaders fired 33 of the *Lavra's* buildings. They carried Kiev nuns into forced labor.

have been into farmhouses where even sewing machines were taken away by the Nazis.

But life is slowly taking shape again.

Out into the villages the Soviets are sending agricultural experts. These experts are rounding up all the old farmers and women. There are no young men left. They are all in the army or have returned to the soil as soldier dead. The old men and women are gathering day and night with the officials and planning for spring.

There are many scenes through the country that tug at one's heart and make those of us who have been reporting on the war for a long time wonder again why the cold, calculating plans of high commands have to strike so ruthlessly at the little people.

A small village outside Kiev is an example.

We were bumping through it in a mud-covered but efficiently humming United States-made truck. Our driver wanted a drink of water. He stopped at what had once been a

house because he saw some people around a well. An old woman, her shawl wrapped about her head in Ukrainian fashion, was dragging her tired feet through the rubble left by fire. Under her arms she was carrying a picture.

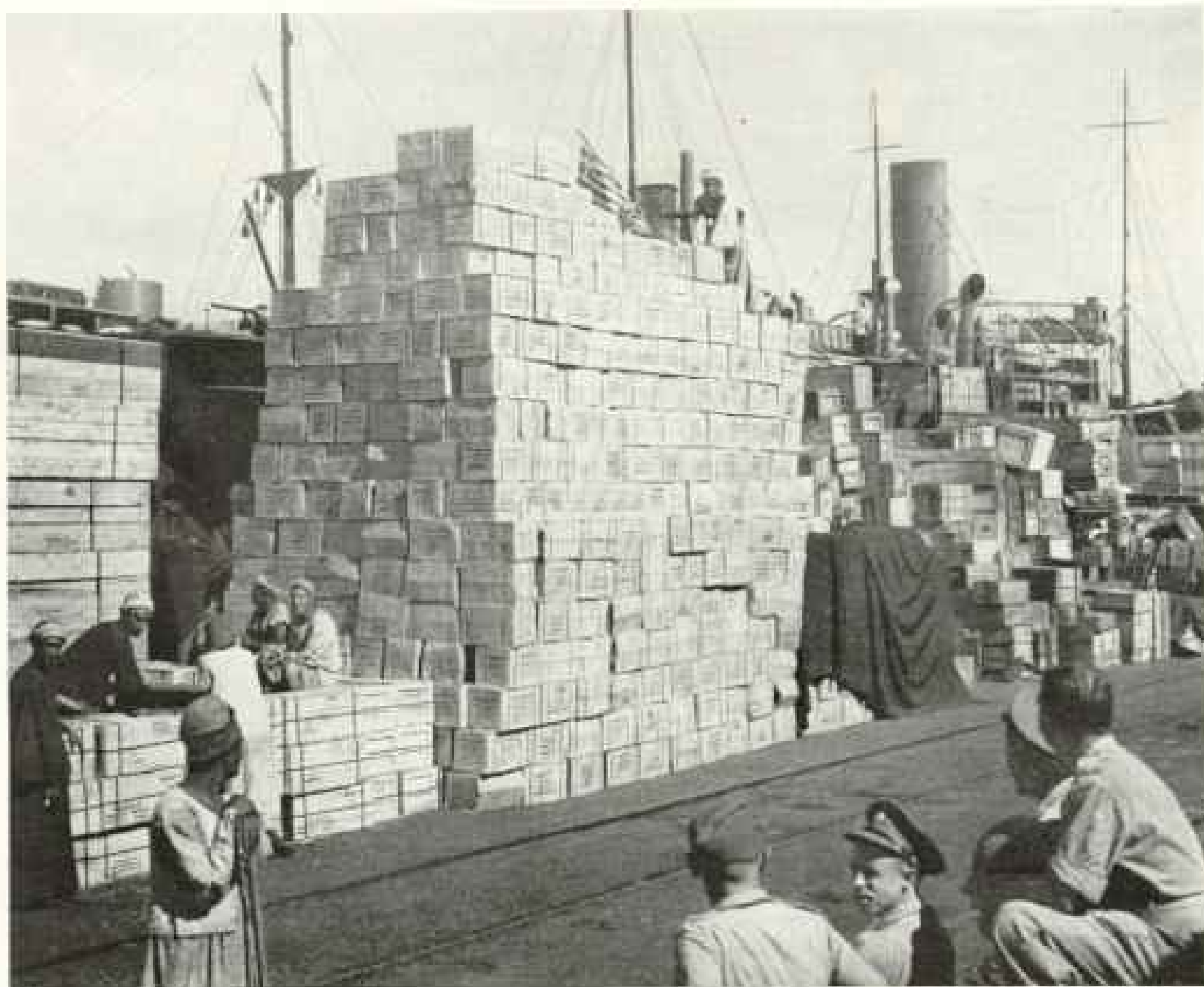
"This was your home?" I asked her.

She started and looked at me with frightened old eyes as she took a firmer grip on her picture.

"Don't be afraid, grandmother," I told her. "I'm an American."

The old lady relaxed her grip on the picture. "Yes, it's my house," she said. "I was born in this village and married here. I have lived in this house for forty-two years. I've had four children here and I've had hard work and happiness and some sadness. But who doesn't in a lifetime? But now it's all gone. I don't have a home any more and I don't have a husband any more and I don't know what has happened to my sons."

She tenderly showed me her picture.



AP from Press Assn.

### By Greek Ship and Persian Gulf Dock, Lend-Lease Feeds Russia's Unabating Offensive

By March 1, 1944, the United States had sent to Russia 8,800 planes, 5,200 tanks and tank destroyers, 190,000 trucks, 36,000 jeeps, 7,000,000 pairs of army boots, and 2,600,000 tons of food. Included were 13,000 tons of seeds, principally for the Ukraine. Total cargo since October, 1941, was 9,500,000 tons.

"This was my husband. The night the Germans came through here we ran for the woods. We hid there, and then when we saw the fire my husband said he was going to look to see what was happening. He never came back. What, oh what have they done with him?"

#### Many "Never Came Back"

Vera Kravchenko's husband is not the only man who disappeared like that. Soviet reports almost every week carry a dispatch about the advanced column of the Red Army, which has come across a long column of Russian civilians being marched westward as the German Army retreats.

There have been cases of as many as ten thousand being herded down a snowy road by German Tommy gunners. Think of those the Red Army did not reach in time!

Through many parts of the Ukraine I have seen villages like the one where Vera Krav-

chenko lived—little places that happened to be in the way of a big mechanized army and got wiped out.

They, too, are rising again. In many places old men who managed to hide their broad axes from the invader have gone into the forests, felled trees, and cut them with their own hands into boards. Then they have dragged the boards back to their villages to make places where they can sleep and be warm.

Until the authorities have moved in with sawmills and lumber, these peasants have followed more or less the same system. Where their houses once stood they have dug out basements. They have cut trench doorways leading to these square holes in the ground.

With the wood they have cut from the forests they have made walls which rise from the ground about five feet. On top of them they have built little slanting roofs, and their women have put on a quick thatching to hold back the snow.







Eddy Gilmore

### Its Monastic Center on the Dnieper Was to Kiev What the Vatican Is to Rome

Soviet contributions to church repairs have been announced by the Metropolitan of Kiev. In 1943 Church and State healed a quarter-century rift. Priests pray for the Red Army, donate defense funds. For heroism as fire watchers, some have been decorated (page 514). Nazi-appointed bishops fled Kiev with their masters.

From the clay of the Ukraine they have modeled little fireplaces, and with anything they managed to save they have moved in.

Thousands upon thousands of Ukrainians lived this way this winter, and in the fierce patriotism that has swept through their land they are at home again—deeply wounded, to be sure, but at least there is a roof over their heads, and warmth; and it is theirs, not the Germans'.

#### Ukrainians Love Song and Dance

Ukrainians, above all other Russians, I believe, love song and dance. I do not necessarily mean the opera and the ballet and the symphony, for they rightly belong to Leningrad and Moscow.\* But I mean simple melodies with harmony, and dances into which boys and girls, husbands and wives, and even old men and women throw themselves with an abandon that is fine to see.

I have met many Ukrainians since I came to the Soviet Union in 1941 and I don't recall one of them who couldn't sing or dance—or at least wouldn't try to with that complete

lack of self-consciousness that Russians, above all other people I know, seem to have. It would be very hard for a Ukrainian to live without making music or without turning a toe or slapping a foot to music.

Realizing this, Soviet authorities quickly did something about it.

It may seem strange to tell that singers and dancers followed the Red Army into many areas. But that is what happened, and they were just about as welcome as the soldiers themselves.

I had the great pleasure of attending the opening performance at the Kiev Opera House after the Germans had retreated. For some reason they did not destroy the Opera House or its lighting system. I don't know why this was. Perhaps they just did not have time, for they fired everything else around the city that seemed to have anything to do with culture, including the University Library and some of the buildings of the Ukrainian Academy of Sciences.

It was an unforgettable evening.

The house was dark when we entered because the manager had to save precious gasoline to operate his generator for the lights on the stage. We felt our way to our seats

\* See "I Learn About the Russians," by Eddy Gilmore, NATIONAL GEOGRAPHIC MAGAZINE, November, 1943.



EVELY GILMORE

### Happily They Return to School through Kiev's Dismal Ruins

German school-wrecking and textbook-burning set back their education two years. Classes reopened as quickly as desks and teachers could be found. New trade and military academies are rising to meet the State's needs (page 520),

and just sat there. A few of us had flashlights, and they made a strange sight as they cut through the dark house, showing the way for Red Army men and women and citizens of Kiev who were coming to see their first entertainment by their own people in over two years.

The Germans had kept the Kiev Opera House going nightly when they occupied the city. They used some Russians—much against their will—but most of the Soviet performers who got caught in the city wriggled out of performing in one way or another.

Moscow had sent out a number of artists to fill in on the bill, but the bulk of the cast was Ukrainian. They sang that night with notes that came from the heart, not from the lungs.

We felt the reality of the front, too, because the performance was punctuated throughout by Red Army guards entering with bayoneted guns and calling out for this and that officer and private. There were soldiers sitting in the audience, many with Tommy guns or rifles sticking up from between their seats.

All of the reoccupied cities are experiencing the same thing. Theaters which were not destroyed by the Germans were opened almost immediately, and where there are no theaters, standing performances are being put on in the best and biggest place available.

### Guitars and Accordions for Reoccupied Areas

Moscow has sent several loads of guitars and accordions to the Ukraine, for Stalin—who knows his people perhaps better than any other national leader—realizes these items are just as important in rebuilding the occupied areas as are bread, meat, clothes, and tractors (page 520).

This summer when the great yellow moons of the steppe spread their golden light over the fields, sowed this time with Soviet grain, songs of the Ukrainians will float once more out into the soft Russian night.

Who will be there to play for them and who will have strength enough after a hard day's work, much of which is being done by hand this year, you may ask.

Girls and women and old men and boys, of course.

"Have a heart and have a soul. All else is passing fashion," may be a saying among a great many Russians, but in the Ukraine the ancient saying should include the guitar also.

I spent a very happy evening one night in the Ukraine with some people who had a guitar, warm hearts, and certainly souls. They started things out with a bowl of borsch, that wonderful red soup of the Ukrainians; and so far as I am concerned it ended with a well-known Ukrainian poet—I said poet—kissing me smack on the mouth, his flowing white mustaches thrown in.

This old man said he had been composing poetry since he was nine, but he simply could not do it while the Germans were around.

"But now," he declared, throwing wide his arms, "we are free. Our Red Army is here, and look, we may not have much more than borsch, but we have our music. Why, we've even got some American friends."

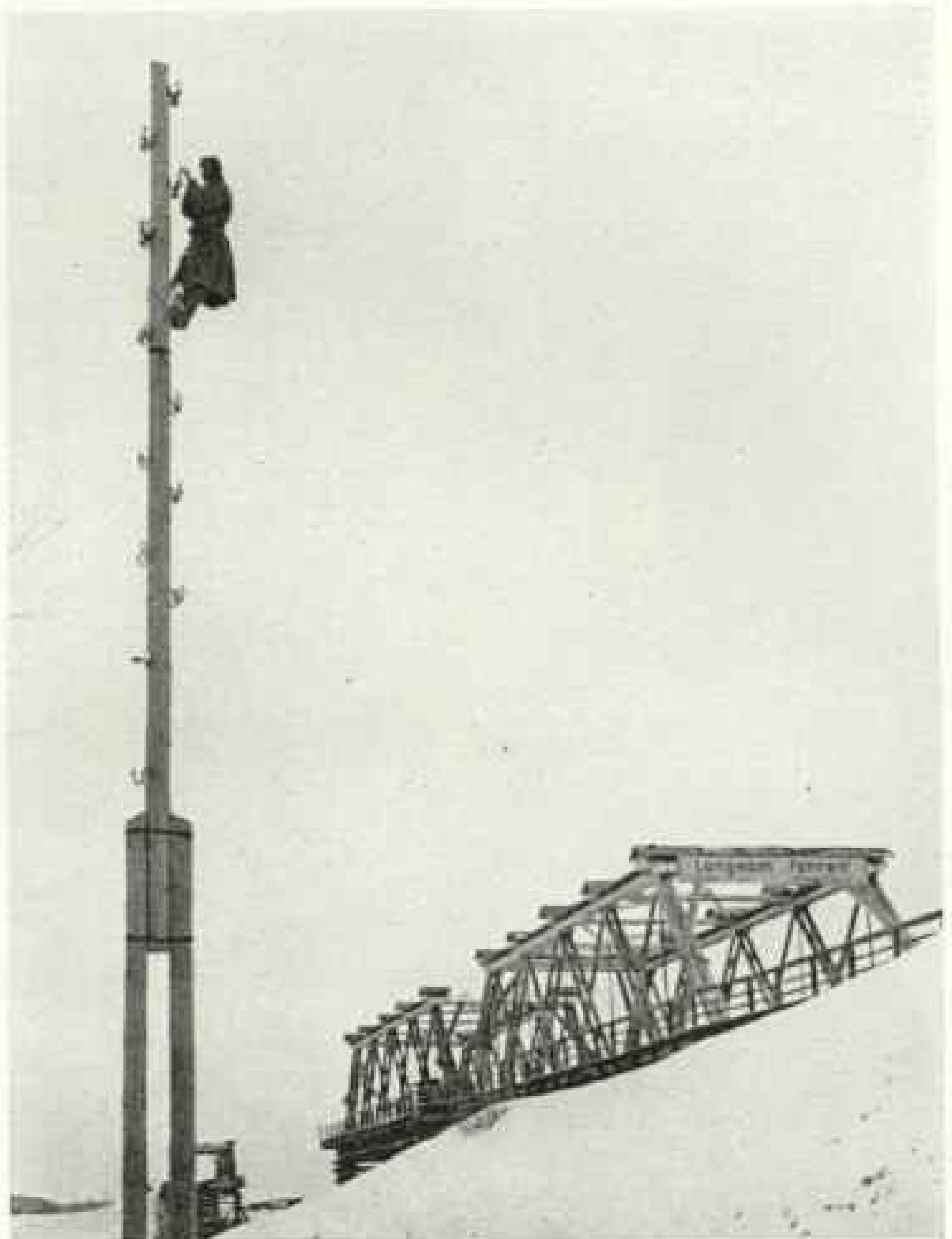
I asked if he was going to write any more poetry.

"Write poetry?" he asked in amazement. "Can that boy help playing a guitar? I've got to write, just as he has to play. We are Ukrainians."

It was this kind of people that Erich Koch, Hitler's boss of the occupied Ukraine, tried to induce to turn out crops for Germany—willingly. He told them that if they excelled in their labors for the *Wehrmacht*, he planned to re-establish private ownership of the land in the Ukraine and that the peasants would enjoy such "benefits."

The peasants became slightly disturbed when they found some of the handbills which Koch had passed out to the Nazi soldiers. They read:

"I, as Commandant of the Ukraine and by the Fuehrer's will, must open her up and make her useful for the New Order in Europe. The



"Go Slowly," the Sign Told Nazis, but They Ran!

The evidence is plain. Hasty dynamiters spared the bridge's foundations, which will support a temporary span. Telegraph poles, sturdy and numerous, defied hurried wreckers. Wires—here under repair—proved easier targets. City lines were snipped with shears fastened to long poles (page 317).

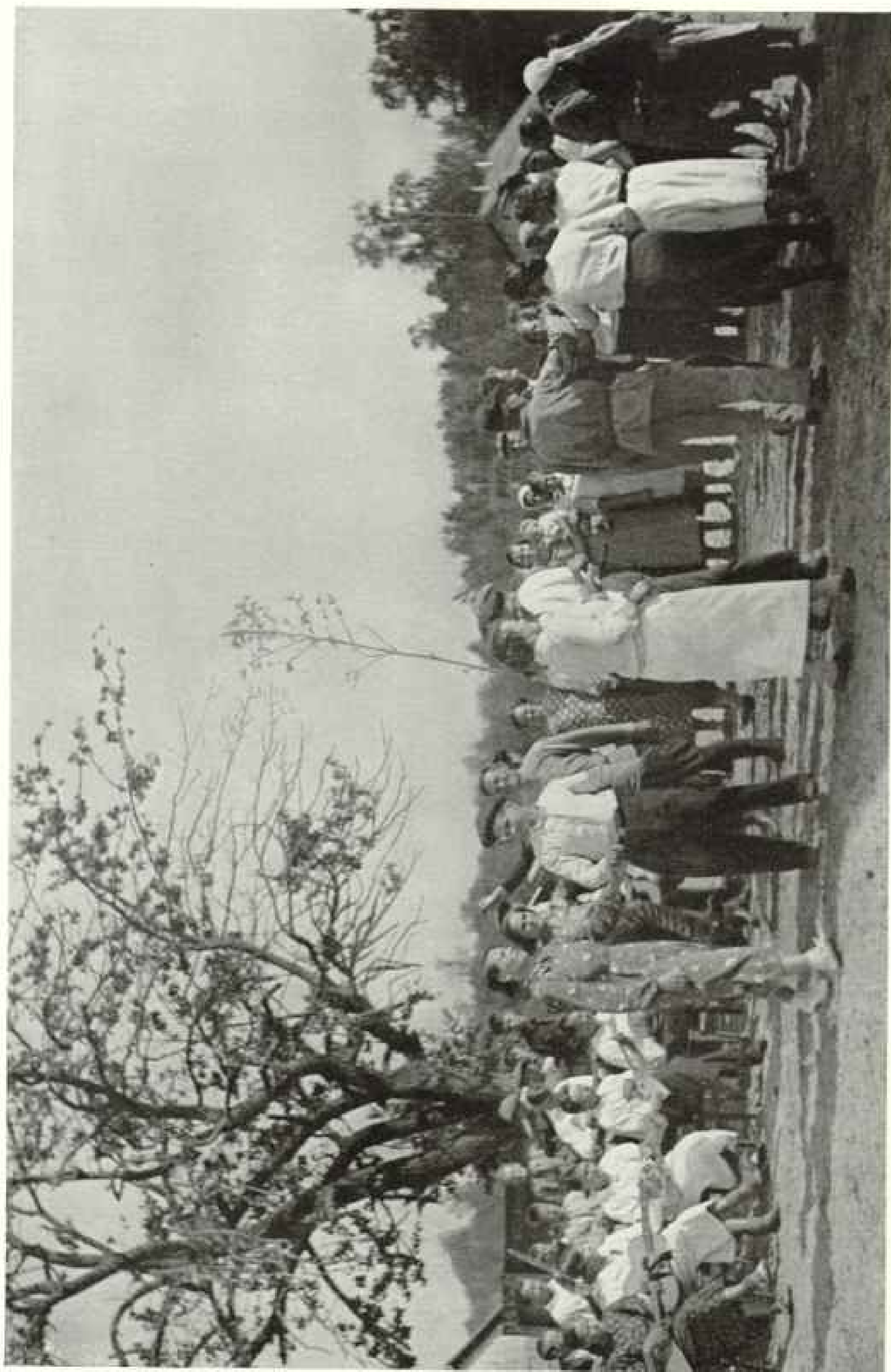
question is to bring in a new population, which will be the greatest work in European history. I am doing it for you and your comrades-in-arms. I don't want your names or your money; I ask only for your faith in National Socialism."

#### Farmers Effective at Sabotage

Relatively speaking, the Nazi occupants of the lush Ukraine got very little from her rich vastness. Chief reason was lack of cooperation among the people. From what I have seen of the war, I believe the farmer can hold out better against the invader than members of any other group of society.

A farmer has a way of seeming to work

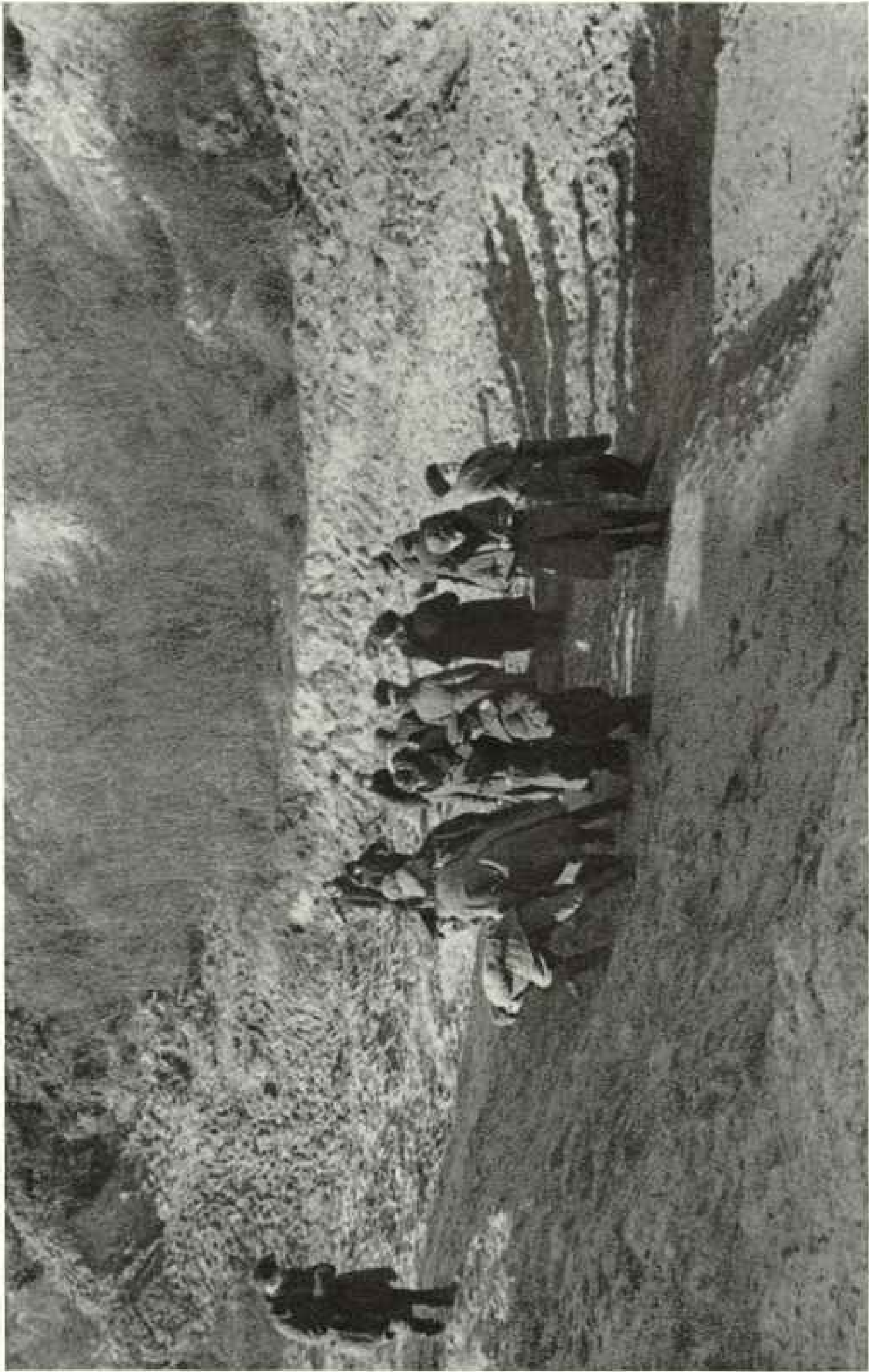




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**Fiddle, Balalaika, and Guitar, Playing for a Peacetime Farm Dance, Are Essential Instruments to Wartime Rebuilding**

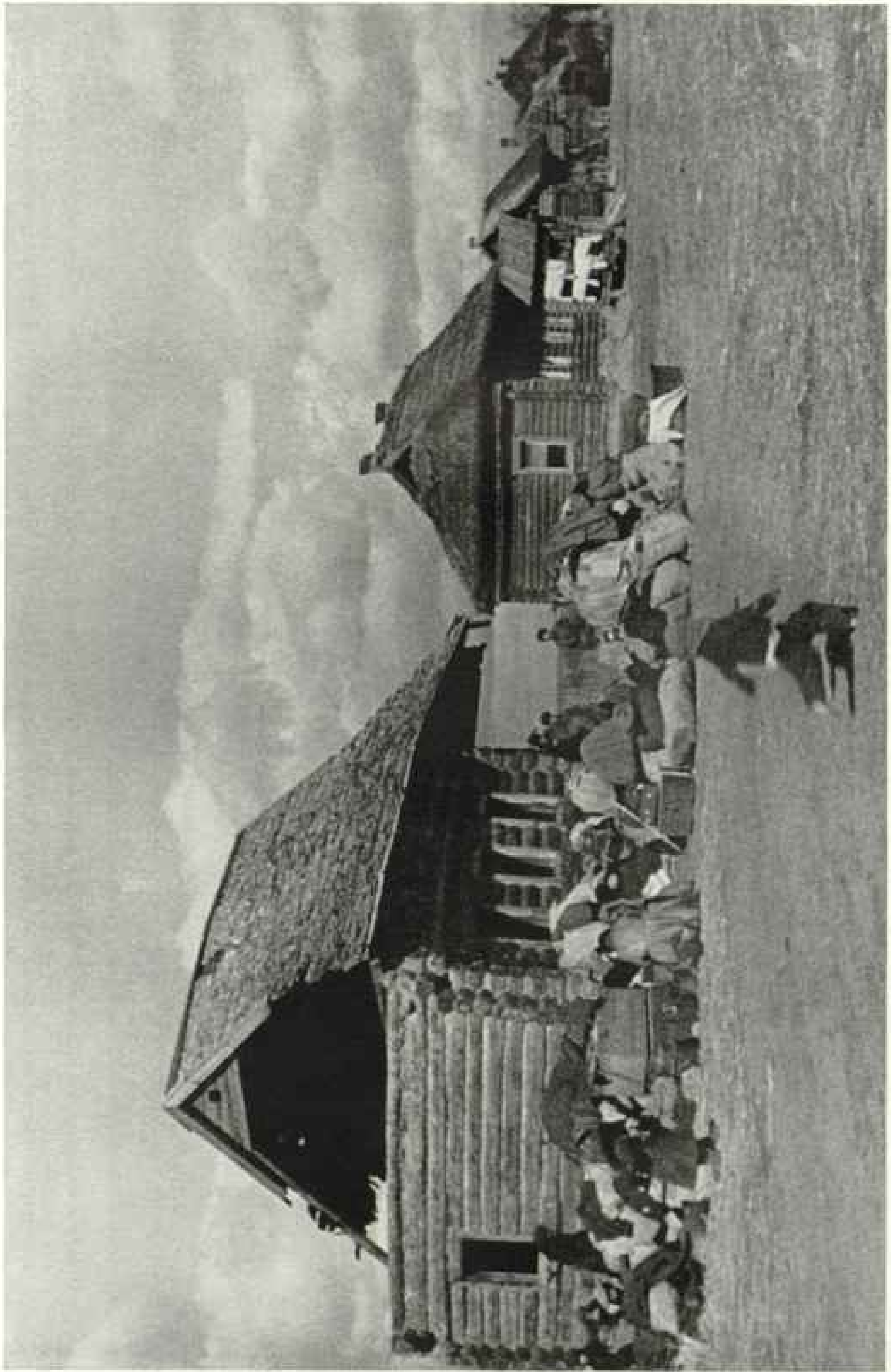
Though Russians work an 11-hour day, they find time for music. As the Red Army relieves an area, singers and dancers frequently follow to entertain the populace. To spur Ukrainian workers, Stalin sends guitars and accordions (page 538).



U.S. ARMY

### Russians Examine the Grave of Thousands Exhumed and Cremated to Conceal Evidence of a Nazi Machine-gun Massacre

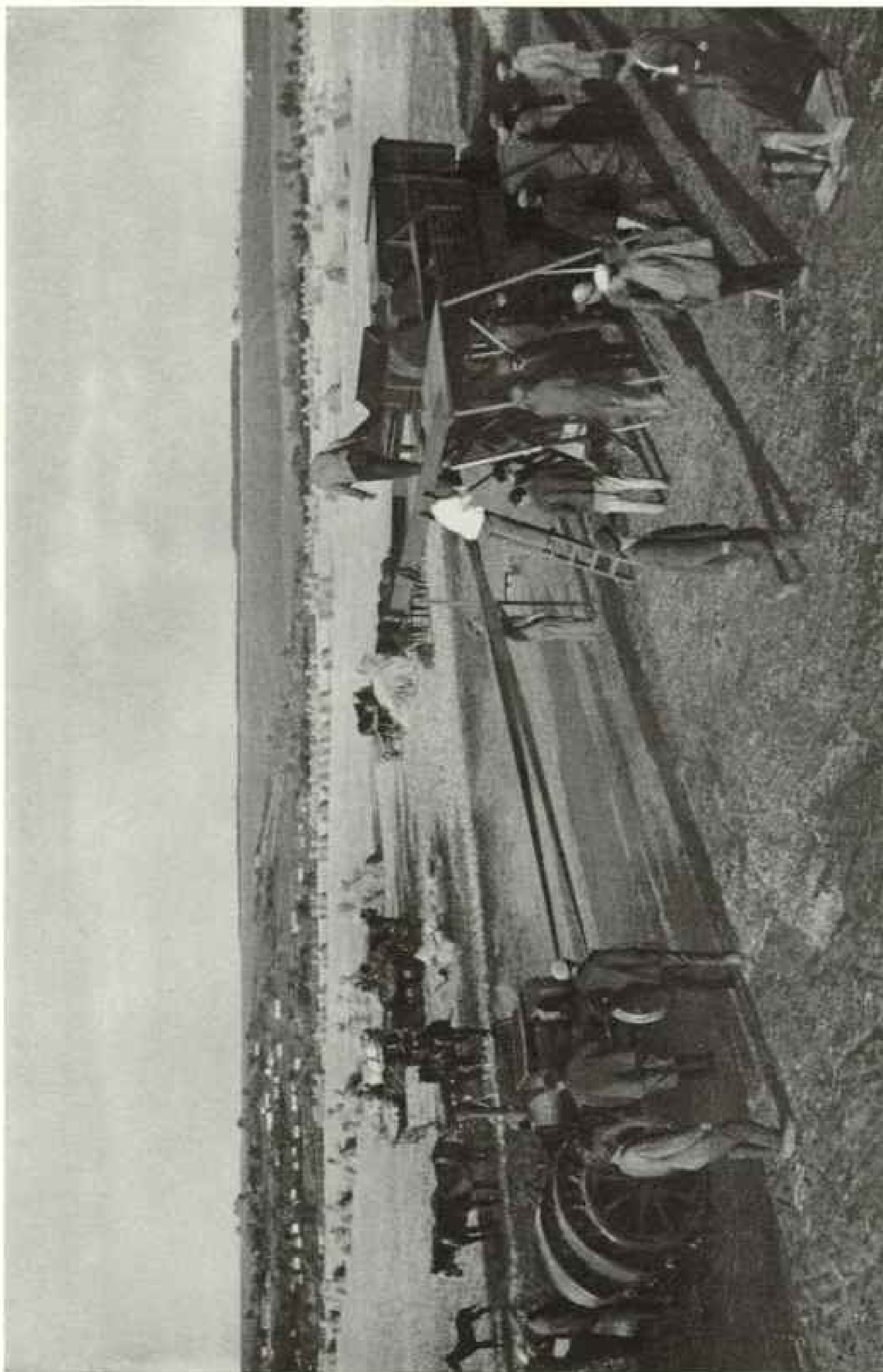
Overlooked by the enemy, bones, clothes, and documents were found in this ravine near liberated Kiev. Three eyewitnesses told how they had been compelled to build funeral pyres of cemetery stones and oil-soaked wood. Ordered to construct a fresh furnace for which no bodies were available, they feared their own turn had come. Past their guards' blazing guns they fled one midnight.



**Little Ivan Runs for Joy as His Weary Elders Arrive Home to Put a Shell-torn Roof over Their Heads**

Undevastated Russian towns adopt liberated villages and send carloads of supplies. Money flows in from distant Siberia. In America, the Russian War Relief is engaged in a campaign to ship three million emergency kits containing, among other things, thread, needles, buttons, towels, gloves, medicines, gauze, soups, cookies, and candies.

Reuter



Part 1000

**Harvesting Russia's Bread, This Was the Ukraine before It Lost Horses, Tractors, and Threshers by Evacuation and Theft**

To restore its farms, the Soviet has sent thousands of tractors, set up repair shops, and exempted a million families from crop deliveries to the State. America contributes seeds but cannot spare farm machinery. Women, old men, and boys now do work on this collective farm (page 326).

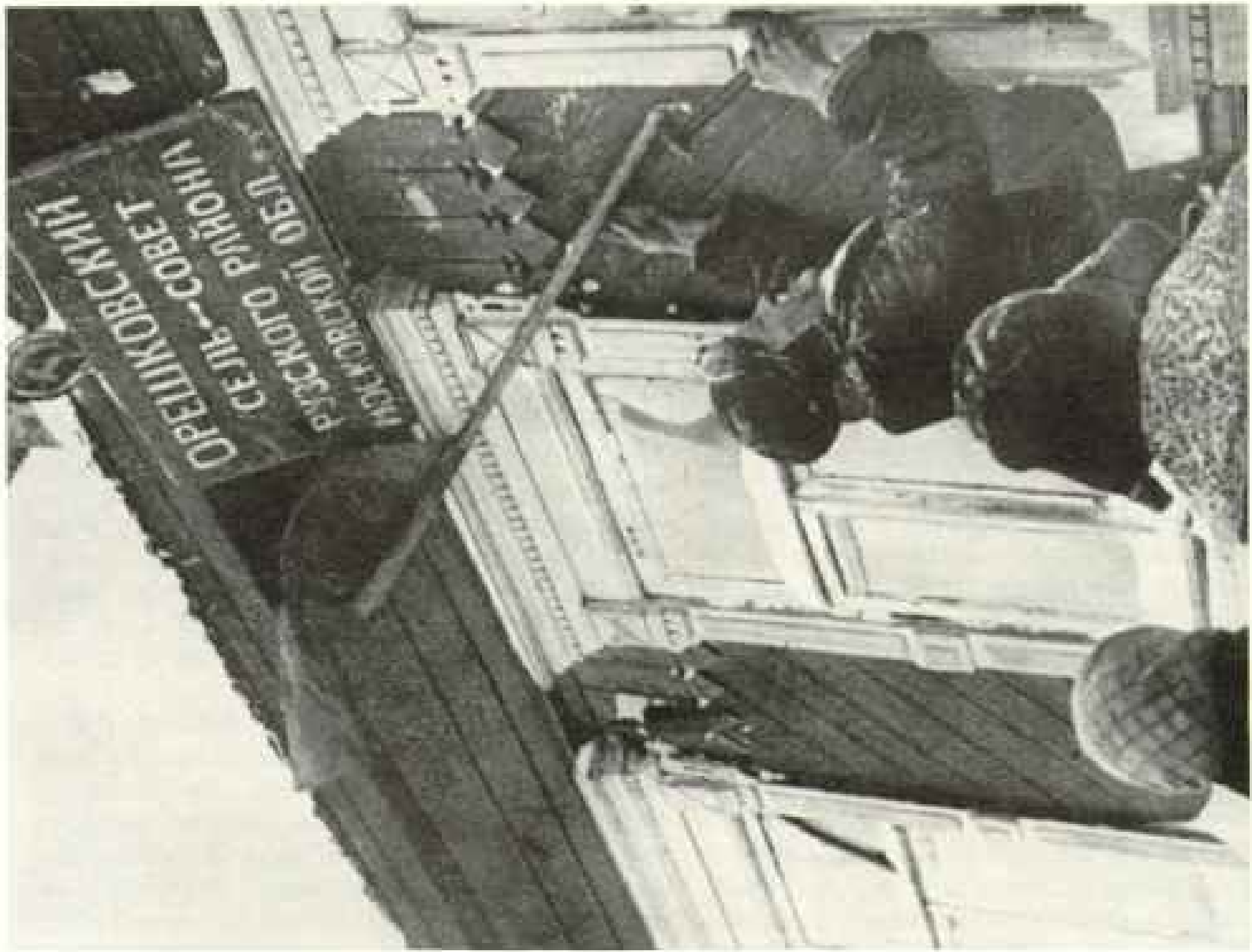




Sam Felt

**Dugout for a Roof, Stump for a Chair, and Broken Sink for the Wash Are Luxuries to Families Home from Forest Hide-outs**

Using mostly local materials, a tremendous rebuilding program is going on in recaptured areas. In 1943 two million Russians exchanged their dugouts for 326,000 newly constructed homes (page 315). Twenty-five factories were set up for production of building materials.



**Triumphantly the Red Flag Returns to a Village Soviet**

Town, district, and region are identified by the sign. Broken windows are boarded up. For nails, villagers use substitutes made of captured German wire.



**Rubbed Out Like Her Lodgers Is Their "Guest Register"**

Belegi, German for "quartered," shows that Nazi troops occupied her home in Tikhvin. Thanks to the Red Army, her days as a slavey are over.

without working. He can plant his seeds under supervision, and still they won't grow into much. He can till his land in the same way, and he can harvest his crops with the fine art of sabotage. This happened on a wide scale in the Ukraine.

It was impossible for the Germans to watch everything. They had hundreds of so-called agricultural agents and they had their Gestapo, but back in the steppe lands and behind the woods and all along the little rivers and streams of the Ukraine the Soviet guerrilla was at work. He encouraged the peasants not to cooperate with the Germans, and when encouragement was not needed, he showed them how to wreck quietly the best-laid schemes of Nazi planners of the "New Order."

Unlike Germany, the Ukraine does not have fences spread about its fields. Cows, hogs, and chickens have a kind of communal way of hanging around their respective collective farms. When the Germans failed to find fences, they asked the peasants how they kept from losing their stock.

"We don't," lied the farmers and their wives. "We must have wire to build fences. We have been losing our cows, chickens, hogs, and sheep for centuries, and we will keep on losing them."

Finding enough wire to fence in the Ukraine was too much for factual-minded Nazis. They told the Russian peasants they would just have to do the best they could. They gave them stiff warnings not to let their animals get lost, but the peasants only shook their shaggy heads and said the Germans asked the impossible.

So, as guerrilla armies continued regularly to feed off the land, German agricultural agents—who flew into rages many times—accepted the situation as caused by a lack of wire.

When the Red Army withdrew from the Ukraine in the first year of the war, it did not have time to take everything with it. Numerous pieces of farming equipment had to be left behind, especially in remote areas. The Germans used some of these in trying to till the land, but many of them, too, were sabotaged. Those that were still in working order were shipped back toward Germany when the Red Army advanced in its present offensive.

The Ukraine is badly in need of farm machinery, and it is being hurried here as fast as the Soviets can get it.

There is a big struggle to make an all-out showing in spring planting this year, but from the Russian authorities with whom I talked, I got the impression that this will be very

difficult. Machinery is one of the worst problems. Most of the Soviet Union's tractor factories that were not destroyed in the invasion are turning out tanks and other monsters of war.

Tractors, of course, are being made and will continue to be made throughout the war, no matter how long it lasts. But in a nation as tremendous as this—one that occupies roughly one-seventh of the earth's land surface—many, many tractors, harvesters, and other types of agricultural machinery are needed. It is a gigantic task, and it is going to take several years to get the Ukraine back on the production basis it once enjoyed as the breadbasket of this Nation.

The Nazis brought few pieces of farm machinery into the Ukraine, and the general result was that the peasants tilled largely by hand. I am afraid many of them will have to continue this way until the Government can get full supplies into the land.

Many of the officials I interviewed hoped America could send over some mechanical equipment, but they realized, naturally, that our contribution must, in the scale of things, be small (pages 515, 523).

I told them of my trip home in 1943 when I visited some of the United States' finest farming lands around Lancaster, Pennsylvania, and in other States, and found that the farmers through these areas also were in need of farming equipment, especially parts.

#### Factories Blasted and Burned

One of the Ukraine's biggest factories which turned out parts for farming machinery was located in Kiev. When the Germans occupied the city, they converted it into a large tank-repair plant. Then, when they were driven out, they converted the factory into one of the most thorough piles of rubble I have seen in this war.

The factory was a couple of city blocks long and about a block wide. The Nazis set about a hundred charges of explosives in the walls and under the supports and set them off all at once. Using anything of the former factory is out of the question. Another parts factory will be built in the capital of the Ukraine, but it will have to be on a brand-new scale.

The same thing happened in Kharkov. Before the war, the Soviets manufactured a considerable amount of farming machinery in this city of once-numerous modern factories and buildings. The Germans converted the factories into tank-repair shops, and when they evacuated they blew them up or burned their insides out. Kharkov, generally speaking,



Reuter

#### Last Survivors of the Herd, a Pair of Goats Emerges from Hiding as from the Ark

To repopulate recaptured grazing grounds, 1,500,000 head of livestock were shipped in during the last four months of 1943. Of these, one-third were animals evacuated ahead of the invasion.

was burned, whereas Kiev was blasted and burned.

In rebuilding these factories and bringing new farming equipment to the Ukraine, such cities as Krivoi Rog, Kirovograd, and Nikopol must, of necessity, play a big role.

As this issue goes to press, the long Battle of the Ukraine is all but ended. Scattering the invader's divisions in the Dnieper's Big Bend, the Red Army has crossed the Dniester into Romanian-held Bessarabia. To the north, it has broken into prewar Poland (map, page 516).

Krivoi Rog's high-grade iron ore is available for rebuilding the Ukraine. Some 60 percent of prewar Russia's iron ore came from Krivoi Rog. Nikopol's recapture makes the task still easier, for this city mines manganese, the steel strengthener.

Kirovograd was once one of the biggest grain centers of the Ukraine. It will soon return to that role, for the Germans were so surprised here by the quick break-through of General Ivan Konev's Army of the second Ukrainian front that they did not have much opportunity to lay waste the grain elevators and mills.

The Ukraine needs power and needs it badly for rebuilding.

The tremendous Dnieper Dam, which the Russians destroyed as they fell back in August, 1941, supplied the Ukraine with much of the electricity which turned the wheels of its many mills and factories, and that, of course, cannot be replaced for a long time (page 531).

Realizing full well the part power plays, the Germans consistently went for the lighting plants whenever they were forced from the cities by the drives of the Ukrainian armies. This is greatly handicapping the Soviets in bringing old life back to the re-occupied land.

Kharkov and Kiev, the two biggest cities of the Ukraine, did not have a power plant left, a bulb burning, a streetcar running, or hardly an electric wire left intact after the Germans left.

#### The Plight of Kharkov

Kharkov was one of the worst messes I have seen (pages 530-533).

On every street in the city electric wires and telephone wires hung limply from poles like giant strings of spaghetti. The Nazis sent out squads equipped with special shears atop long poles, and they systematically cut the wires between every two poles. Outside Kiev, especially to the north where power lines ran





Infra

### In His Horse's Shafts, Grandfather Trudges Home with Mama in the Driver's Seat

A rare sight in the wartime Ukraine is the young man in civilian clothes; chances are he has been a guerrilla. New thatch for skeleton roofs is resettlement's easiest problem. Posts and twigs compose the fence.

into rich agricultural lands, they repeated this operation (page 519).

I have ridden along roads here for ten to twenty miles and seen wires snipped every hundred feet; yet the Russians by now have established much order in these public utilities. Kharkov, Kiev, and even badly wrecked Poltava, have electricity and coal, and wood-driven engines are spinning dynamos.

It will take months, perhaps even years, for the Soviets to electrify the Ukraine as thoroughly as they did before Hitler's invasion. Many a little hut had electricity in those days, but I am afraid it is going to be candlelight for a long time.

#### Government Helps Small Business

It is factories and mines of the Donets coal basin\* that must have power piped to them first, and this restoration is getting along on a rapid scale. And in Stalino and Voroshilovgrad industry is getting a foothold again, but it takes driving and sweating and long hours.†

One of the most interesting features of reconstruction of the Ukraine is the Government's encouragement of individuals opening small enterprises for private profit.

The first official notice of this came in Kiev in *Pravda*, the city's leading newspaper, which the Russians started printing the first week after the city's recapture. The notice advised any citizen, who so desired and who had the qualifications, to start a small business.

This is not so radical as it might seem at

\* The Donets coal basin is some 10,000 miles in area and stretches from Stalino and Rostov eastward to the Don. Its reserves of high-grade bituminous and anthracite are estimated as being between 60 and 90 billion metric tons. Much of the bituminous is of good coking quality. With the rich iron ore of Krivoy Rog, west of the coalfield, the manganese of Nikopol, and ample supplies of limestone and dolomite for smelting, the Donets Basin is one of the largest and most firmly established industrial areas of the Soviet Union.

† See "Magnetic City" (Magnitogorsk), Core of Valiant Russia's Industrial Might," by John Scott, NATIONAL GEOGRAPHIC MAGAZINE, May, 1945.

first, for profit is allowable on a small scale and under certain conditions under the Soviet Constitution. Private enterprise must compete against State trade, however, and taxes on it are high.

A number of restaurants have sprung up in several cities as a result of this policy. The owner goes about operating in the following fashion: He applies to the cooperative trading organization of his city. He outlines his financial situation and sketches his plans for operating. If the officials feel he is capable of carrying on his business, they rent space to him, usually where he wants it. From then on he is more or less on his own.

Restaurant operators then go into the country or to market and buy up all the cabbage they can locate to make borsch. They purchase pigs, chickens, eggs where they can find them, striking bargains with the peasants, who are allowed to sell or to do as they please with anything raised or produced above the norm allotted them.

The operators must then make their own arrangements about hiring cooks, waitresses, and waiters; finding cooking utensils, plates, and so on; and getting together enough chairs and tables for their customers.

Authorities help out where they can.

It may sound like a terrific undertaking. Frankly it is, but lots of these little businesses are under way. A cooperative tobacco factory, manned by Ukrainians invalidated by war, is being planned. Officials do not predict how long or how successfully these private-profit businesses will operate, but the general impression is they will exist during the reconstruction at least. When I was in Kiev several restaurants were already operating and doing a big business.

#### German Printing-press Money

The Germans flooded the Ukraine with their printing-press money when they came in. It is still around almost everywhere, but it is worthless. The Soviets did not redeem it, and virtually every Ukrainian has a sock full of it. I brought back some for souvenirs after a recent visit to the occupied area. A peasant woman was delighted to receive some Russian rubles for it.

The trouble was that when word got out—and it gets out fast in the Ukraine—that some crazy Americans wanted to buy some German money and would pay good rubles for it, we were swamped. Folks young and old came from wood and valley, and it became very difficult to tell these kind people that we wanted only a few pieces of German money for keepsakes and to show in Moscow.

The money was designed fairly artistically, but was on a very poor grade of paper, and much of it had worn through in two years' handling. It was printed in German and the Ukrainian language and usually bore a portrait of the German conception of a Ukrainian maiden or young man.

"What are the liberated peoples doing for money?" I asked.

Officials described the uniform plan. As soon as possible they block out what enterprises, what factories, what rebuilding, what schools, what places of entertainment and municipal services can be started soonest.

They call in people for jobs and, after consultation with them, assign workers to various positions. However, the choice is mostly up to the individual. He can apply for whatever job he wants.

After questioning them on their qualifications and experience, the authorities then advance their people money against their earnings. There is no interest, and the money may be paid back just about as a worker wishes.

This policy is very broad and extremely elastic, it was explained, because the persons with whom the Government is dealing have been through months of German occupation, and they have suffered aplenty.

#### "Help Wanted" Signs Urgent

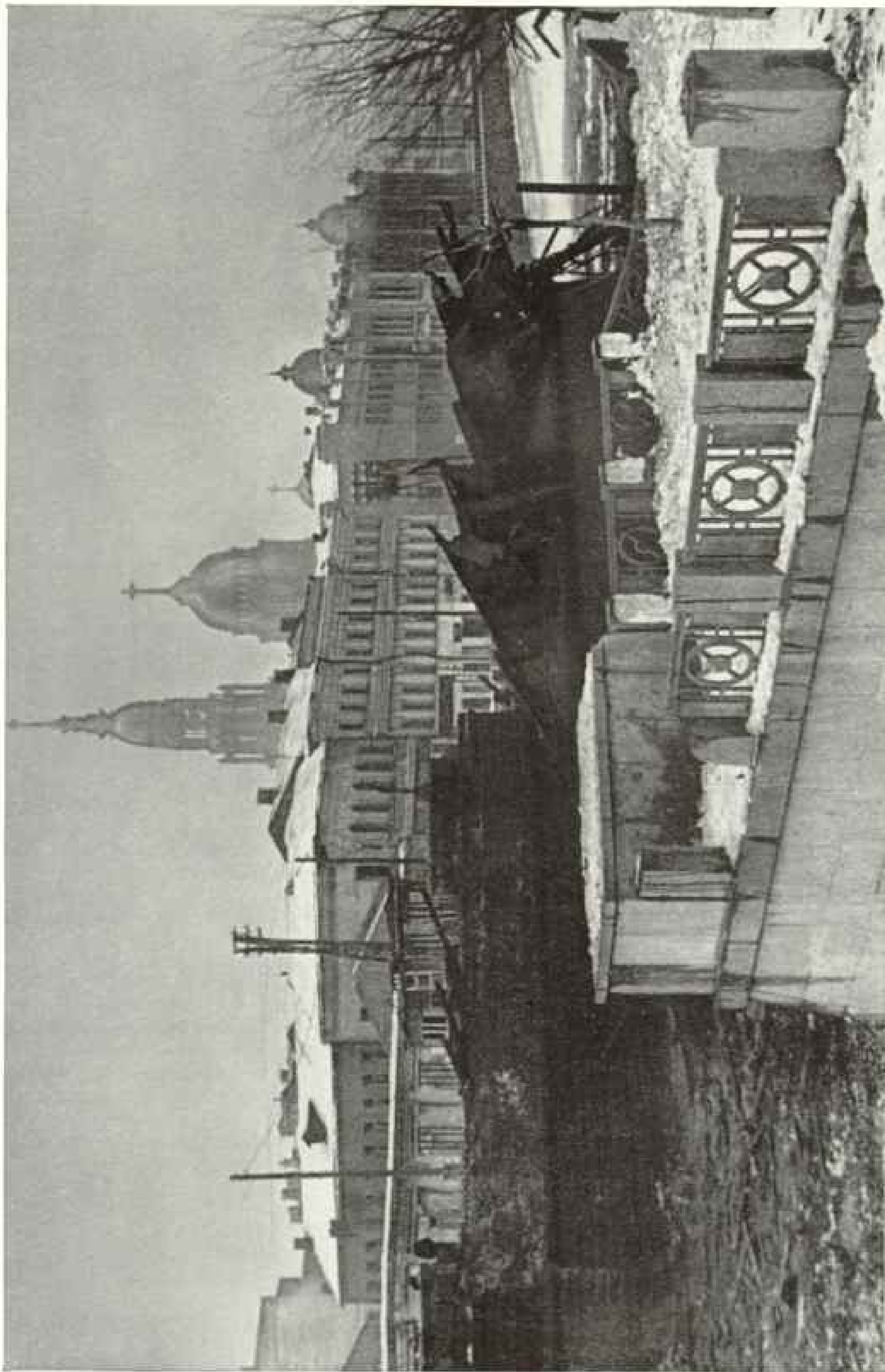
Every City Soviet—a kind of town hall—which I visited in the Ukraine had its outer wall plastered with notices of "Help Wanted."

It is a heartening sight to see these people out in front of the City Soviets studying notices, most of which are written out in long-hand.

Building trades want men and women for bricklaying. The carpenters' trust wants experienced labor—"Please bring saws and hammers if Germans did not steal them from you." The city school system wants teachers—wants them immediately. Plumbers please apply at such and such a place. Electricians badly wanted. And there are already notices for girls to drive streetcars and buses.

In many sectors the Soviets have hurried in instructors and teachers, responsible persons who can teach quickly the basic principles of a trade to young boys and girls or to older people who are willing to learn something about a business in which they, in their worst dreams, never imagined they would be involved. The response, officials say, has been encouraging.

Spring planting and work on collective farms have not drawn so many applicants as are needed so far. This is to be expected, for



Barbara

**Fragile Domes Survive the Nazis' Good-bye to Kharkov, but a Stout, Strategic Bridge Is a Ruin**

On his second retreat the enemy turned the city into a booby trap for men, women, and children. Stoves, chairs, closets, and pianos, even an atom-smashing machine, were wired to explosives. Russian sappers sprung more than 70,000 deadly snares.



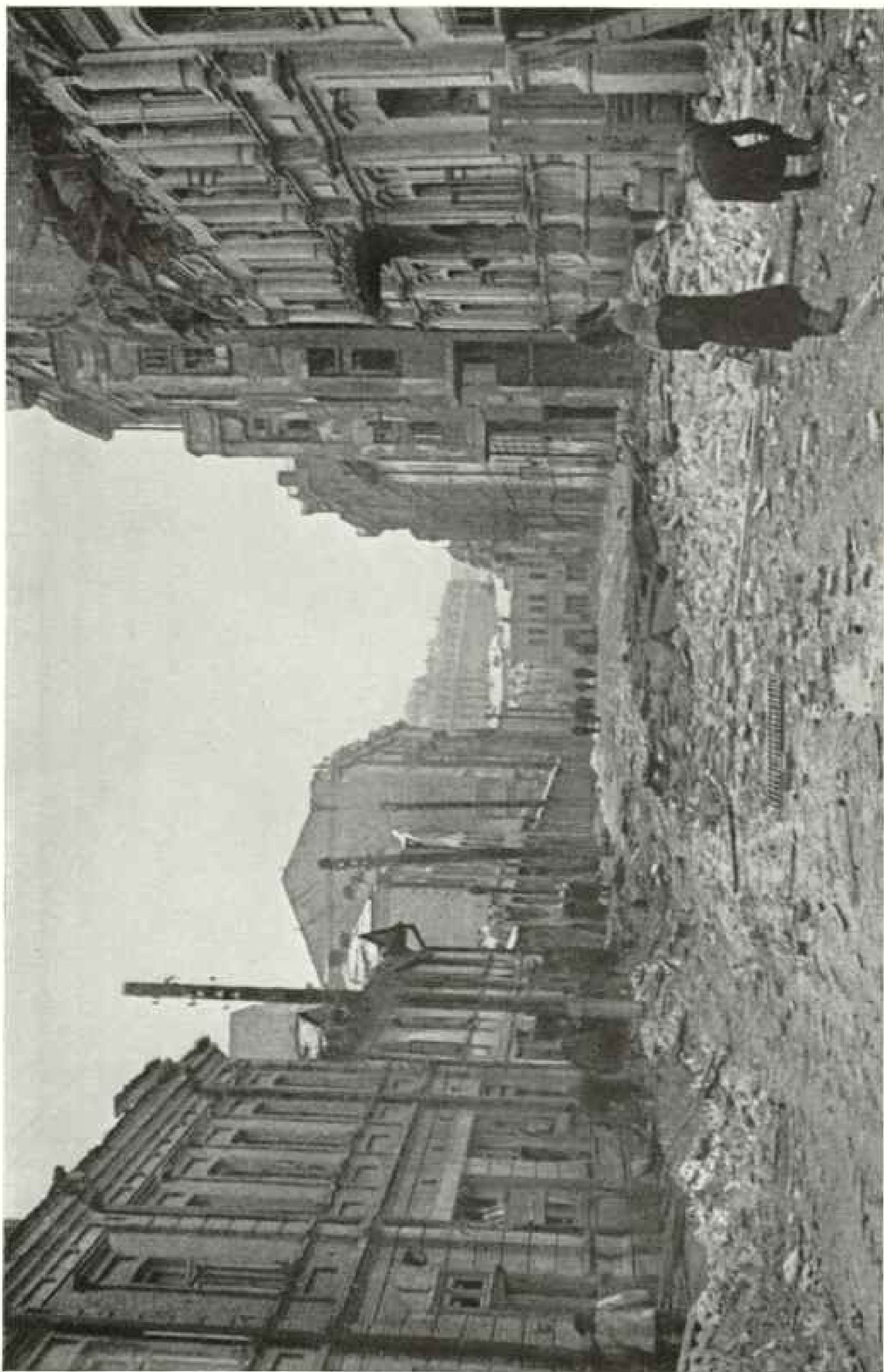
**"Scorched Earth" Now, the Dnieper Dam Requires Tremendous Repairs before It Turns Ukrainian Wheels Again**

In 1941 retreating Russians ruthlessly crippled the hydroelectric station they had so proudly completed nine years earlier.



**From Their Hiding Places, Kharkov's Survivors Emerge with Market Baskets to Gather Food and Salvage**  
Corner clock and trolley cables testify that the Germans, proverbially thorough, did a careless demolition job at this point.





Hubbs

**Like an American Town Struck by a Tornado, Kharkov Picks the Debris for Possessions Left by Nazi Bomb and Torch**

Two-thirds of the city's dwellings were left uninhabitable. At first it mattered little, for only a quarter of peacetime's 830,000 residents remained. To them life was primitive, the enemy having demolished every utility. To get water, long walks were necessary.



**Daylight Peeps through the Skeletons of Fire-blackened Skyscrapers in the Heart of Kharkov**

Hitler's arsonists lacked time and dynamite to level Dzerzhinsky Square. Now Soviet gunners guard the sky against his bombers.



**Desolation Greeted Soviet Trench-mortar Squads Entering Kharkov's Railway Station**

Fleeing Nazis felled a viaduct above the yards. Returning, they cleaned up the mess. In flight again, they left the rails clear.

AP/WIDE



H. H. H.

#### For a Fresh Start at the Old Hearth, They Have Fireproof Oven, Samovar, and Junk

Despite a revolutionary quarter-century, grandfather remains a typical Tolstoy muzhik. Like that character, he used the oven top as winter's cozy bedstead. In some villages the invader destroyed beehives, shade and fruit trees, as well as homes.

most people who live in a city prefer to continue to live there even though their homes have been ruined by the invaders. They want to start fixing up the old place.

Authorities in the Ukraine have plunged into the difficult task of getting everyone registered and identified again. Care is taken before handing a new Soviet passport to an applicant. During the occupation, the Germans took up all Soviet papers and issued new ones—German identification cards to citizens.

This process of sorting everyone out again, taking down his former address, occupation, relatives, and so on is a time-consuming job and, of course, requires hours of detail. A citizen usually has someone known to the authorities to vouch for him, and generally this is sufficient.

#### Raising the Sunken Dnieper Fleet

During this winter the Kiev river front has been one of the busiest parts of the Soviet

Union, as workers raised from the bottom of the Dnieper the sunken Dnieper fleet.

This is a little-known story.

When the Red Army advanced across the steppe east of the Ukrainian capital, and the Nazi commanders saw that they could not hold the Russian push, they ordered the sinking of all ships, boats, and barges along the river.

The Dnieper is readily navigable, and the larger portion of its steamers and barges tie up here for the winter. In their great haste the Nazis ordered up dynamite and assigned special squadrons to this job. They did not want the craft to fall into the Soviets' hands in usable condition.

"Blow them into the heavens," was the order.

When the dynamite squad arrived at the river to set off the charges, they found many of the ships sunk, and those that had not reached the bottom were slowly settling.

While Nazi officers screamed and raged on the bank, the ships disappeared, and they had to take their dynamite back and put it under more of Kiev's buildings and houses.

What had happened was that Soviet rivermen, who had been left behind in German-occupied territory, heard of the plan to blow up the Dnieper fleet. In the dark hours the Russians stole to the river bank and, climbing aboard many vessels, opened enough valves and petcocks to sink most of the ships. Where they didn't have time, they cut holes in the bottoms.

None of these patriots was caught.

Then the Red Army came in and, when there were time and workers, authorities began the hard, long job of raising the vessels. Konstantin Guzykin took charge.

"In two months," Guzykin reported in January, "we have raised as many boats as we would have raised in such operations in eight months before the war.

"I realize," he added, "that the secret of this lies not in any high degree of mechanization, but in hard work, pure and simple. Everything depended on the workers themselves."

The raising of a fleet which numbers more than a hundred ships and barges is a back-breaking task.

#### No Time Clock or Overtime

During the height of the activity, when rivermen were rushing to get the ships to the surface and into dockyards in time to repair them for spring navigation, there was no such thing as a time clock or overtime checks. Workers just worked, that's all.

Diver Ivan Zemlyany made 15 trips to the icy bottom of the Dnieper in one day. The water was exceedingly cold despite his thick diving suit, which was not heated, and 15 trips is a high degree of patriotism in that kind of water.

Uacob Levin, director of Kiev's repair shipyard, went four days and nights with hardly more than a couple of hours of sleep. Besides managing the shipyard, he lent a hand in repairing and supervised some of the electrical jobs and foundry work.

Directors of the project were short-handed, for, as stated before, man power is scarce in the Ukraine.

"We simply don't have enough people," said Levin during some of his busiest hours. "There's enough work here on the river for all of Kiev, but the rest of Kiev, we realize, has duties, too. We've just got to work on."

It was a hard battle against time, for the Dnieper, of all the rivers of the liberated

Ukraine, needed ships for spring and summer. The Nazis left the railways and roads in bad shape. Military traffic must pour over these communication lines as the Red Army drives westward, and never before were ships so valuable.

#### Ships "Manned" by Women

The Russians take advantage of their broad, deep rivers and are excellent rivermen. The traffic these vessels will handle before next fall will be amazing.

Women play a great role, too. Just as some ships on the Volga are manned by women captains, engineers, and stevedores, the same thing is planned for the Dnieper fleet.\* The Soviet Union has an increasing number of women boatmen. They seem to like their work, too.

The latest figures I obtained on the speed with which the Donets Basin sector of the Ukraine has gone into war production revealed the following:

Two blast furnaces at the Ordzhonikidze plants are operating, and the central power station of this gigantic factory is furnishing power once more. The rolling department is working, and the first rails were turned out in January of this year.

Steel is being smelted in the open-hearth shops at the Makeevka Works, and by the first of February more steel was produced than during two years of German occupation of the mill.

A 50,000-kilowatt turbogenerator is operating and producing power for the Zuevka power station. Miners and iron and steel workers are reported to be performing almost miracles in spite of the adverse conditions under which they are laboring.

Recent dispatches from all sectors of the Donets Basin report that living standards are rising monthly. In the Voroshilovgrad region 15,000 miners have moved into new apartments since the first of the year.

The Ukrainian Municipal Planning Institute is hard at work at Kharkov planning details for restoring the large cities destroyed by the Germans. Projects are being drawn up with an eye to architectural beauty and modernization of municipal economy. Beauty and comfort will be the keynotes of a revived and rebuilt Ukraine.

Although schools and institutes come first in permanent rebuilding toward culture, theaters, movie houses, and clubs are rapidly being opened. In seven Ukraine regions 2,410

\* See "Mother Volga Defends Her Own," by Maynard Owen Williams, NATIONAL GEOGRAPHIC MAGAZINE, December, 1942.





Julien H. Bryan

### Imagine the Fate of the Ukraine's Sturdy Prewar Babies!

Before 1941 these children thrived on milk and gruel. Afterward they were lucky to get herbs, grass, and potato peels. As typhus and malaria spread, they lacked hospitals, nurseries, medicines, and doctors. "Adopt an orphan!" is the theme of a campaign in undevastated Russia.

clubs were given to the public before February 1, and 130 movies have reopened with Soviet, and some American and British films.

The famous Shevchenko Theater of Kharkov now is giving nightly performances, although it was sacked by the fleeing Nazis. It has new scenery and lighting effects and is playing to packed houses.

The Ukraine is even turning out books again. Fresh from the press volumes in the Ukrainian language of Shevchenko, Tychina, Rylsky, and Bazhan have been issued to the people.

All this speaks eloquently of the way in

which the Ukraine is returning to the place it occupied as one of the brightest jewels in the Soviet Union.

The Moscow News recently paid high tribute to this gigantic enterprise:

"Life is returning as the mighty Ukraine rises to her full majestic stature. This is being achieved at the cost of tremendous effort. It involves overcoming of great obstacles. The fact that our people are waging two such titanic struggles simultaneously—at the front and behind it—is additional proof of their moral stamina, their vitality, and their truly indomitable will."

### Reprints Available for Mosquito, Classic Greece, and Insignia Articles

At the request of medical officers of Army camps and Navy operating bases in the United States and Canada, the National Geographic Society has made available under one cover reprints of "Saboteur Mosquitoes" and "Life Story of the Mosquito," with 8 pages of color paintings of dangerous disease-carrier mosquitoes, from the February, 1944, NATIONAL GEOGRAPHIC MAGAZINE; obtainable from The Society's headquarters, Washington 6, D. C., upon remittance of 25 cents in the United States and possessions.

In response to hundreds of requests from schools and universities, The Society has also made available separate reprints of the articles on Classic Greece by Edith Hamilton and Richard Stillwell, with 32 pages of paintings by H. M. Herget, from the March, 1944, NATIONAL GEOGRAPHIC MAGAZINE. Added to this 97-page presentation of Greek life and culture is the 31-page article on the Isles of Greece, which appears in this issue; 75 cents per copy, paper covers, in the United States and possessions.

Also available is a complete color reprint in a handy 150-page book of the insignia, badges, decorations, medals, etc., of the U. S. Armed Forces from the June, October, and December, 1943, issues of the NATIONAL GEOGRAPHIC MAGAZINE; 1,701 full-color illustrations, with authentic descriptions, the most comprehensive presentation published. Bound in blue heavy-weight cover paper; 50 cents in U. S. and possessions, postpaid. Elsewhere 75 cents in U. S. funds. Obtainable from National Geographic Society, Washington 6, D. C.

# Nigeria: From the Bight of Benin to Africa's Desert Sands

BY HELEN TRYBULOWSKI GILLES

**A**FTER we had braved the wartime perils lurking in the broad stretches of the Atlantic, the first sight of the bar of Lagos harbor brought a spontaneous prayer of thanksgiving to our lips. As the ship slowly made her way up the channel, we gazed reverently at grass that had never seemed so freshly green. Even the dark clumps of casuarinas and palms nodded as if in welcome.\*

We were hailed by the crew of the pilot boat, who seemed as much surprised to see us again as we were to be back in Lagos.†

The larger of two small islands on the Lagos Lagoon was known as Eko before the Portuguese named it "Lagos." The other island is Iddo (map, page 540).

In the 15th century the Portuguese found Lagos ideally situated for slave raiding and trading. It lies between mangrove-bordered creeks, with Dahomey on one side and the old Benin area, amid dense forests, once the center of the slave trade, fetishism, and human sacrifice, on the other. On the mainland to the north is the Yoruba country.

All these areas made good slave-trading soil. In those years Lagos waxed rich, while Benin has retained the impress of Portuguese teaching on its brasswork, wood, and ivory carving.

## Yachting in the Lagos Channel

Not many ports reveal such beauty at first glance as Lagos offers in its seaside façade.

Beyond the tiny fishing hamlet near the mouth of the channel, imposing villas nestle in colorful gardens, some with boats and yachts drawn up on their own runways. The white walls of Government House stand out impressively amid tall palms.

Along the length of the Marina, a fine coastal road, move vehicles and pedestrians representative of every section of Nigeria and the neighboring lands.

On Sundays the Marina becomes the promenade for all to take a "breeze." Syrian, Greek, Indian, and other merchant communities freed from duties are joined by their families, and there are countless Africans in gay native costumes or some atrocious combinations of European garb.

In their colorful Sunday dress the women seem to become a part of the landscape. Cloths wrapped around their full hips are left rippling in a drape at one side, blouses are frilled around neck and arms, while individ-

ual fashions are expressed freely in their head-dresses. The more prosperous may add a pair of shoes and a handbag.

The men, except for those who have adopted European trousers, apparently prefer the comfort of pajamas, which are often of vividly colored stripes and prints. This seems to be the acceptable garb for office, shop, or street. To it they add anything from a felt hat to the Moslem cap or else go bareheaded.

## Friendly Greeting Is a Ceremony

Considerable ceremony is enacted when friends meet. Women kneel and express greetings in the guttural Yoruba or Ibo tongues, the latter the principal language of the south as Hausa is in the north (page 563). Men shake hands three times and interrupt each shake to lay their hands over their hearts.

The Lagos African is much more sophisticated than the mainland folk, and speaks fairly good English. But he has his own special vocabulary, such as "chop," meaning to eat, "dash," a tip, "softly, softly," meaning slow, and many similar expressions. Of profanity he has learned choice examples which he is apt to air at embarrassing moments.

Some of the more ambitious southerners have entered the professions, or fill posts in government service.

Behind the few Lagos streets, where center the main European business establishments, there is congregated a large part of the city's 167,000 people. Much of the island was low-lying swamp, but on Ikoyi plain arose the surprisingly attractive suburb where most of officialdom dwells. Besides a fine race course, golf links, and clubs offering other recreation, the small island has bush territory that is excellent for riding, with trails through forest, grasslands, and swamp.

Lagos still retains its native chieftain whose so-called "palace," behind a walled enclosure, has an old field gun mounted at the entrance. Retainers walk about among the various buildings of no special merit, while livestock roams

\* See "Three-wheeling Through Africa," by James C. Wilson, NATIONAL GEOGRAPHIC MAGAZINE, January, 1934.

† Mrs. Gilles is an American, who attended school in Baltimore, Maryland, where she was secretary to Dr. Raymond Pearl at the Johns Hopkins School of Hygiene. She was married to Dr. E. C. Gilles, a graduate of Johns Hopkins, and accompanied her husband, a British subject, to Ceylon, and later to Kano, Nigeria, where she now lives.



Part from Three Lions

**"And Another Thing, Corporal" . . . a Lagos Police Inspector Gives an Order for His Force**  
To its native constables the Nigeria force offers wages, uniforms, housing allowances, sports equipment, and the opportunity to learn a trade. A colored recruit may rise to the rank of inspector.

freely in the compound. The tame, dirty gray ostrich seems particularly anxious to inspect any visitor.

#### A Plague of Locusts

One of my most stirring memories of Lagos was the excitement of a locust wave when men, women, and children, armed with pillowcases, cloths, sheets, and towels, rushed about catching this manna from heaven, which, when roasted, is acclaimed a delectable food.

The waters around Lagos offer a variety of seafood. At night the flat-bottomed dugout canoes of the fishermen glide noiselessly along the edge of the channel out to the open sea, their small lamps glimmering like glowworms.

Their womenfolk await them the next morning, ready to unload, sort, and market the catch. The southern Nigerian woman is a capable, buxom creature, as adept at disjuncting at the meat stall or fish market as any man. She will paddle her own canoe with a "piccin" at her back, bringing her produce to market from up the creeks and rivers.

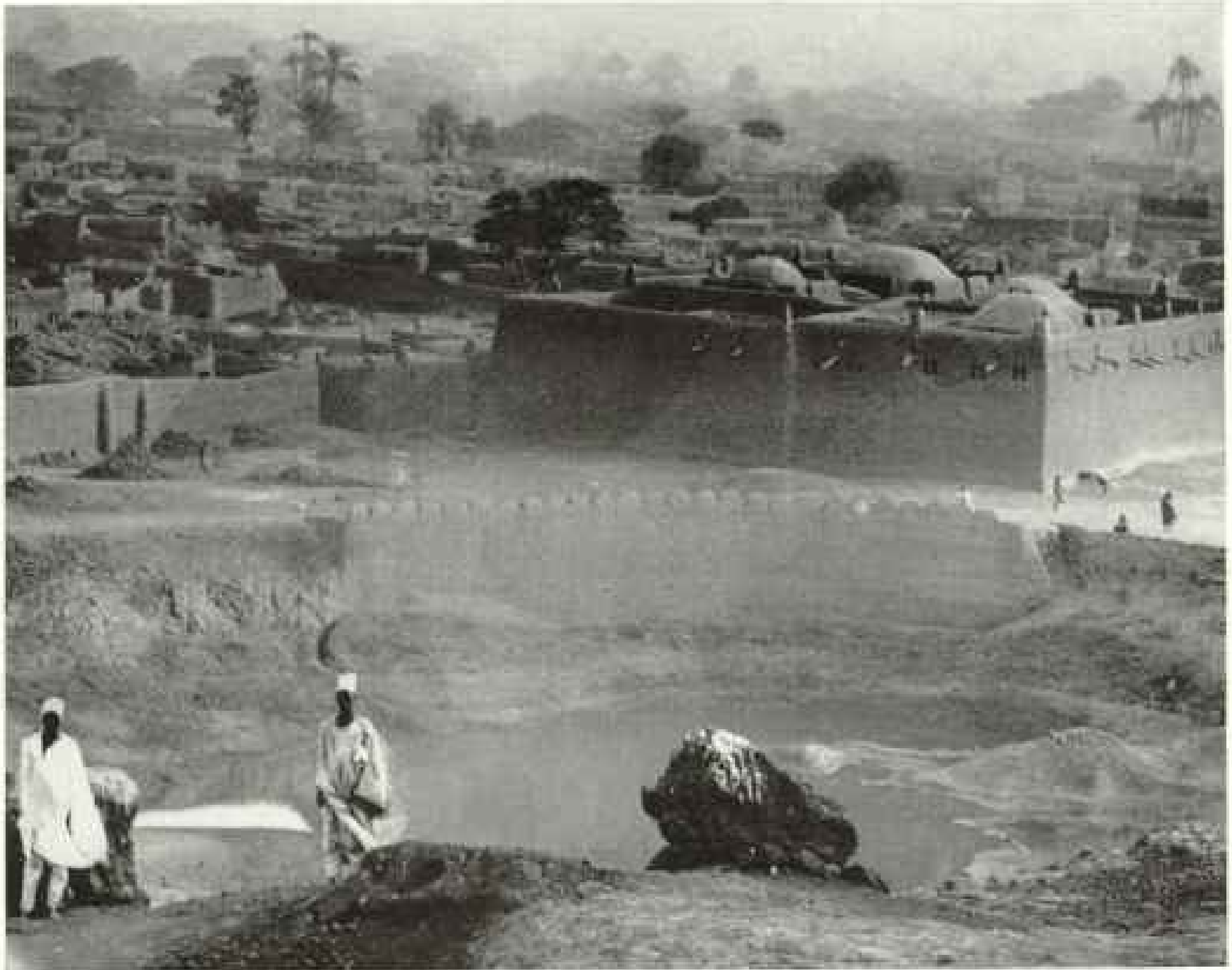
Some of the most attractive women are the Jekri, claiming descent from the Portuguese.

The southern Nigerian woman, no matter how prosperous her husband, is usually self-supporting at some trade or business even after her children arrive. Any increase in the earnings of the Nigerian male sends his thoughts drifting immediately to the acquisition of another wife, for the number he possesses is an outward index of his prosperity.

Usually the women return to the home of their parents for confinement. Often the first wife will assent to and sometimes even select wife number two, to take her place in her absence, but of course will retain her honored position as first wife. And on Sundays, holidays, or evenings, they all walk proudly in procession—women following behind the man in the order of seniority as wives.

Despite this domestic felicity in the practice of polygamy, life is not without its trials. Many times an African has come to us wailing, "My womans—they make too much palaver!"

Should the husband bestow more attention,



© Margot Lubinski from Camera Club

### In Contrast to Mid-Africa's Thatched Villages, Kano Is a City Fashioned in Adobe

Viewed from a pit-side within the city walls, palms rise from walled gardens. Batteries of spouts carry off rain water shed by roof domes made of mud plastered over wooden frames. Wall-top "battlements" are decorative knobs. To Kano, whose written records are centuries old, the 41-year British occupation has been brief (pages 559-561, 564). Its European "discoverers" were amazed by the thriving city.

gifts, or other benefits on one than on the other, it is not difficult to imagine the kind of warfare that breaks loose in the compound.

Because of the independence of the women, they do not hesitate to terminate an unsatisfactory relationship and seek another.

#### Women Traders in the Markets

Native life best expresses itself at the Lagos market, where most of the traders are women.

Viewed from Carter Bridge, the animated market scene spread along the shore below, splashed with bright colors of fruits and vegetables as well as the gay bandannas of the women, resembles a patchwork quilt of tremendous proportions.

The picture often reminded us of river life in China or Burma where, under matting or other makeshift shelters, the business of life is mixed with trade, the mother feeding her young as it reaches around from her back to grip her breast. Most native women breast-

feed their children until they are two or three years old.

The maze of commodities gathered here ranges from vegetables and fruits, fish and poultry (of ducks and guinea fowl the African is especially fond), eggs, grain, and cereals, cloth (homespun, native-dyed, and imported), to a large section devoted to stacked firewood brought by canoes from the forests.

Most amazing is the weird collection of fragments at the medicine mart.

Apart from strange herbs and oils, there are clumps of evil-smelling feathers, bones, teeth, fur, feet, and claws of bird and beast. Some are important for decoctions to cure maladies, others are even stranger potions to make "juju" (page 553).

Near the market another congregation of women set up a noisy babble as they indulge in their favorite pastime of bathing and washing their clothes at a shed. As they wait for their laundry, spread over the surrounding





### Wartime Nigeria's Railroads and Air Routes Provide Important Channels to the East

Lagos, seat of the British Governor, is capital of the Colony and Protectorate. Ibadan, the largest city, contains 318,000 people. Islam is dominant in the Northern Provinces, but in the pagan Eastern and Western Provinces Christianity is gaining ground. Nigeria's position in Africa is shown by the inset.

ground, to dry, they do not miss an opportunity to trade. They may have nothing to sell but a liquid ranging in color from deep orange to a bright red, which is the palm oil of national economic value and a vital part of the southern Nigerian's food in this region.

The southern Nigerian loves nothing better than to pluck the fruit of the oil palm to make his own oil. The trees wave on the mainland shore and grow in dense profusion throughout the rain belt.

Oil from the groundnut, or peanut, as we know it (*Arachis hypogaea*), holds an analogous position in the north.

Palm oil "chop" and groundnut stew are week-end luncheon institutions with the European communities in Lagos and the south.

Lagos, as chief port of Nigeria, is provided with modern docking equipment at Apapa, on the opposite shore of the channel. All this shore between creeks was swamp reclaimed

with dredgings of the channel when it was deepened to admit ships of heavier draught to come alongside the wharves.

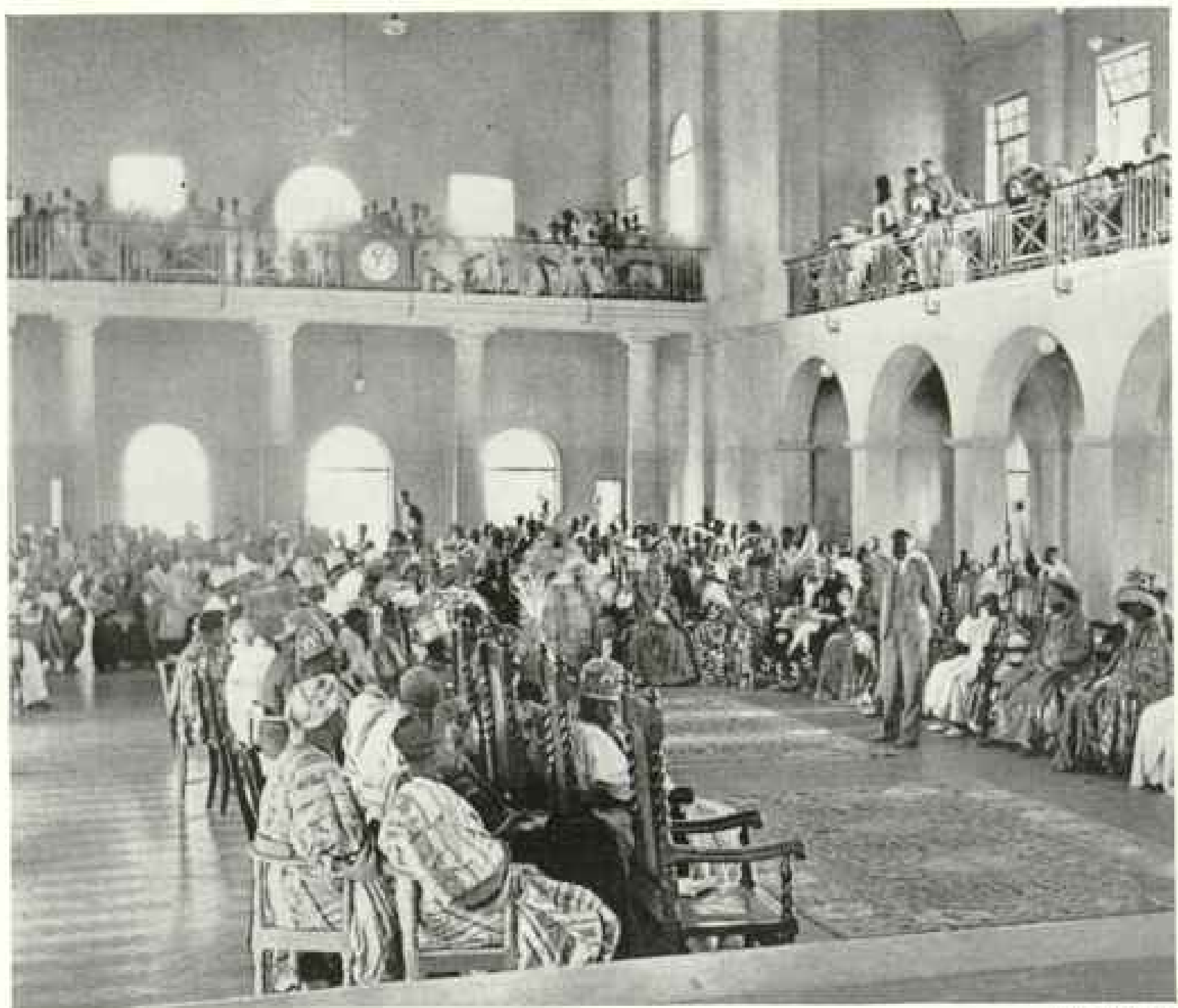
The warehouses hold countless bags of peanuts, bales of cotton, dried hides, precious tin ore, cocoa, and even live cattle, for export.

#### Mammoth Logs Float to Wharf

At Ijora wharf, farther along the channel, facilities are available to deal with mammoth logs of rich timbers brought down from the forests not many miles distant.

For many centuries these giants had lived hidden in their deep, dense forests, finally to succumb to the ax. Several species of mahogany and African cedar and walnut are only a few of the many timbers that find their way abroad in logs of ten tons or more.

In journeying northward to Ibadan, we traversed a section of the dark forest belt



British Official

### Some in Crowns and Some in Gowns, Chiefs of Western Nigeria Confer at Ibadan

Colorfully robed rulers, speaking half a dozen languages, occupy seats facing their interpreter, who wears a plain business suit. Their councillors are among the spectators. This Congress was initiated by Nigeria's Governor. British policy encourages the natives to manage their own affairs.

around Abeokuta where magnificent trees raise their mighty crowns to prodigious heights.

Lagos, along with a few miles of its immediate surroundings, constitutes the Colony, and is not representative of mainland Nigeria, a name bestowed on that vast territory of states from French West Africa and Lake Chad on the north to the Bight of Benin on the south, which form a protectorate of the British Commonwealth.

Varied indeed have been the fortunes of some of these states, now designated as provinces of Nigeria.\*

Bornu, in the north, once was an empire whose influence was felt far beyond its borders. Its cities, and other northern towns, became centers of learning when Arab scholars first ar-

\* See "Timbuktu and Beyond," by Laura C. Boulton, NATIONAL GEOGRAPHIC MAGAZINE, May, 1941.

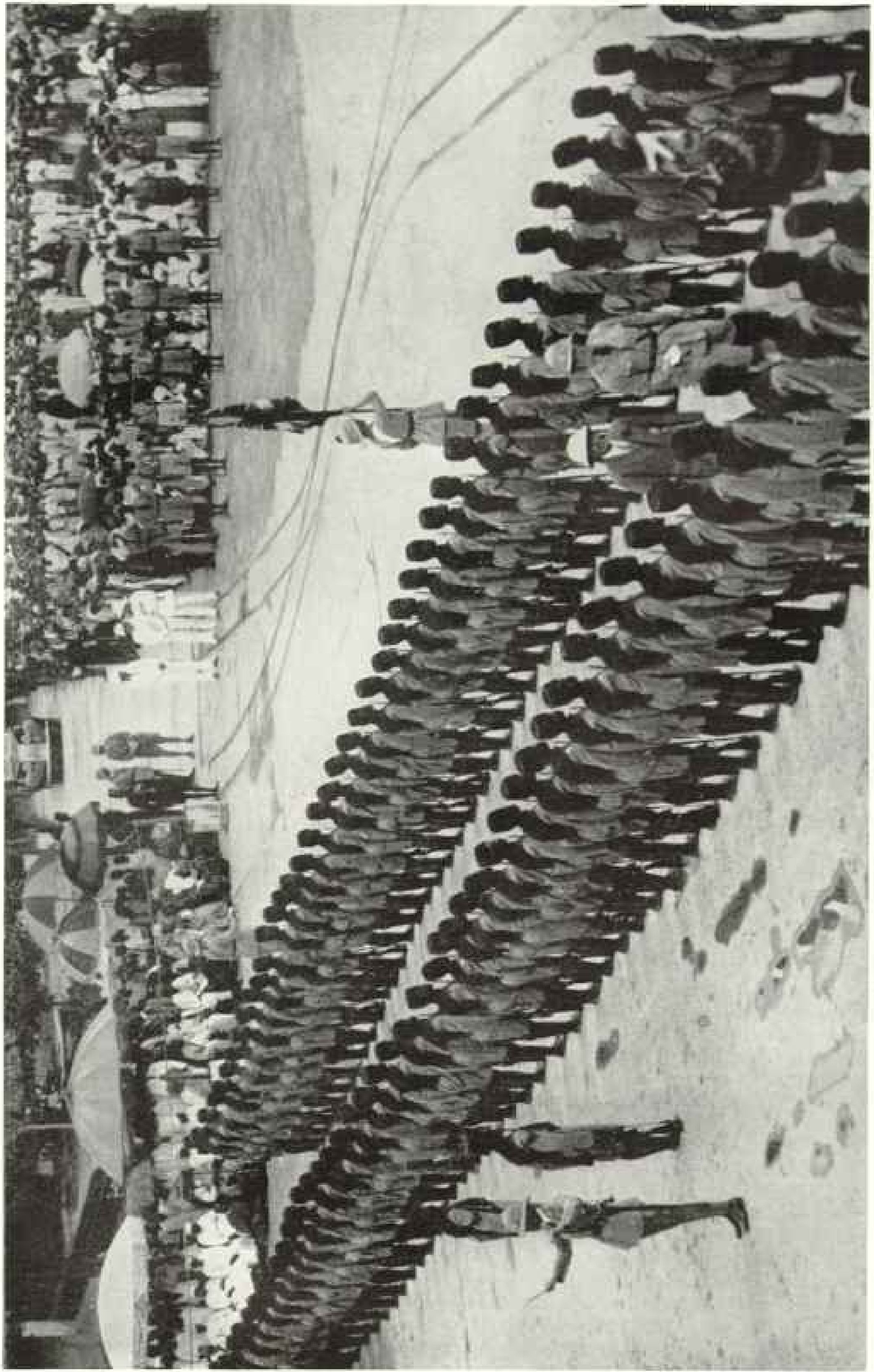
rived to disseminate the teachings of Islam.

Kano, Sokoto, and Katsina were other such centers. The late Emir of Katsina, keen and active though nearly 80, was a progressive ruler. He visited England with his four sons, who have gained renown as excellent horsemen, carrying off victory after victory at racing and polo in Nigeria. They have also played abroad.

Sokoto, the capital of the neighboring state of the same name, is the holy city of Islam in Nigeria, the Emir of Sokoto being recognized the leader of the Faithful.

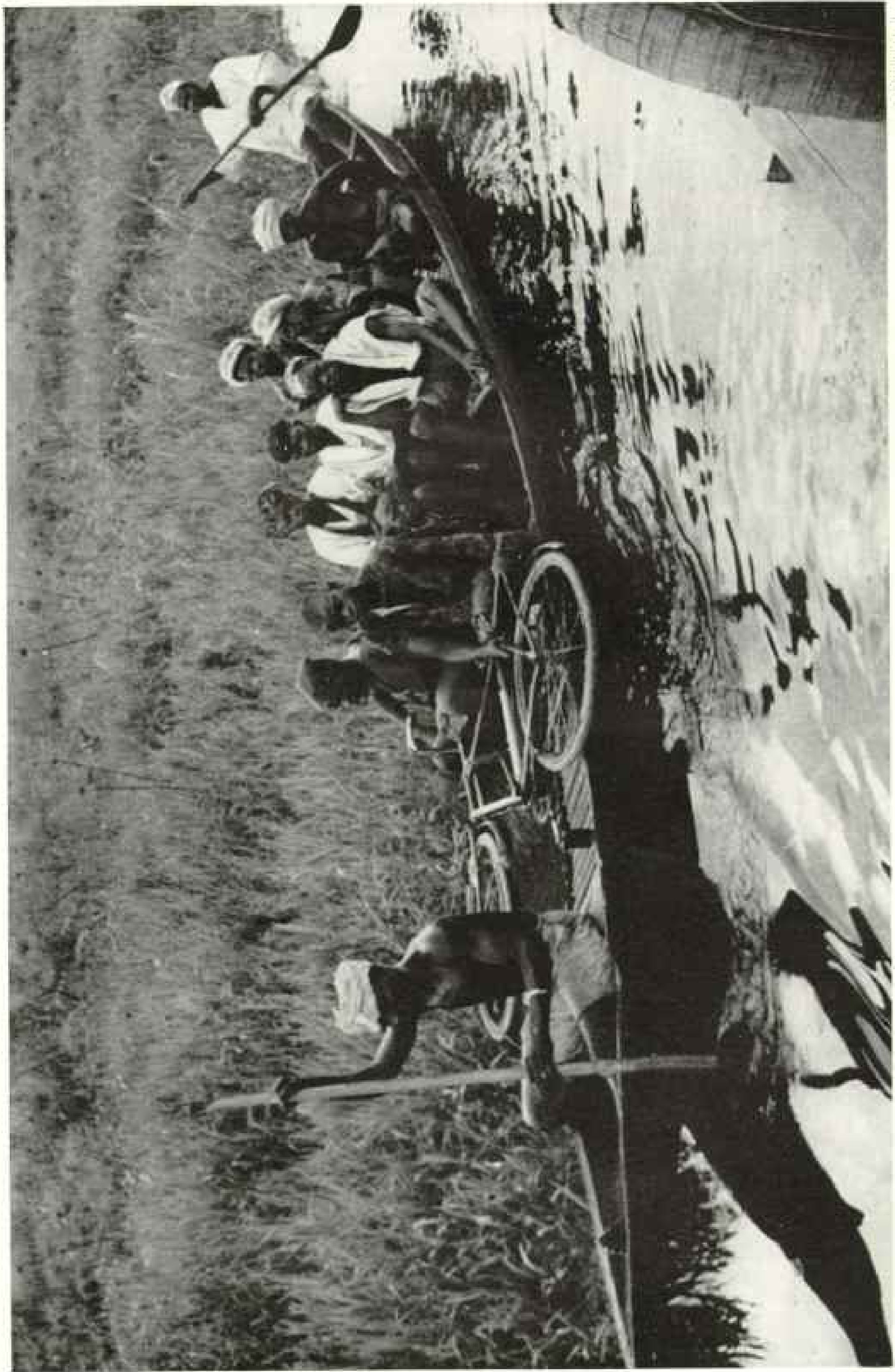
The Emirates of Kazaure, Gumel, and Hadejia in the far north are arid regions, but where irrigation is possible gardens flourish.

Zaria also has played a historic role, and today grows the bulk of cotton for foreign export and produces cane sugar from its considerable plantations.



British Officials of the Nigerian Government inspect the Lagos Police Force

Holding rifles with bayonets fixed, the native constables resemble soldiers. As army reserves, the Nigerian police are liable to military service. A baton waving at the left indicates that a band is playing; Parasols shield spectators from rain (note the puddles) and from sun.



© Kerl Lubinski

**Nine Ferry Passengers Take Their Ease as Two Paddlers Propel Their Canoe Along a Branch of the Niger**

One youth refuses to be parted from his cherished bicycle. Before the tire shortage became acute, cyclists transported the entire commerce of some villages, even to live animals. Groups of 20 ang as they pedaled. To motorists their course was most unpredictable.



The completion of Carter Bridge made communication easier with the mainland. Rail service from Iddo extends northward almost to the frontier of French West Africa. Trains run from the southern creek and mangrove swamp area, through the forest or rain belt, then the plateau region, on to the grasslands (page 557).

The creek territory to the east of Lagos, including the sprawling Niger Delta, was long known to early traders who lived on their river hulks and bartered on the beaches with the numerous native tribes. These water and bush people had no chieftains, but vested power in councils of family, village, or clan. Today many of them are Christians.

Port Harcourt and Forcados are the chief ports of this section; the latter was the principal Nigerian seaport before the deepening of Lagos harbor.

The word "beach" is still in use when referring to trading or canteen areas in the country, and struck me as particularly incongruous when I heard it in Jos (page 553) applied to the shopping area. I expected to find a river or a lake beach!

The southern Nigerian is not so diligent a farmer as his northern brother and is unable to combat the encroachment of the wilderness.

Many are continually forsaking the land to seek their fortunes in the towns, joining the ranks of laborers, domestic servants, clerks, and artisans. The Ibo in particular, a densely populous group, migrate far from their homeland.

#### The "Tie and Dye" City

One of the first important towns north of Lagos is Abeokuta, spread among ebullitions of gneiss. Developed by the Egba, a clan that wished to be independent of the Yoruba yoke, it is today a highly Christianized community, whose chief fame is its dyeing industry. "Tie and dye" is a byword identifying these cloths, which are a form of batik and resist dye by tying or by use of starch.

Many of these Abeokuta cloths find their way to other parts of Africa through the efforts of the Hausa trader.

Ibadan, farther north, 120 rail miles from Lagos, is the most populous of African cities in equatorial Africa; it has some 318,000 souls, mainly Yorubas (page 541).

The total Yoruba population, numbering more than three million, consists of many clans, and these, like other Nigerian tribes, are identifiable by tribal marks scarified on their faces. Women among some of the river tribes are given to highly ornamental decoration of their bodies, while women's hair-

dressing is a fine art of innumerable styles.

Most Yorubas are stalwart men bearing a likeness to the Sudanese. The Yorubas for many years spread their influence and culture south, including the Benin country. Theirs was a flourishing kingdom till tribal wars and slave raiding brought disruption, especially when certain clans joined the ranks of the Fulani conquerors (page 554).

#### British Bring Peace to Yorubas

Among these were the clans that formed the Emirate of Ilorin, to the north of Ibadan. The Ijebas are another of the independent clans, who have in the main become the middlemen in the cocoa and palm-oil trade. Not until the British came did peace again reign in Yorubaland.

Yorubas are still largely pagan worshipers. They believe in a supreme being, the Olorun, and bestow reverence on anything awe-inspiring in Nature—mountains, rocks, trees, or even reptiles such as the python and monitor lizard.

Strange customs and evil practices must still exist in the fastnesses of remoter villages as drums send out their messages by night. Conspicuous by their absence are the aged, infirm, and feeble-minded.

Certainly Yorubas don't trust their own kind. Especially is this true of the educated classes, few of whom ever return to their homes and villages lest misfortune befall them. They fear the envy and jealousy of their relatives and elders, who may decide that so-and-so, having forsaken the habits of his forefathers, is no longer worthy to be a member of the clan, and therefore should "go to sleep" with his fathers.

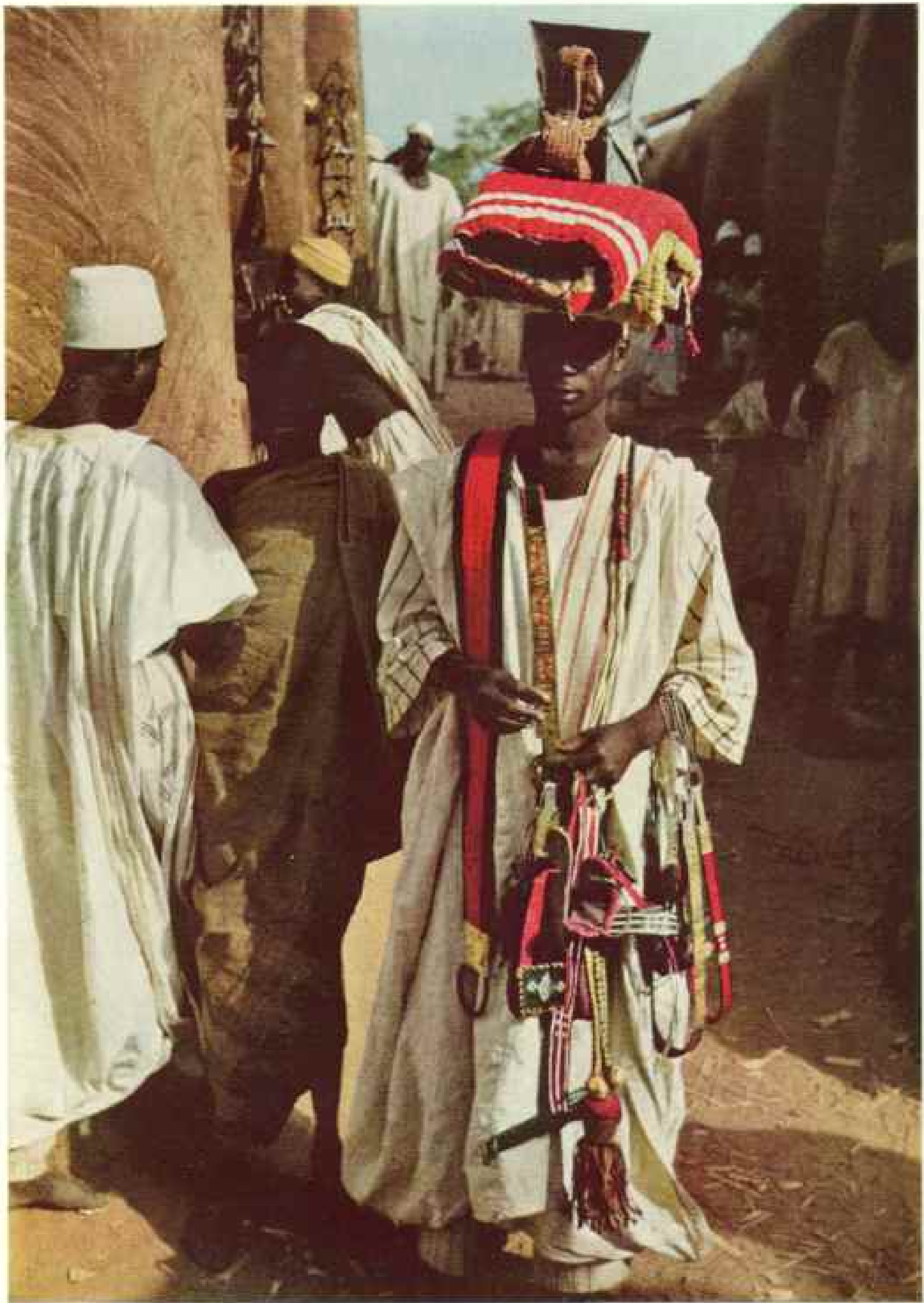
They will not hesitate to bring this about themselves, or else indicate to the unfortunate one that he must take his life with his own hand. Suicide has, in fact, been regarded by the Yorubas as an honorable death when convention has required it.

The most inhuman tabu among many tribes in Nigeria was the attitude held, until very recently, by the people toward twins. They were considered evil and thrown into the bush to die.

At Ife, the ancient spiritual center of Yorubaland, some interesting discoveries have been made in the form of bronze heads of exceedingly fine workmanship. The Oni of Ife still retains his spiritual leadership over his people, while the Alafin of Oyo is recognized as the suzerain of Yoruba chiefs.

A lingering impression of the enormous city of Ibadan is its maze of tin rooftops spread over many miles and dominated by the town

## Kano, Mud-made City



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### A Walking Harness Shop Carries His Wares on Head, Arm, and Shoulders

Dressed in a *rigo*, a neckless gown, this Nigerian sells bridles, cinches, and martingales for camels, horses, and donkeys. Stirrup and saddle pad are a light load for his neck; Kano laborers balance empty wheelbarrows on their heads. The natives are Hausa, a Negroid people celebrated in Africa as traders.



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**Gutter Spouts, Bristling from Roofs Like Guns. Like Guns from a Fortress, Carry Off Rains That Might Reduce Kano to Liquid Mud**

Clay walls of the merchants' stalls still bear the curving strokes of the plasterer's trowel. Bamboo frames shade open-air merchants from tropical sun. The goat is one of hundreds romping Kano's streets. In the evening, electric globes on the poles will light the market place.

Kadachrome by George W. Bond



© National Geographic Society

Kodakman by George W. Bell

**Each to His Stall, as Alike as the Cells in a Honeycomb, Kano Merchants Find Their Way**

Two feet of dried mud break the sun's rays. Mud hides termite-proof palm logs bracing doorways. Goods woven in Kano from Nigerian cotton are sold here. Manchester and Japanese cottons normally compete. Being in Islam, this is a man's world. Most women are in seclusion.





**Hooded Vulture, Kano's Refuse-disposal Plant, Hungrily Spies Out a Scrap of Meat**

*Necrosyrtes monachus* perches above an open-air slaughterhouse. This bird, a fighter over a carcass, spares domestic animals. As city-scavenger it has man's protection. In West African towns a score or more roost in a single tree.



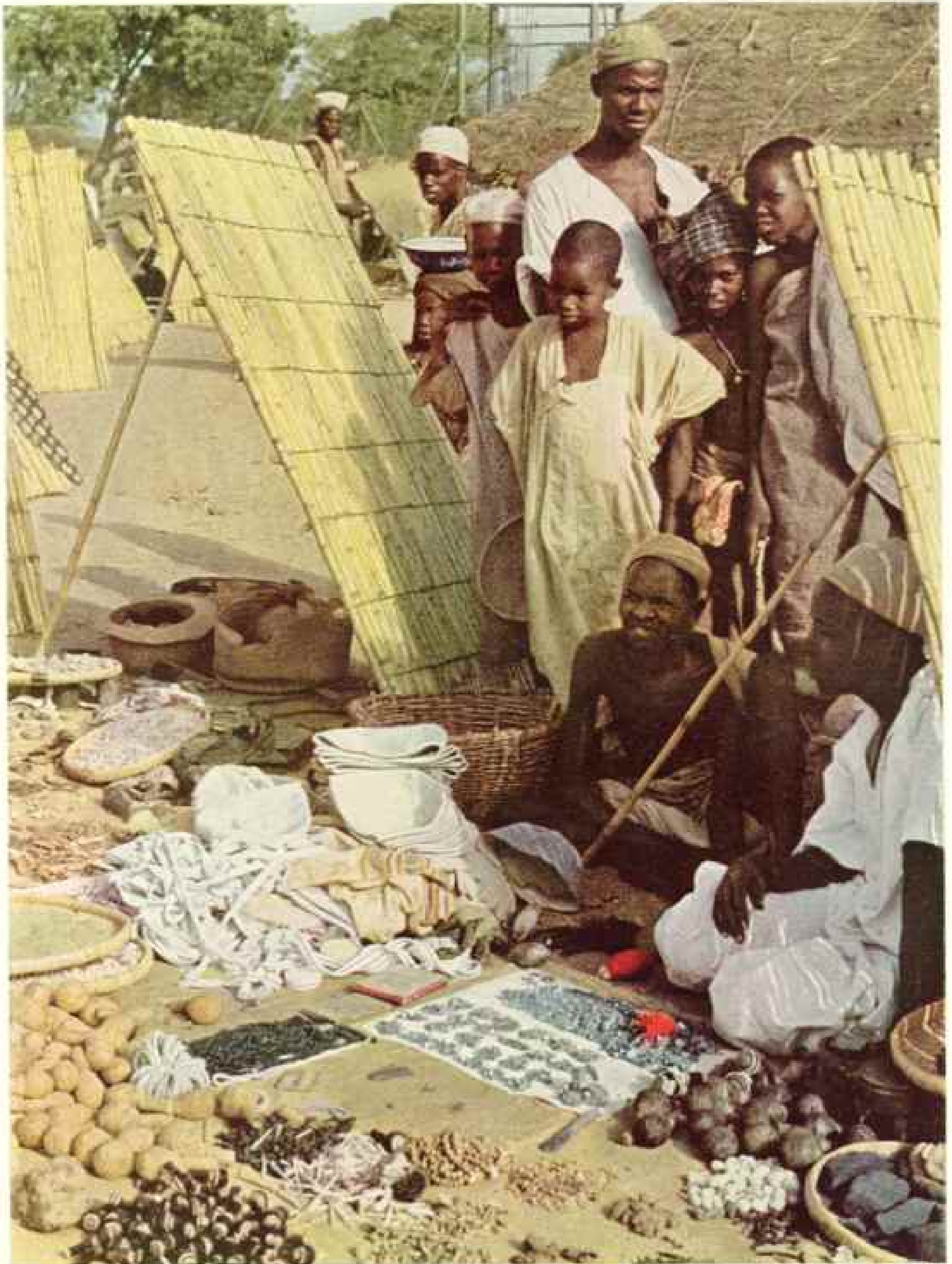
© National Geographic Society

Katschinas by George W. Smith

**Selling a Dab of Peppers or a Pinch of Salt, He Deals in Fractions of a Penny**

The measuring cup is his pride; many of his competitors use discarded tin cans. Kano is a good market for what the world throws away. Old razor blades, bits of string, and empty bottles are in demand.

## Kano, Mud-made City

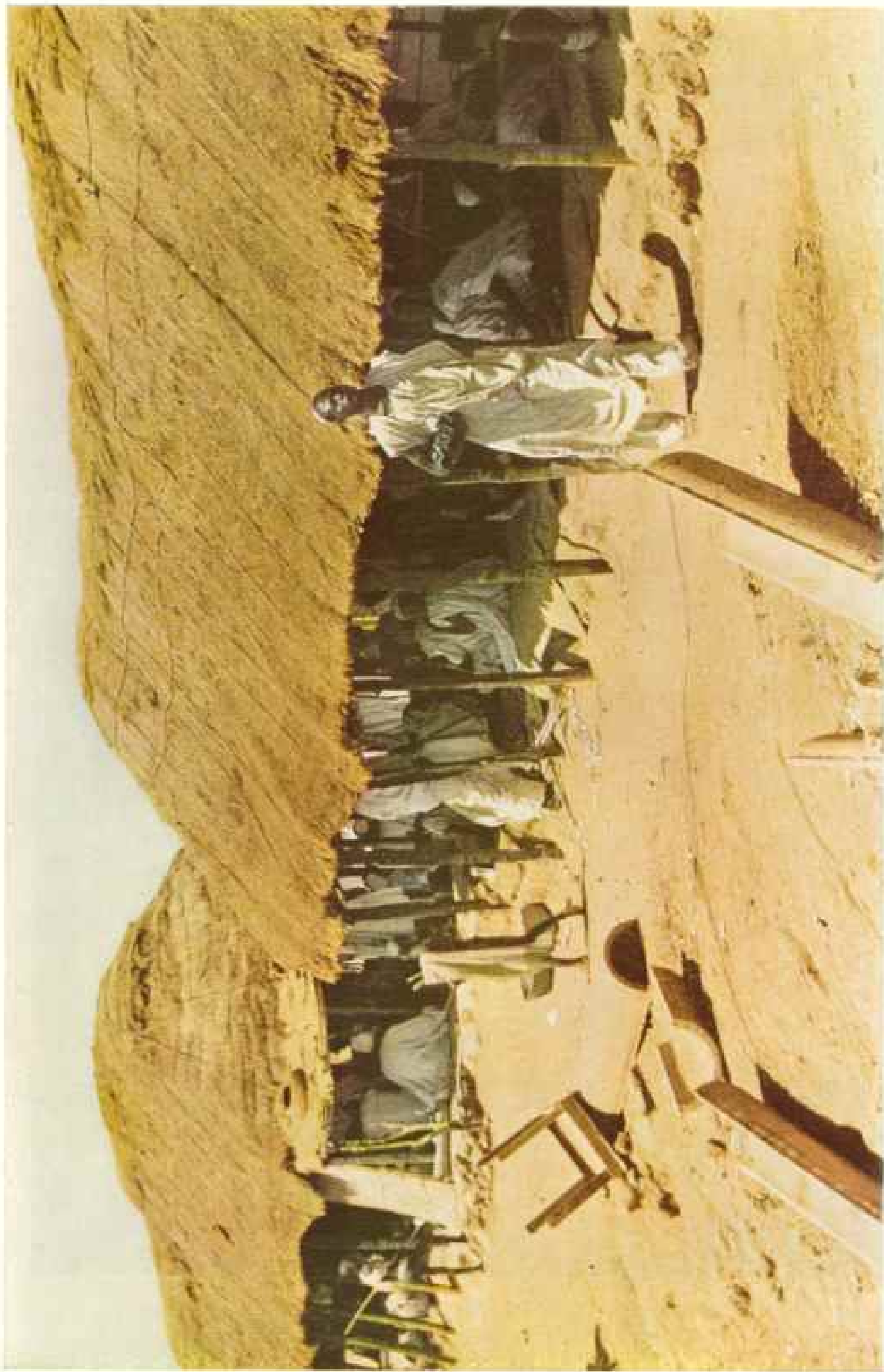


© National Geographic Society

Kano, Nigeria. K. E. Twitcheil

### On Their Mats Two Dirt-floor Merchants Spread a Bewildering Array

One offers charcoal, shells, beads, spools of thread, and kohl for beautification. His companion sells the white cap so popular with Kano men. Under the second bamboo shade, their drinking water cools in a semiporous jug. They have an audience; the crowd loves to have its picture taken.



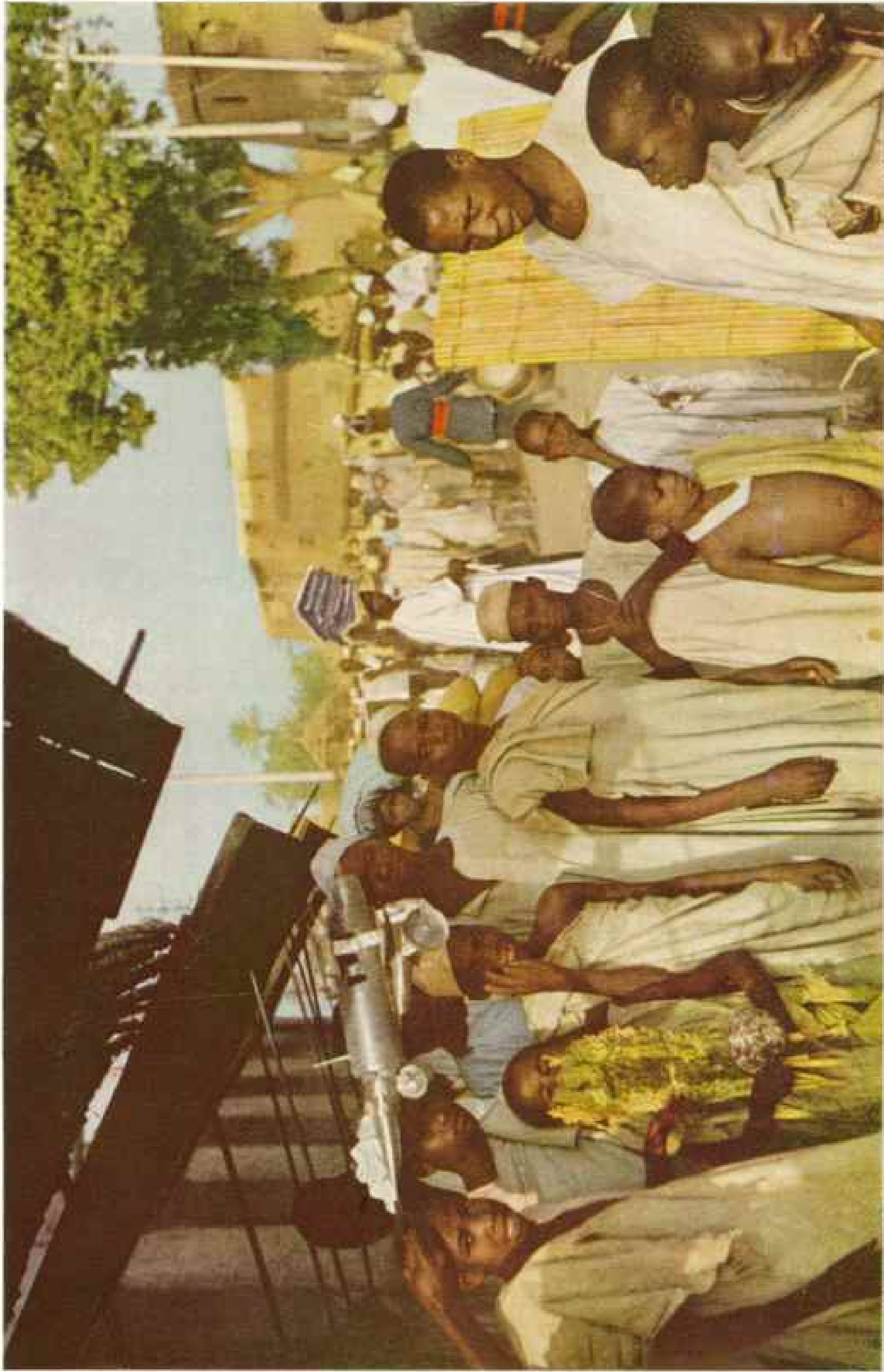
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**In the Gloom below Thatched Roofs, Salesmen Sit in Ghostly White Gowns**

Thatch marks the third-class mercantile section of the walled-in native city. Concrete houses the better merchants, and mud the second class. Last in importance are the bamboo-shade and pack-on-head merchants. On the "sidewalk," man and boy are barefoot.

Illustration by George W. Hart.





© National Geographic Society

Photograph by K. S. Swinhart

**Cameras and Airplanes Delight the Natives—A Group Poses below a Model Plane Made of Thermos Flask and Tin Cans**

The Royal Air Force maintained a station here even before the war. Now the American air route to the Middle East crosses Africa in the general vicinity. Left, a boy carries several heads of sorghum. Center, a policeman curbs the crowd and a peddler balances his stock of blankets.





**In the Paddock of Kano Race Track, Boys Prepare to Saddle Entries**

A tent pitched beside the finish line is the reserved seat of the native Emir. His fellow enthusiasts are visiting Yanks, Tommies, Anzacs, and South Africans. The British colony maintains the track outside the city walls.



© National Geographic Society

Kodachrome by General W. Scott

**A Visiting American Flyer Tests the Edge of a Dagger Made from an Automobile Spring**

"Ask a native how good a knife is and he will tell you 'Ford,'" says Mr. Scott. He stands between a native policeman and a money-changer. Kano's police chief occupies the thatched booth in the main square.

council chamber of elders, rising from its height like a Pantheon against the sky.

We were fascinated by the panorama of African life in all its phases, both pleasant and sordid, but somehow we never felt at home there. Early European officials chose a separate hill for every house; consequently, their settlement is scattered over a wide area.

#### Citrus Fruits and Coffee Grown

The rain-belt region around Ibadan is producing some much-needed coffee nowadays, and is especially good citrus country. In our own garden there lemons lay in a golden carpet on the ground. Oranges and grapefruit are abundant, and at Aro, a station on the way to Ibadan, they are offered to travelers at sixpence or a shilling a basket. Farther along the rail line bananas and large pineapples are available in plenty. Grass mats are a specialty of a station farther to the north.

The African, however, finds nothing so satisfying as the kola (cola) nut which is as indispensable to him as betel is to the peoples of the Far East. This nut possesses immense sustaining powers against fatigue and satisfies hunger and thirst. The first act of friendship and hospitality is the breaking of the nut. Be careful to take the right section, as it may make for you either friend or enemy!

The rain belt's riot of vegetation includes dense forests of valuable timbers and oil palms. Intermingled with dense bush, the cocoa and coffee plantations, and rubber to the east (production lately intensified), lack the orderliness of plantations in other tropic countries.

Along narrow, reptile-infested bush trails the villagers go to their farms in bush clearings often at some distance from their village communities. They have no fear because "juju" is supposed to protect them. The yam, cassava, and maize are cultivated for food. The yam must first be proclaimed "safe to eat" at a festival. Cassava furnishes starch for another of the south's industries.

The train halts often at large and small stations, among them Ilorin, gateway from the north to the south, which has developed into a busy trading center. The rumble of the guttural southern tongues heard at these stations, as everyone freely expresses his emotions, is a feature of southern Nigeria. Not until one passes Jebba on the Middle Niger, spanned here by a bridge completed in 1916, is a definite change perceptible.

Jebba also is an important junction and trading center, but is remembered for the embroidery of the Jebba islanders, who work Moslem emblems and geometric patterns in

buttonhole stitch, gold and silver embroidery, and in intricate beadwork.

In the middle of this historic river, rising in flood as much as 30 feet or more, Juju Rock stands like a formidable sentinel, held in reverence and fear. To it cling many superstitions and legends. It appears in picturesque angles as the train progresses, soon to enter the savanna country where one feels in a freer atmosphere, as if the Tropics had been left behind.

The landscape begins to thin out into lower bush, with only patches of timber and palm between grasslands, and assumes a parklike character farther on. Instead of the zinc-covered rooftops of the southern dwellings, there are groups of round mud houses with grass roofs behind mud walls or cornstalk fences, first evidence of the privacy sought by Mohammedan populations.

In the dry season the scene may appear somewhat bleak, lacking the dense foliage left behind us, but when the rains come all is transformed into rich fields of grain.

From here northward we were always impressed at the various station stops by a people of quiet dignity and manners, whose language is more mellow.

Among the more important towns are Zungeru, Minna, and Kaduna, the latter the administrative center for the Northern Provinces. It also is the rail junction for the Jos line to the plateau, as well as back south to Enugu, the coal-mining district, and Port Harcourt.

#### A Visit to the Plateau

Beyond a palm belt the train climbs a veritable alpine route of loops and bends in the picturesque *kloof* that forms the plateau. The air becomes light and fresh. Jos, at an altitude of about 3,900 feet, in a valley beneath lofty peaks, enjoys "eternal spring."

In recent years Jos has become a health station, though many people prefer Kaduna, at about 2,000 feet elevation and with less severe temperature variations.

Where water is plentiful on the plateau, gardens are a riot of color and beauty all year round. Vegetables and many fruits of temperate zones yield abundantly, while peas seem to do phenomenally well.

Roads stretch to remote tin mines. Grim ranges rising from the plains disclose themselves in fantastic formations—a chateau, perhaps, or a temple with a kneeling worshiper, a reclining figure, a brooding Buddha, or a large head that might be human. A streak or patch of silver denotes a waterfall, or a "loch" where water has been made captive.



British Official

### Lathered "Gold Dust Twins" Are a Study in Black and White

These recruits of the West African Frontier Force take their induction bath in a stream at Bukuru. On long marches under tropic sun, they will carry the regimental supplies without distress.

One steep escarpment within easy reach of Jos is at Jekko, where the Kurra River has been harnessed for power. A narrow serpentine road recently opened up winds in and out among these hills. They offer interesting contrast to the rugged scenery around Jos, for on descent to lower levels and warmth the hills are clothed in tropical verdure reminiscent of the luxurious hill country of eastern tea plantations. In time these hills may be planted in tea.

#### The Fulani a Mystery People

Among these grim ranges are level plains that provide excellent pasture for large herds of cattle driven over the territory by the Fulani, to me the most interesting racial group in Nigeria.

The Fulani were among the first to follow the Green Flag of the Prophet, and helped to spread the Faith. By the end of the 18th century many had already embraced Islam, when a leader of one of their clans, Usuman (Othman) dan Fodio, started a holy war. In 30 years he conquered nearly all the northern territories except the states of Kebbi and

Bornu, stopping short of the highlands and plateau.

Probably a white race originally, they have blue eyes, fair complexions, fine aquiline features, slender figures, and straight hair. For several centuries they have roamed across Africa, herding their flocks of humped Zebu cattle that possibly originated in India.

Their delicacy of features and ruddy complexions are still evident among the pastoral, or Cow Fulani tribes, known as the "Boro-roje" (*bororo* is the Fulani word for cow), who have held aloof from intermarriage with other tribes and retain their own language to this day. They never abandoned their nomadic life to follow the *jihad*.

The Town Fulani, on the other hand, are descendants of those who participated in the Fulani conquests, or else forsook their cattle to deal in slaves.

Most of these Fulani have lost their true identity, as they have long been intermarrying with other tribes, chiefly the Hausa, and have adopted their language. Yet the slightest trace of Fulani blood is sufficient for the claim to "Fulani."



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### A Kiss on His Bayonet Is the Pagan Recruit's Pledge of Loyalty to His Regiment

Under British officers, they will serve in the West African Frontier Force, which defends Nigeria. The army will teach them English and a trade. They average six feet in height.

Even here in Africa there are notable racial discriminations. The Fulani consider themselves a superior race, having been the conquerors and never slaves, and not having worn tribal marks. This mixed race of Town Fulani has produced scholars and statesmen, and many hold posts in native administrations of the north.

The Bororoje, meanwhile, have kept to their wanderings. One year they may be found in Adamawa Province, the next in Sokoto or Zaria, and even in the far south; therefore, it may be years before they get back to their original starting point, if ever.

#### Wild Game Still Roams

Adamawa Province, where they predominate, is unsurpassed scenically in Nigeria, and, as in Bauchi, Bornu, and Chad (French territory), elephants, giraffes, lions, leopards, and other big wild game still roam there.

Yola and its environs are one of the few areas which may be termed a permanent locality of settled Fulani. These are composed of Bororoje who have wearied of wandering and now keep only a few cattle for their milk

and butter, and occasionally sell an animal to supply their other needs. Sometimes, though rarely, they may turn to agriculture.

#### Dodging the Tax Collector

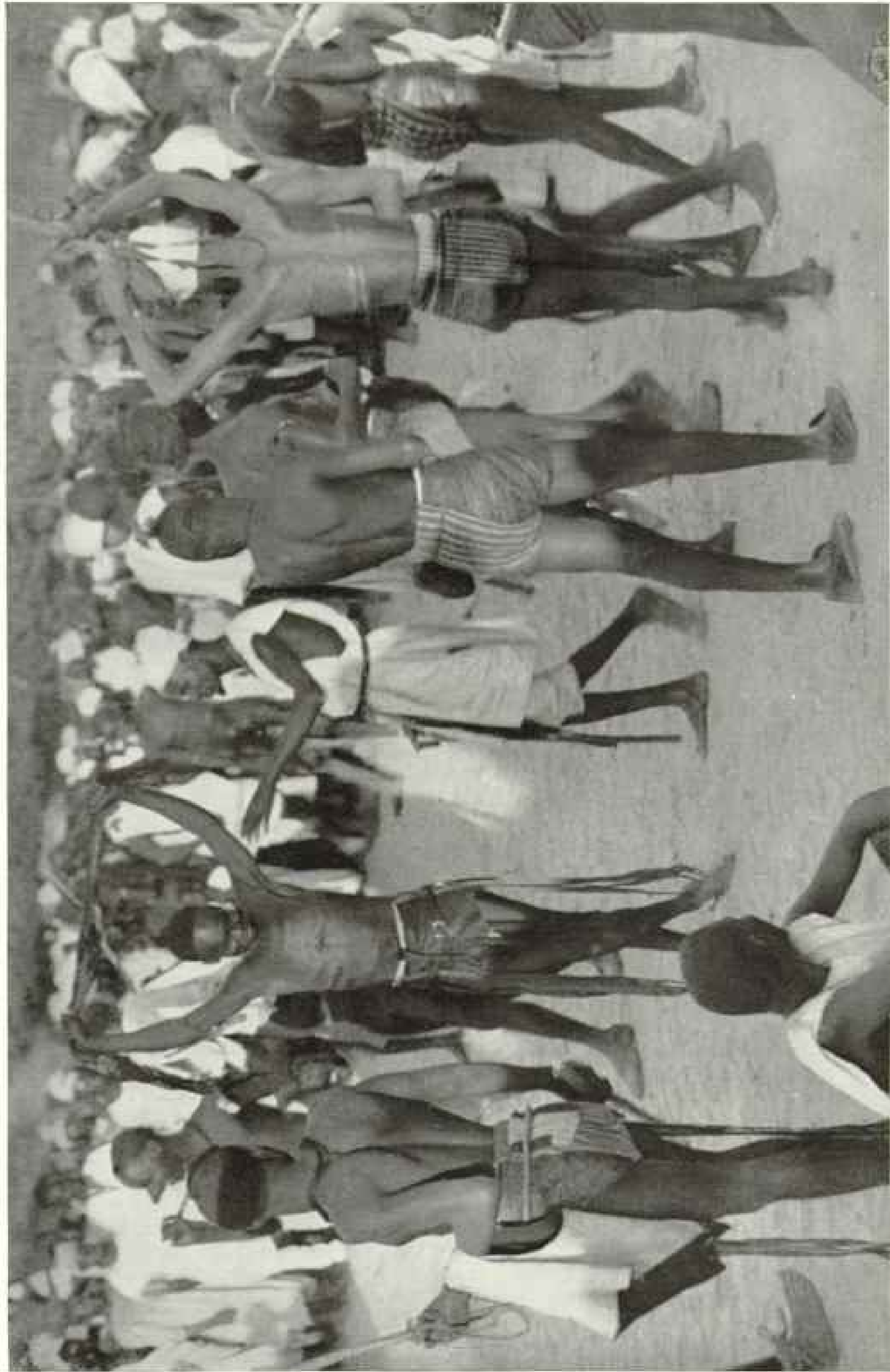
The Bororoje love the freedom of their nomadic customs, and their cattle, which they treat most kindly, seem as dear to them as their children. The animals are all given names. The story is told that when a tax collector appears, the Bororoje utter some strange sound to which the cattle have been trained. The animals at once stampede, with the herdsmen hidden among them.

A young Cow Fulani begins to acquire cattle early in life. Herding for the clan leader, who may have up to 10,000 head, brings its reward at the end of the first year of service of a two-year-old bull; at the end of two years' service, a two-year-old cow; and so on.

By the time he is nearing manhood and ready to marry, he already may have five or six head of cattle.

The Fulani women will not consider any man acceptable until he has proved his courage at a public demonstration, which consists of a

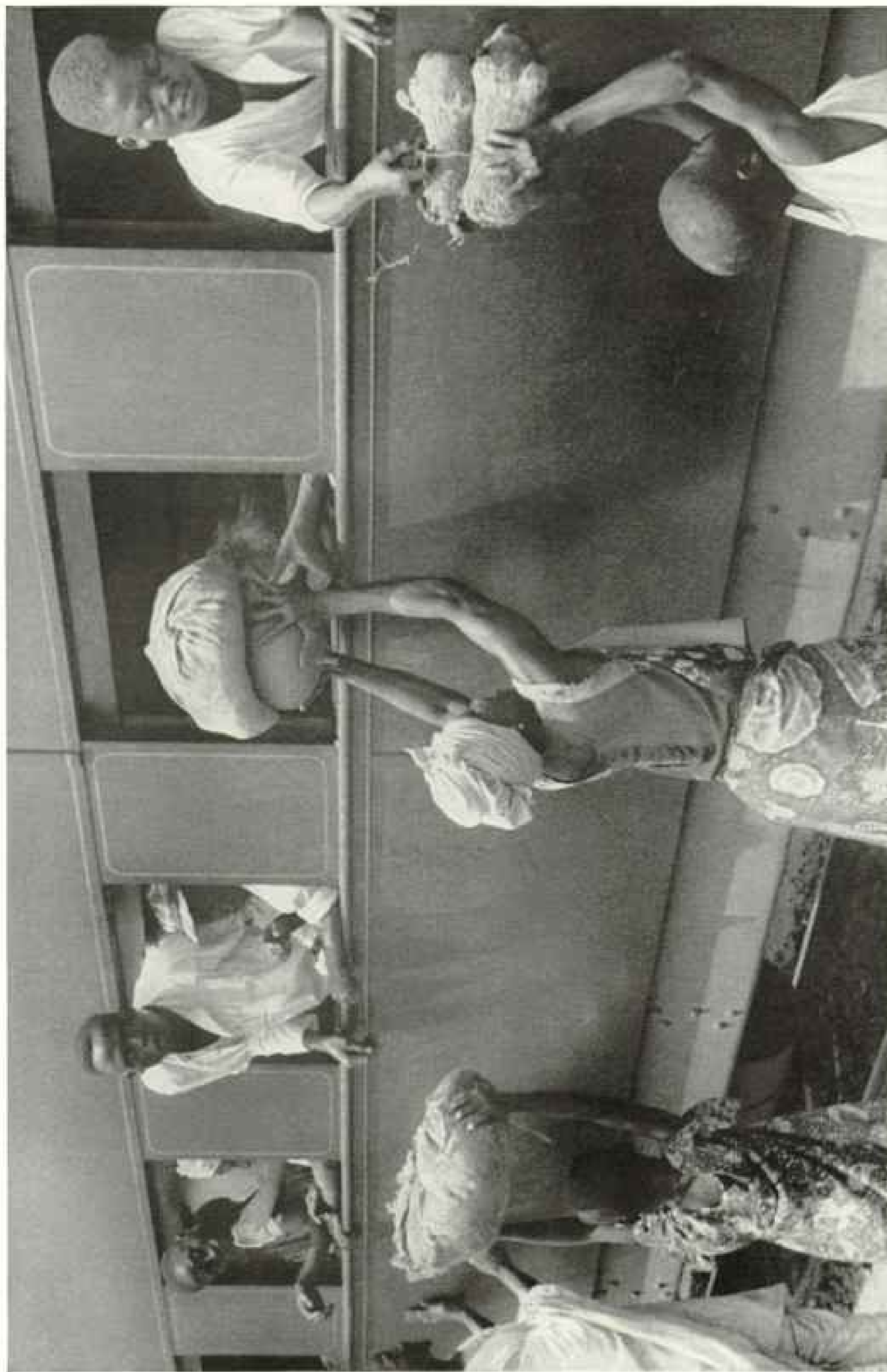




J. P. Flaxler, from Helen Frydendal's *Ututu*

**To Prove His Courage, a Fulani Youth Smiles as He Endures the Lash—If He Flinches, His Intended Bride Will Refuse Him**

Prepared to wield a blow from any quarter, floggers surround the boy at the left. If he drops the sash held above his head, he is disgraced until a new ordeal vindicates him. To the right, another candidate reveals two weals; he may carry the scars the rest of his days (pages 555, 555).



© Hans Lilholm

**Nigerian Railway Passengers Dispense with Porters as Friendly Arms Hoist Luggage to Third-class Coach Windows**

First-class passengers get tea, fans, beds, and meals. Small traders ride second class, ordinary natives third. Colored men staff the entire train. The Lagos-Kano main line hauls to the Atlantic in a few days the commerce that camel caravans used to pack to the Mediterranean in seven months (page 564).



© Kurt Lattincki

#### As to an Altar, Little "Priestess" Carries a Goat to Market

White clay, mixed with animal fat, is smeared on the faces of initiates into a women's secret society as a sign that they are of marriageable age. Brown clay is used as a "rouge."

flogging imposed by the young men on each other. Since the flogger must himself undergo the same ordeal, he probably inflicts as many lashes as he thinks he will be able to stand, which may be only two, four, or, at most, a few more (page 556).

The nonchalance with which the ordeal is borne constitutes courage. If he flinches, he is stamped as a coward, and no woman will have anything to do with him, though in time he may go through the ordeal again with better success. However, if a young man is exceptionally brave, he is usually rewarded with presents of cattle and dogs from his relatives and friends.

At marriage, similar gifts come to him. Thus a Cow Fulani is ready to start out on his own

nomadic existence in search of good grazing for his herd. His wife builds the house, usually of matting with grass roof, and sees to household arrangements. Sometimes, if a man has a beautiful wife (and many Fulani women are beautiful), a rival may steal her. This does not usually happen without the woman's consent, as she is not likely to encourage another unless he is a wealthier man than her husband.

The families of a clan burden themselves with few household goods. Proceeds from the sale of their milk products suffice to buy them their needs in the village markets, and at any time their leader may give the word to move.

Particularly is the event sudden if any member of the clan dies or cattle sicken. Stakes are uprooted overnight; possessions, women, the sick, and the aged are mounted on cattle, and the procession and herds are moving at dawn. Hausa or pagans will be paid to bury the dead, for

the Bororoje feel an evil spirit has visited them and is waiting to destroy them all should they remain.

Were misfortune to befall that would destroy all a man's cattle, the Bororoje would indeed be a lost man, for he has no other interest in life. In that event the families of the clan meet and decide how many cattle to give him to start afresh.

#### Pagans Utilize Nature's Camouflage

Some of the pagan tribes may have dwelt on the plateau from earliest times, as the simplicity of their life and customs has escaped outside influences. Their very nimbleness in scaling rocky heights to the refuge of their hamlets, so hidden that only a trained

eye can detect them, perhaps by some palm, mango, or banana trees appearing between the rocks, shows that the inhabitants have long been accustomed to this environment.

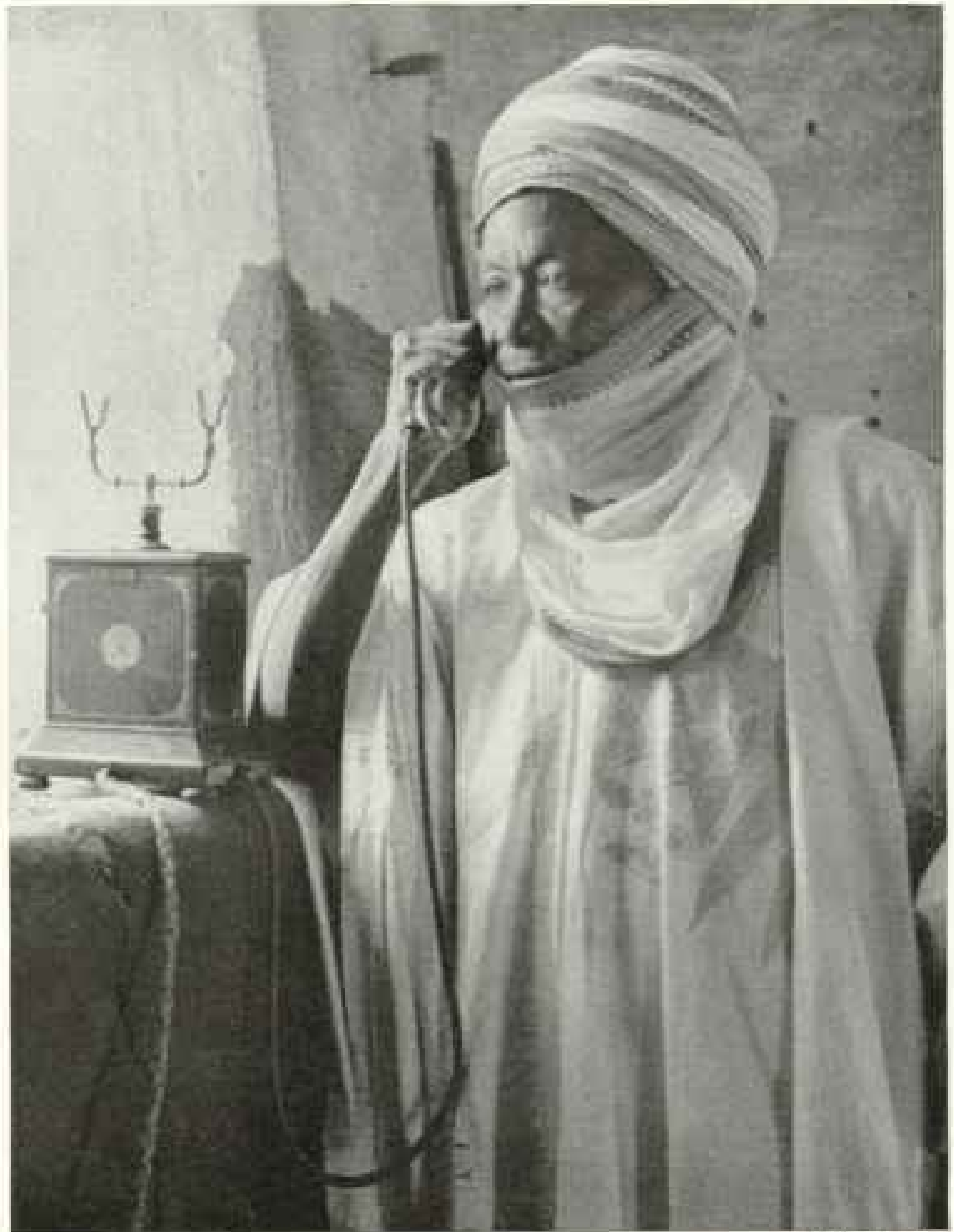
There are numerous tribes, governed by bodies of chiefs and elders. There is little cohesion between one pagan community and another. Each tribe stays to itself and keeps its own customs.

Even in their nudity the people have distinctive fashions. Bunches of leaves, front and back, suffice to adorn some of the women. Others "dress" in loops of string or grass, or a circular disk. Young maidens are attired in strings of beads or brass disk; the men often wear only a sheath. Tobacco is a solace of both sexes.

With toil and child-bearing the women age early. In their youth, even when pregnant, or while carrying a child strapped to the back in a goat- or sheepskin, they cover many miles afoot with ease and grace. From the back the women are almost masculine in appearance. Walking and climbing have developed in these women of northern Nigeria long, lithe bodies with none of those voluptuous curves peculiar to the southern Nigerian woman—curves which are especially cultivated by them in their "fattening houses" before marriage.

The pagans seem inured to the extreme changes of temperature among their rugged havens, where they have built their thatched settlements with cacti fences as additional barriers. They grow their grain, rear small short-horned cattle and sturdy ponies, and hunt. Some are adept at wood carving.

They are not fastidious in their choice of meat; dogs are favorites with them. There are tales that dead bodies have been exhumed from their graves for food.



E. O. Hippel—Pitt

#### Clerk of the Market at Kano Phones the Latest Prices to the Emir's Palace

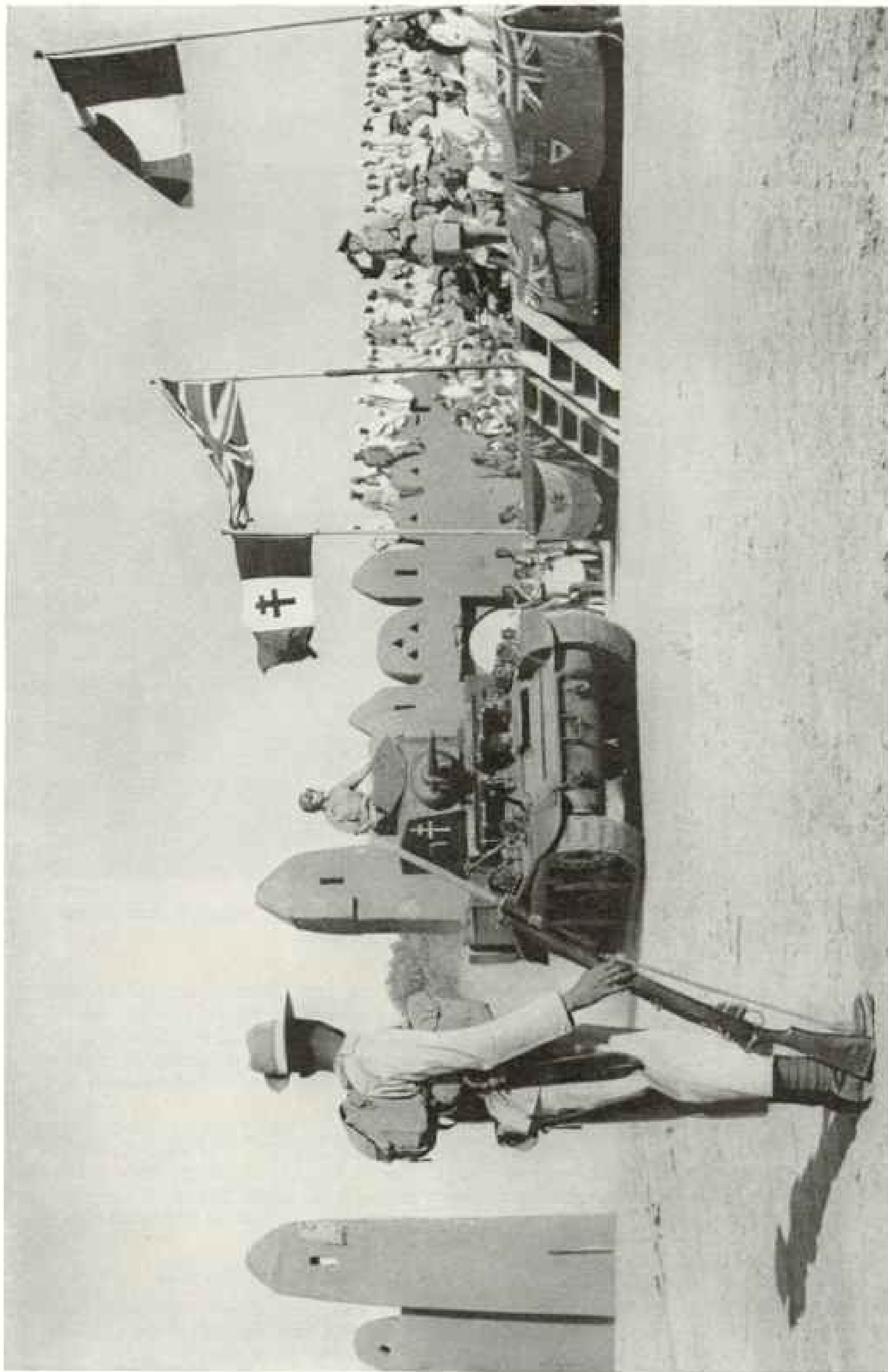
Among the formations of natural masonry piled up eons ago by volcanic action lies untold wealth that has gained enormously in importance since the first shipment to Britain of 57 pounds of tin ore. Other minerals now are being sought.

The first mining camp was formed at Narguta, near Jos, in 1903. The mineral is oxide of tin, or cassiterite, found as black, water-worn grains from coarse gravel to fine sand. It is also found as pegmatite and small quartz veins on younger granite.

#### Wooing the "Tin God"

Tin ore has been mined here since early times. To woo this tin god, fissures, clefts, ditches, and pits have overrun a landscape that is practically treeless, having been de-

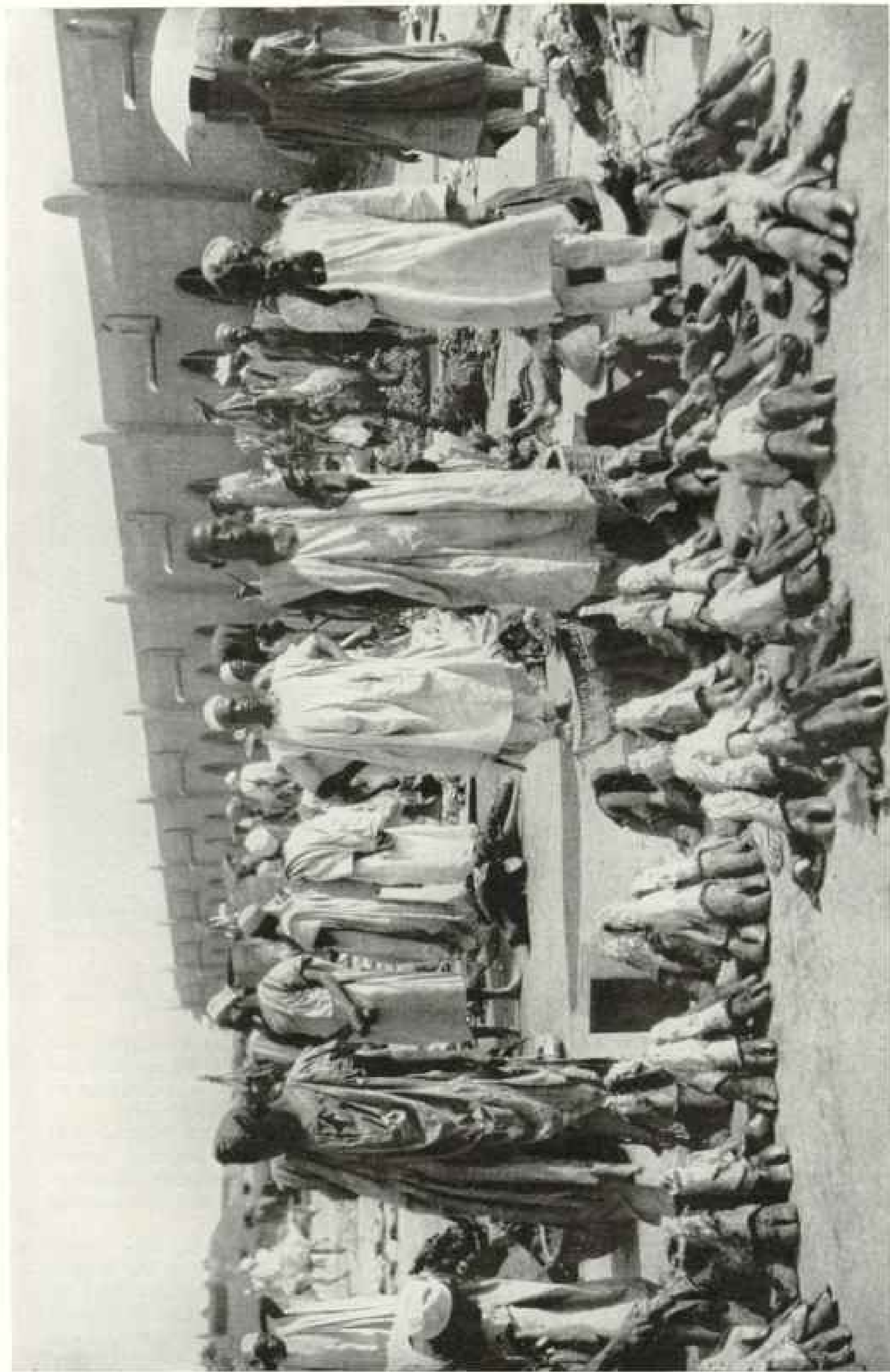




British Columbia

**White-robed Subjects Form Living Battlements on Kano's Mud Wall as Britain's Nigerian Forces Parade**

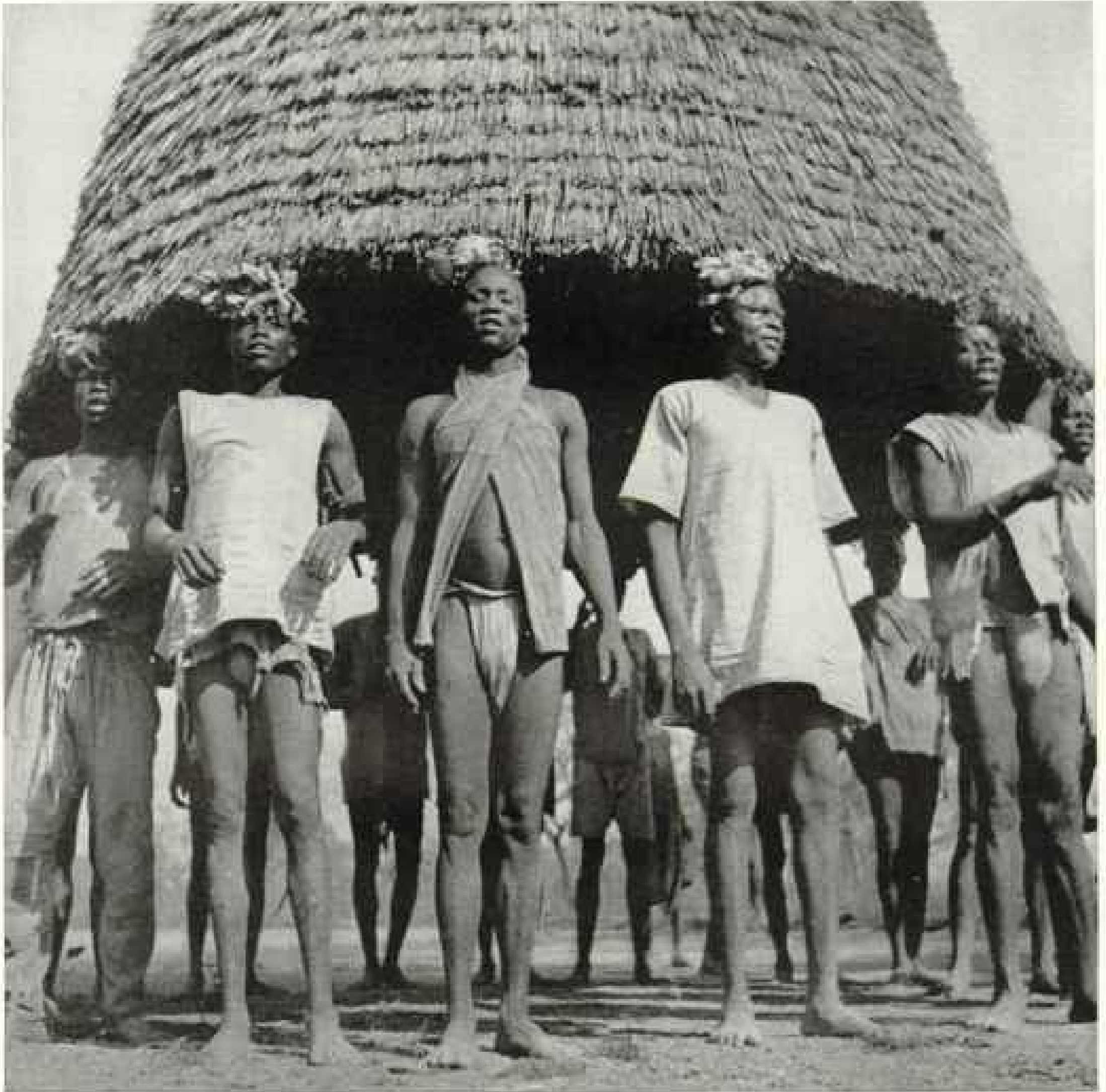
As a tank rumbles past, a major general stands at salute. In the review stand are provincial Emirs and their entourages. Above them fly the flags (left to right) of the Fighting French, Great Britain, and France. A native band provides music. Daybreak is the parade hour, allowing dispersal before the heat sets in.



© British Press Corbis

**Stacked in Fours on Kano's Pavement Counter, Hoofs and Hoeks Support One Another as the Four Quarters Did in Life**

Travelers with sensitive noses take pains to skirt the butchers' open-air market, as tropic sun brings out its worst. Cattle for the slaughterhouse arrive from great distances. Long lines of sheep and goats are herded in daily. For scraps of meat,urchins serve as apprentices (page 367).



© Metin Misfah

### In Rural Nigeria, Moving Day Holds No Terrors

Their heads cushioned, a dozen husky natives carry the hut of a dead chief. Living columns, they are reminiscent of the Greek sculptors' caryatids, the draped marble figures supporting an entablature on their heads.

nuded by the early workers before electrification. Yet there is still demand for human labor.

The pagan is not a steady worker, and since the mining companies cannot depend on him entirely, they have imported laborers from other provinces, who live with their families in encampments at the mine. Yet the pagan's strong, sturdy physique enables him to work untiringly at digging and carrying loads, while for clearing bush there is none to compare with him. Not yet having learned what to do with money, other than pay his tax, he naturally labors only as the spirit moves him.

I once offered some bush children a few coins. They ran away in fear.

Among some remote tribes in Nigeria, the cowrie is still currency. Cowrie shells of the genus *Cypraea* were probably introduced to the West Coast by early slave traders.

Today there are tribes in Nigeria who counterfeit current coinage, and they cannot understand why the Government imprisons them. They feel they ought to be commended for their cleverness!

A land the size of Nigeria, with nearly 373,000 square miles (including the British portion of the mandated Cameroons, with an area of 34,000 square miles), and 21,000,000 people, is bound to offer many diversities in topography, people, and language. Of languages there are hundreds—a confusion un-

paralleled—but the language of the north, Hausa, is the common tongue of central Africa and may be heard along the Mediterranean, in the Middle East, and southward.

While primarily an agricultural people, the Hausa also are great travelers and shrewd traders. A short growing season in their home country left many months for travel and trade.

The Hausa states established in a remote period had an old history, but their records were destroyed by their Fulani conquerors. They have a literature—Hausa is the only West African language I know about which long ago was reduced to writing—but much of it is legend.

Some believe the Hausa originated from the Nile Valley and were of Coptic origin; others think they came from lands east of Mecca. Paganism apparently prevailed among them, as the Jakara Pool in Kano was held sacred; but their form of worship differed from the fetishism practiced in the south.

As the northbound limited approaches Kano in the early hours of day, the sweetness of the morning air is like perfume. The spirit feels liberated as the eye falls upon a park-like country with the grotesquely gnarled baobab (*Adansonia digitata*) trees standing like strange specters among their more orthodox thorn, tamarind (*Tamarindus indica*), and locust bean (*Parkia filicoidea*) neighbors that are a part of every farm. Here and there a magnificent silk cotton, or kapok (*Eriodendron orientale*), raises its mighty crown heavenward, a giant among dwarfs. Vultures seek the topmost branches for their nests.

#### Bird Life Varied and Beautiful

Nigeria's bird life is varied, beautiful, and curious. The usual morning song is merely a tuning up to an orgy of sound at midday, when the screeching and chatter become deafening, subsiding after an interval until night-fall, which brings another sudden outburst.

The regal crowned cranes, or "crown birds," as they are more familiarly called because of their golden crests, herald daybreak and night-fall with a startling warlike trumpet that can be heard for miles. Among the more unusual and rather offensive in appearance are the burutu birds, or ground hornbills, with "eyelashes"—really degenerate feathers. They feed almost exclusively on meat (page 566).

The tawny hues of the countryside in the bright sunlight of the dry season reminded us of Egypt. Occasional hamlets dotting the miles of plain swarm with guinea fowl, poultry, and pigeons, while the ubiquitous brown goats that furnish Nigeria's famous "Morocco" leather gambol about with shy sheep.

Women are abroad early milking the cows, which, together with the other domestic animals, are usually the property of the female members of the household.

It does the heart good to see orderly fields of tilled land—unusual in this part of Africa—that have yielded rich harvests of bulrush millet (*Pennisetum typhoides*), guinea corn (*Sorghum vulgare*), groundnuts, beans, and other crops. The land is again being fertilized with heaps of manure which the donkeys bring back to the farms from market to be accumulated for the next planting season during the rains, May to October.

Firewood is scarce, so every dry twig is collected. Goats dispose of other rubbish and neatness prevails. Doubtless, if Nature were more prodigal, there might be disorder.

#### Traders and Craftsmen Help on Farms

Every March and April sees the return to the Hausa country of the traders, who have journeyed forth in the dry season with cattle to Ilorin or to Bornu for potash. Even craftsmen leave their benches for the field, labor makes its way back to the farm, and blacksmiths are busy forging farm tools instead of making swords, stirrups, and the like.

It is amazing how expertly the Hausa cultivates his field with a simple short-handled hoe. Men or boys will set to, each at the head of a furrow, and in no time have it plowed.

Families give each other neighborly assistance. If the farmer has called in much help, he usually provides musicians for entertainment and kola nuts for refreshment.

At harvest time the guinea corn rises many feet above the head of a man on horseback, and he is well hidden as he treads a path through this ephemeral forest. His corn is the farmer's most valued possession, to be hoarded carefully in his bins against famine. The sweet potato is another food crop that matures after the rains, and in many sections of the north it yields most abundantly.

Peanuts, however, are the commercial wealth of the northern farmlands, and Kano Province, it may be said, produces two-thirds of Nigeria's crop. After harvest they are poured at the feet of traders, mostly Syrians, who have posts in all the districts and buy up the crop for export. Tripolitan Arabs, of whom there are many in Kano, were among the early traders here.

Like a scene from Biblical times, the early-morning hours see a procession start for market. Peasant women draped in their indigo-dyed cloths carry a burden on the head and perhaps a child at the back, hidden completely under their draperies; men and boys



drive their donkeys, laden with grain, sugar cane, and the like, or carry loads of other products on their heads.

A dignified village headman rides his gayly festooned pony like a lord of the manor. The horse in northern Nigeria still enjoys prominence both for utility and for sport.

Until we learned that it is a greeting, the shaking of the fist in salute seemed unfriendly. The gesture usually is accompanied by a melodious *Sannu, sannu, or Rankeshi dade*—May your life be a long one!

Under the welcome shade of trees along the roadsides where women dispense delicacies, wayfarers stop for rest and refreshment.

### The Walled City of Kano

Many Hausa towns which were walled lie in ruins from war and famine, but Kano, capital of the province of that name, which embraces the lesser Emirates of Kazaure, Gumel, and Hadejia, has not lost its importance (page 539). There is an element of the eternal about Kano, a flower among her neighbors.

Today Kano Province, about 17,000 square miles in extent, with some two and a half million people, is still the richest and most progressive. Water service and electric lights are available inside the walled city of Kano, as well as in Kano township, and in Sabon Gari. This last literally means "new town," but is a designation applied to sections in every town where "the stranger dwells."

Since the infidel was unwelcome in the Walled City, Sabon Gari's population is made up largely of southerners who are mostly Christians. An African Hospital within the Walled City, designed to conform with existing Hausa architecture, is perhaps the best in central Africa.

Kano, at the crossroads of many routes across Africa, with its industries of leather, hides, ghee, dyeing, and trading in cattle, groundnuts, and gums (including fossil resin, gum copal, etc., mainly from Bornu), is an important emporium.

Dr. Heinrich Barth described Kano as the great mart on the desert trade route to Tripoli, Timbuktu, and to the east and south. Today the airplane has penetrated to most of Africa, but the camel caravans still plod the time-worn trails, and hundreds of camels, with their silent drivers in their blue *lithams*, or veils, visit Kano. There are a few handsome Tuareg, but most of them are *buzu*, the slave race of the Tuareg.

Kano's dye pits are unrivaled for their indigo dyeing. For years they have provided the blue cloth for the lithams of these camel

drivers, who trade salt from Bornu and Lake Chad for grain, leather, Hausa homespun, and dyed cloths, as well as kola nuts.

Kano's Walled City is 11 miles or more in circumference. Once it was surrounded by two ditches, the mud walls 40 to 50 feet high, and thicker than that at the base, with inside terraces wide enough for several soldiers to march abreast. Today Kano still stands in considerable of its old-time dignity (pages 539, 560).

We often think of the sweat and toil of the countless men and beasts that went into the prodigious task of erecting this formidable barrier, built of cones of mud. It must have taken years, since only in the dry season is it possible to build with mud.

The work of the elements during the centuries and recent lack of maintenance are beginning to leave their traces on this tawny bulwark, as portions are slowly disintegrating. From some of the higher ramparts goats, sheep, donkeys, vultures, crows, and humans alike gaze out over the surrounding plain, its tableland interrupted only by two hills, Dalla and Goron Dutsi, and a few gneiss masses.

Within these walls followers of the Prophet pray at least five times a day. Urban Hausa hold posts in the native administration or at the Emir's court; others are traders, craftsmen, artisans, and laborers. These people swarm about their habitations, which, despite their note of poverty, have a distinctive style.

The façades are often decorated with scrolls and patterns. An occasional dome interrupts the monotony of flat roofs. The flat-topped roofs offer a refreshing retreat on hot nights.

In January and February, when the *harmattan*, a dry, dust-laden wind, blows from the Sahara, the temperature at Kano drops to about 50° Fahrenheit, and early mornings are crisply fresh. Everyone goes about enveloped in all the robes he possesses, in addition to blankets. As the sun creeps higher, the people bathe in its warmth, huddling against the side of the house or wall that first gets the morning glow.

The few women in evidence, mainly young girls or older women, are more active than the males. The smell of food arouses everyone, and when the sun is higher they are ready for their daily tasks.

Open doorways of their humble dwellings reveal manifold scenes of industry and indolence. The inmates are leather workers, tanners, and cobblers making boots and sandals of many patterns, colors, and designs; weavers of cloth, for which Kano is renowned, are busy at looms improvised under the shade of some trees.

Inside some dark chamber children lustily chant the Koran, which they repeat after their teacher: in a doorway sits a Hausa treading a sewing machine, his assistants at his feet embroidering flowing *rigas* and trousers. In another doorway old wiseacres discuss war, or merely sit dreaming in the sun.

Women are eternally spinning. They are soft-voiced and gentle, even in groups on their way to market. Toil has apparently subdued their spirits. Yet, as in the south, these women enjoy a degree of economic independence from the sale of their produce and invest any proceeds in more livestock, particularly goats.

Old and young indulge their little vanities as they stop to survey themselves in tiny leather-covered mirrors, apply antimony to their eyes, or indulge in a beautifying process of hennaing their hands in an elongated, decorated calabash.

This practice of *lalle* is observed from a tradition of the dim past.

Moslem women must go to the bedside of a dying parent, if possible, but a sleeping husband must not be disturbed. The story has it that Lalle, upon receiving news that her father was dying, cut off her arm rather than awaken her husband, whose head was resting on it. She reached her father's house, but, returning, dropped dead before her own door. Later it was discovered a shrub was growing on the spot where she had died, and this, the henna (Egyptian privet: *Lawsonia alba*), which produces a red dye, became known as *lalle*.

Except for very young unmarried girls with exposed bosoms, who are learning the art of trading, and the older women past child-



© Martin Mitchell

#### For Stalking Game, Two Heads Are Better than One

This elderly Nigerian has disguised himself as a ground hornbill (page 566). Only the headdress, which he has made of wood, leather, and beads, will be visible as he creeps through the bush to his unsuspecting quarry.

bearing age, who are shown considerable respect by all, few Mohammedan women are abroad. But behind the walls of the *zenana* happy laughter and giggling betray their presence. There they are doubtless pounding flour or busy with other household chores.

Along every street there is perpetual motion of humans, donkeys, horses, camels, goats, and sheep, as well as chickens, ducks, and the garrulous turkey gobbler with his family.

#### Sights and Scents of Kano's Mart

Much of this traffic is bound for the famous Kano city market where there is such a bevy of tradespeople that there seem to be more traders than purchasers. Beggars, lepers, the halt and blind, pray that Allah may grant



J. Zisra from Helen Trzostowski/Globe

### Captive Ground Hornbills Dream of the Marshes Where They Caught Frogs and Snakes

Science knows the author's "burutu birds" as *Bucorvus abyssinicus*. They are noted for their hairlike "eyelashes." Eyes are red-rimmed, feathers black, and wing tips white. The puffy throat is blue. The voice is a deep booming drum (page 563).

us plenty, so that we in turn will distribute largess generously.

At the grain stalls the faithful donkeys are unburdened of their loads of guinea corn, millet, maize, peanuts, sugar cane, onions, peppers, etc. Soapbox merchants display soap, mirrors, padlocks, safety pins, and needles. Others measure out small cups of wheat flour, salt, and imported sugar.

The perfume peddler wheedles the crowd into buying a few dabs of sweet fragrance which no true Mohammedan can resist.

Cloth vendors sell at stalls native woven cloth, shirts, and towels, and also the dazzling plushes, damasks, and other flamboyant textiles that may have come from hidden stocks. The white caps worn by Mohammedan males are available by the hundreds. It is a man's world; no efforts are spared to adorn him.

Cured and dyed hides hang from roofs of low-thatched market stalls. Near by are

elegant trappings and saddlery for horses.

Drums beat incessantly as the crowd bargains and barterers over meat, both killed and on the hoof; vegetables, especially yams; and cooked foods. Some of it is decidedly appetizing, such as the meat skewered on sticks and grilled over a small fire.

An entertainer with his cheetah tries to extract a few *anenes* from the crowd for his tricks. An anene is a tenth fraction of an English penny—a useful coin up north where the natives can buy so many things for only a few anenes.

Nature's gift to the African, the calabash or gourd, which grows in many shapes and sizes and has numerous uses, is offered. Artists are busy before mounds of gourds which they embellish with hot arrow points.

Potters, too, have brought their wares made by molding, as the potter's wheel is unknown.

The market headman cleared the path for us through the crowds. He was respectfully

saluted by all, but he did not hesitate to use his long staff to jab at any obstructionist.

At the slaughterhouse evil-looking vultures keep their vigil to pick up scraps of waste. The butcher is never without assistants; urchins serve their apprenticeship for a fragment of meat (page 561).

Apart from the cattle brought for slaughter, Kano has long been a busy cattle-trading mart. Branding is practical; it is a mystery how owners identify big herds brought here from all over the north, even from Chad.

The Kuri cattle from Chad are of special interest for the great girth of their horns.

Then there is the bewildering array of milk products and honey, seeds, herbs, antimony, and jewelry. The mattress and pillow makers are beside the kapok and cotton sellers.

There are mats for sleeping and floor coverings, as well as building materials, such as *azara* sticks (lengths of trunk of the ant-proof deleb, or fan palm), *makuba* daub (the red waterproof native cement), and grass roofs, for erecting native structures.

Toward evening activity attains a high pitch as traders urge bargains upon late buyers. Then, when the sun begins to sink in the western sky and the muezzin's call to prayer is heard, the crowd thins; soon the market falls into silence for the night.

#### Feasts and Fasting

In a land where Islam holds sway, observation of *Sallah* festivals brings these people their greatest spiritual joys, and also the indulgence of all their appetites, especially after the long fast of Ramadan.

Ramadan and Bairam Sallahs arouse high enthusiasm. The less fortunate must rack their brains to raise money to buy a ram or goat for the feasting, and new *rigas* and cloths for the family.

Many have to borrow, but borrowing is no unusual experience in the life of the African. Most Africans are in debt all their lives, and unpaid debts are often the only legacy they leave their offspring.

Their creed is to live only for today; Allah will provide for the morrow.

For *Sallah*, farmfolk also cease their labors, get out all their finery, and even reward that ever-faithful servant, the donkey, with new trappings. Thus arrayed, they pour into the Walled City from all directions through its many gateways of chaste design. Within a radius of 30 miles of this Walled City dwell nearly a million people.

The virginal streak of the new moon has been observed and proclaimed to break the fast of Ramadan. Early next morning while

the breath of dawn still hangs over this tawny world, the men in their flowing robes and *rigas* make their way afoot, on horseback, or donkeyback, to the Kofar Mata, or Women's Gate. There the Emir makes his appearance later to join them in prayers.

#### Camels, Donkeys, and Bicycles

Perhaps no faith breaks down the barriers of class as does the Mohammedan. Rich and poor all bow themselves in humility.

After prayers, while womenfolk prepare food, the men mount their horses, donkeys, and camels—some youths ride bicycles—and return to the neighborhood of the palace to await the Emir and his retinue.

Some bicycle owners today have their perplexities. A trader who often came to our house was disturbed because a trip to the bush had ruined his tires, and he could not replace them. Downcast and disgusted at his own lack of judgment, he remarked, "I be big damn fool sell em 'doky' (horse) and buy em this 'dokin karfe' (iron horse). My doky he be take me for bush no trouble."

Cyclists are the forerunners of the Emir's procession, and their sense of balance enables them to perform many tricks which bring cheers from the waiting crowd.

Horsemen of the royal guard in bright *rigas* and vestments, their steeds bedecked in varied trappings ranging from colored quilted cloths, blankets, and leather trimmings to gleaming metal harness, precede the royal party.

The Emir, resplendent in a sumptuous *riga* and cloak, rides a fine stallion weighted with silver saddle and trappings.

As he dismounts, his servants hold over him a huge colored umbrella, change his slippers for ostrich-plumed ones; then he advances to the waiting party, shakes hands with the Resident, and exchanges a few polite phrases.\*

Meanwhile, the waiting crowd watches the antics of the bicycle riders, the stilt walker, the weight thrower who has a hooked arm, and groups of dancers.

Before remounting, the Emir's ostrich slippers are changed for ones that will admit his feet into the shovel-like, silver-mounted stirrups. With the umbrella still held over him he returns to the palace, receiving salutations of the crowd and of hundreds of horsemen, among them the district and village heads from every part of the Emirate.

Their several hundred stallions, shoulder to

\* See "Trans-Africa Safari," by Lawrence and Margaret Thaw, NATIONAL GEOGRAPHIC MAGAZINE, September, 1938.





Nana Hashim.

#### A White Official's Canoe Trip Is Cartooned by an African Sculptor

To black men, the white pioneers were gods and their weapons were irresistible. With familiarity, however, they learned to use mockery as a defense. Their artists created remarkable caricatures exposing the white man's traits. Here the Englishman's pipe is made to seem ridiculous. It is detachable, as are umbrella, paddles, and hats.

shoulder, are held in check by severe bits. Beneath the voluminous rigas of the riders peep elaborately embroidered trouser legs or highly ornamented boot tops.

Some of the warriors are clad in tattered coats of mail and armor, reminiscent of the Crusades, and carry large leather shields of antelope, bullock, or hippo hide, and spears or bows and arrows. Camels decked in holiday trappings jog along imperturbably behind their veiled leaders.

The next day the Emir visits the Queen Mother and a return courtesy call is made with his entire retinue on the Resident. The large Residency garden overflows with chieftains, warriors on their spirited animals, and all entertainers re-enact their roles of yesterday while the Emir is being received. The present Emir Abdullahi Bayero was appointed by the British in 1926. He is a son of the eighth Fulani ruler of Kano of the Fulani dynasty in power since 1809.

Several days of feasting and celebration ensue, and similar festivities take place in other Mohammedan Emirates of Nigeria.

Customs of the northern territories have changed little under the British. The people are conservative, and the Government has ob-

served a policy of noninterference, more or less letting the people govern themselves as of old, the British serving only as councilors.

In the next generation the children of today doubtless will adopt more of the European customs and culture, though there is little likelihood that Islam, deep-seated as it is, will be uprooted. The southern Nigerian emulates Europeans and is more ambitious to follow in their footsteps.

When it is remembered that Lagos has been under the British less than a century, and the rest of Nigeria not even half that long, and that cannibalism and human sacrifice were practiced until comparatively recently, progress has been gratifying in a country long regarded as part of the "white man's grave." There is an old saying:

Beware and take heed of the Bight of Benin,  
Where few come out, though many go in.

True, only the surface has as yet been scratched in this vast country, and man has still to conquer malaria, yellow fever, sleeping sickness, and other ills. But with care one may live fully and freely in this land of contrasts, a land the world will know more about in years to come.

# Coal: Prodigious Worker for Man

BY ALBERT W. ATWOOD

**WE** AMERICANS take our high standard of living and abundant luxuries very much for granted. In the same way, we are quite unconscious, except when strikes or wars interfere with its smooth supply, that coal, which seems so commonplace, is the prodigious servant that does the bulk of our work.

It is the only substance of which there is enough available in the world at present to provide the light and heat and power that make modern civilization possible.

Measured in dollars, our country's annual output of coal is nearly twice that of iron ore, copper, gold, and silver combined.

It takes an unbelievable amount of coal to supply the country. The weight of one week's production of coal is greater than that of all motorcars produced in the United States in the automobile industry's most prosperous year.

West Virginia and Pennsylvania together produce a bigger bulk of coal in a single year than all the earth excavated from the Panama Canal.

Coal is used in these prodigious quantities because, directly or indirectly, it heats a large percentage of all buildings, drives a large proportion of all factory engines, railroad trains, streetcars, and steamships, and must be used in about the same quantity to make steel as iron ore itself.

Over half of all the electricity and most of the manufactured gas are made from coal. Electricity provides much of our artificial light and power, and makes possible our movies, radios, and countless appliances. Coal, gas, and electricity together cook the food of city folks, and of many more in towns and in the countryside.

## Lumps of Coal Are Genii of Chemical Miracles

But this is only a beginning. Many of the newest discoveries of science stem from a lump of coal.

The wizardry of modern chemistry has touched it with a magic wand and brought forth such useful things as sulfa drugs, vitamins, fibers, rubber, fertilizers, dyes, perfumes, disinfectants, insecticides, and paints (page 591).

Nor is national survival in modern war at all likely without coal and its inseparable companion, iron ore. Italy, the first of the Axis countries to collapse, has neither coal nor iron in quantity.

Amply supplied with both, England, Ger-

many, Russia, and the United States were predestined to be great world powers.

Coal deposits are in reality gigantic storage batteries of solar energy, the rays of the sun having been hoarded up in the living vegetation of millions of years ago.

In the future man may get his light, heat, and power direct from the rays of the sun, but he does not yet know how to do that.

At present he must depend upon the mineral fuels—coal, petroleum, and natural gas—and upon water power.

But the coal mined in this country in one normal day contains more potential power than the total generated by the Grand Coulee and Bonneville Dams combined, operating at capacity continuously for three years.

There is not enough water power in the whole world to do man's work, and much of the undeveloped power is at present in inaccessible parts of Africa, Asia, and South America.

True, petroleum and natural gas do practically the same work as coal. But the known reserves of these fuels in this country will last for only a relatively few years as compared with probably a few thousand years for coal, unless the period is cut by increased demands for energy and chemicals.\*

New sources of petroleum and natural gas may be found, as in the past, but the voracious appetite of war is depleting oil reserves much faster than those of coal.

## United States Has More Than Half of All the World's Coal Reserves

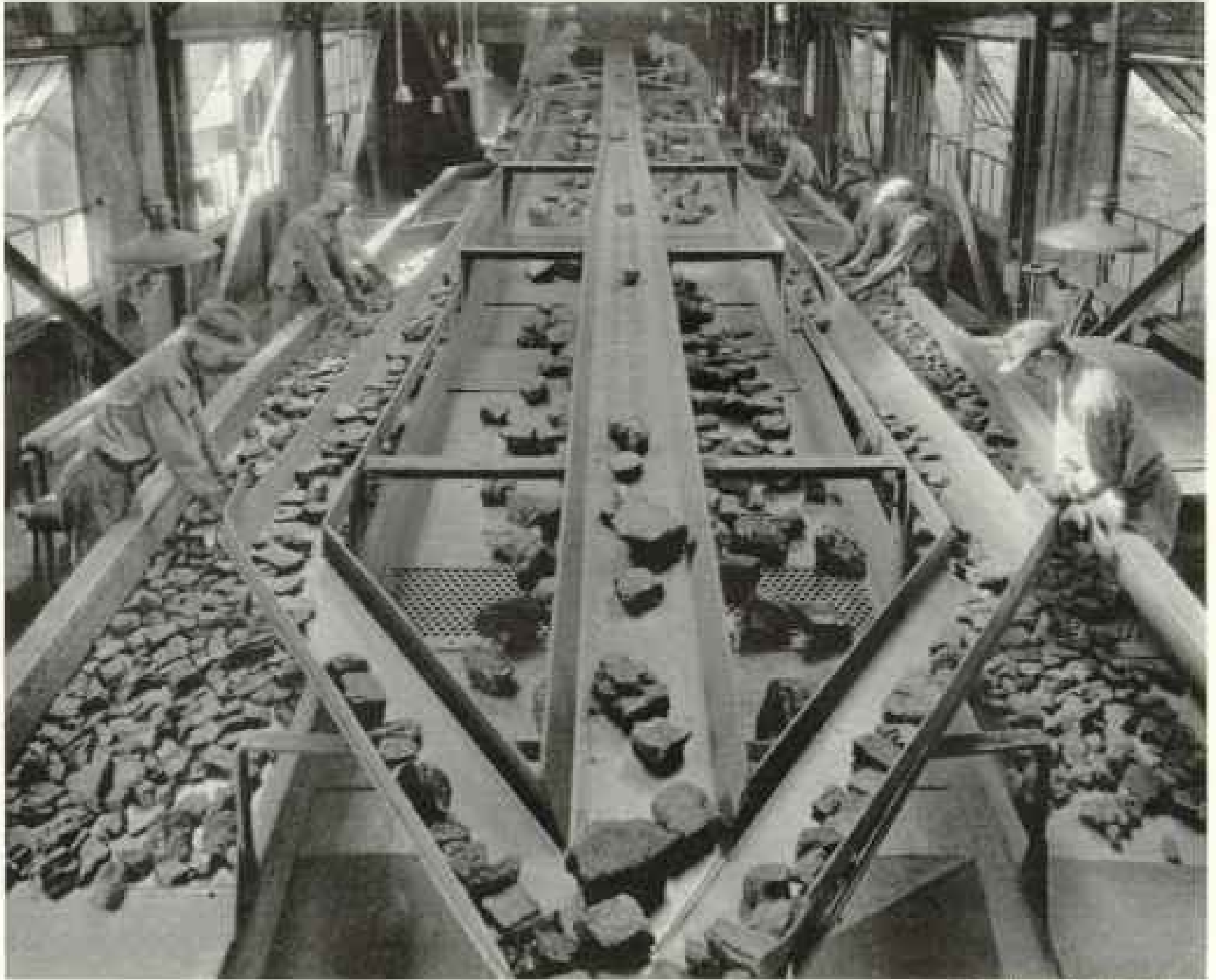
Coal is widely distributed throughout the world, although most of it is in the Northern Hemisphere. North America, Europe, and Asia are the continents with ample coal. Africa, Australia, and South America are not nearly so well endowed in this respect.

According to latest estimates, North America has five-sevenths of the world's reserves of over seven trillion metric tons, and the United States has slightly more than half the world total. This country also produces and uses more coal than any other.

Canada ranks next in reserves, with 17 percent of the world's total. But its great coal resources are remote as yet from centers of population and industry. China and the Soviet Union also have vast untapped reserves.

We have used up a much larger percentage

\* See "Today's World Turns on Oil," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, June, 1941.



Norfolk and Western Railroad

### Busy Hands in a Tipple Pick Impurities from Coal Moved by a Shaking Conveyer

Mechanically screened for size, lumps roll forward to railroad cars waiting below (page 571). Fuel in the lower conveyer already is sliding into its chute. Slack coal, first to drop, does not appear.

of the high-quality coals of the East than of the lower-quality reserves which exist in such colossal amounts in Colorado, Wyoming, and Montana. But only slightly more than one percent of the entire original coal reserve in the United States has been exhausted.

What is this useful substance of which a careless world still has more than seven trillion metric tons, and where did it come from?

Coal was formed in past geologic ages by the burial and crushing of masses of partially decomposed vegetable matter under layers of sand, clay, and mud.

Coal formations range in age from a few million years to almost 300 million years. Nature is a great provider, but she takes her time.

In vast jungles or swamps stretching across North America, Europe, and parts of Asia grew monster trees, ferns, mosses, and other plants in a luxurious density difficult for modern man to picture.

Climate was uniform, extremely humid, and

probably tropical or subtropical; vegetable growth was undisturbed by seasonal changes. Vegetable muck was probably hundreds of feet deep.

Then came earthquakes and other catastrophic changes in the earth's crust. The swamps were submerged and buried; again they were elevated; once more they subsided. The process was repeated many times.

Gradually the vegetable masses, preserved from complete decay by being buried, hardened and mineralized into coal.

### Strata of Coal Are Chapters in Geologic History

Coal is found in seams because in its formation the vegetable matter was overlaid and underlaid by sand, clay, and mud. Such awesome forces of Nature as time, heat, and pressure wrought the magic change.

In one place in West Virginia 14 separate seams of coal lie one above the other, separated by layers of different material. In the



Norfolk and Western Railroad

### From Mine to Tipple to Cars, Coal Flows without a Pause

In an Appalachian field, cars four abreast receive loads according to various sizes. Through the mountain-side head house, a belt conveys coal from the mine.

West geologists have counted 30 such seams.

Within a few minutes after I entered a coal mine for the first time, my guide pointed out the imprint of a fern on the coal above us.

Frequently fossil remains of plants, trees, fish, or reptiles are found embedded in the coal or in the roof slate above. Among these are different kinds of ferns, some that once grew to a height of 60 feet, and tree trunks one to five feet in diameter (page 577).

Coal is a rock, because it is part of the solid substance that forms the crust of the earth; but, strictly speaking, it is not a mineral. It is vegetable matter that has suffered geologic and chemical change.

It may be assumed that all coal began as peat in prehistoric swamps. Peat is still found in the Florida Everglades, the Dismal Swamp of Virginia, and the Irish bogs.

Peat is used for fuel in Ireland and the Netherlands; in this country for lawn improvement. It is not a variety of coal but merely an incipient stage in its formation.

There are a number of varieties or "ranks" of coal—anthracite, semianthracite, low-volatile bituminous (often called semibituminous or smokeless), high-volatile bituminous, sub-bituminous, lignite, etc.—each representing a stage in millions of years of prehistoric chemistry and geology. Wondrously, Nature has created coal for every human need.

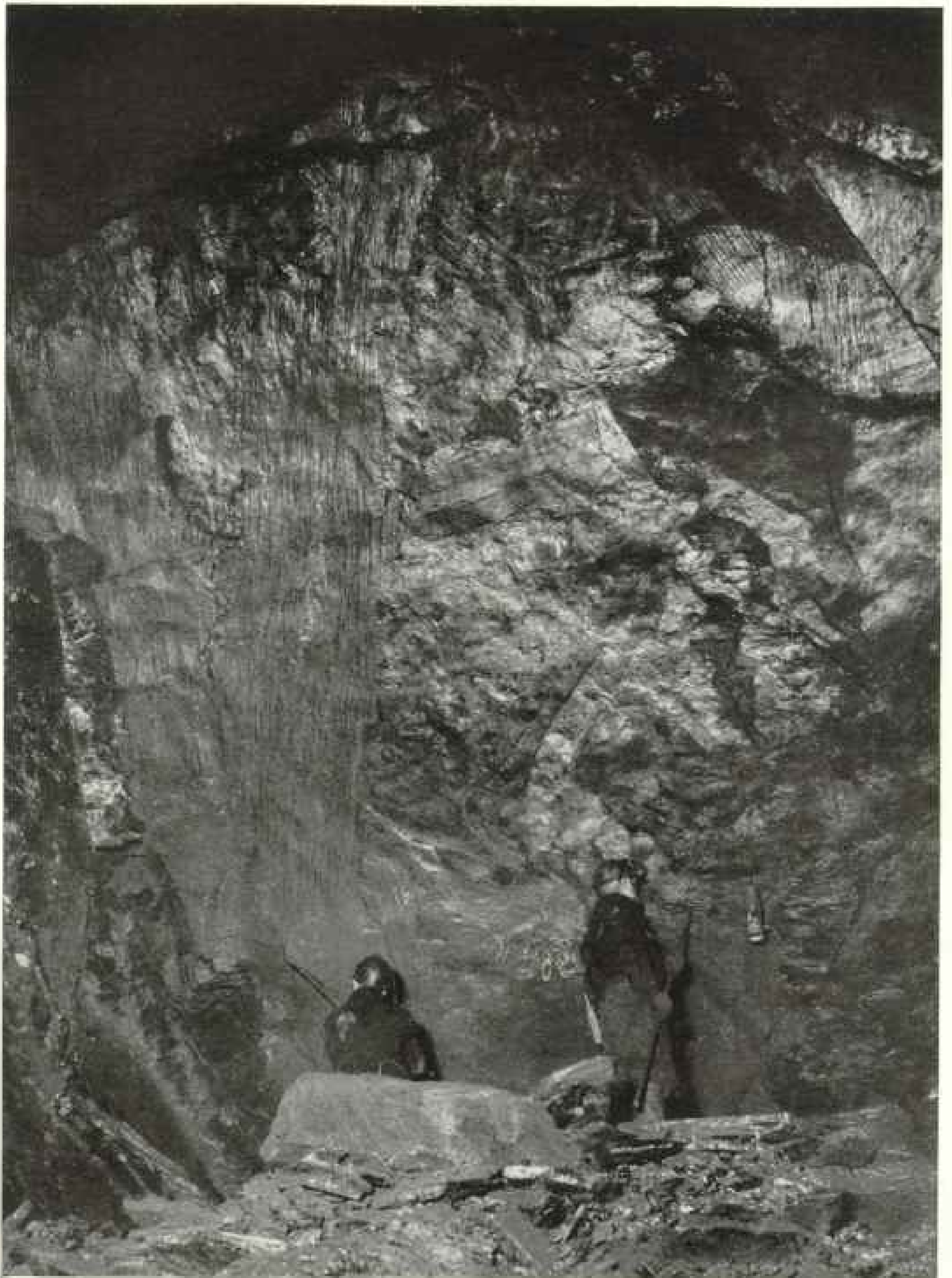
In a sense, coal is merely the result of a long, gradual process by which oxygen and hydrogen (the constituents of water) have been expelled, leaving mostly carbon.

Even "soft," or bituminous coal, averages 60 to 80 percent carbon, and "hard," or anthracite, has 90 percent or more.

The most essential constituent of coal—in fact, of all fuel-energy materials—is carbon. It is in all living substances, animal and vegetable.

Carbon is a singularly versatile element. The carbon atoms form chains by uniting with each other; carbon is the base of organic chemistry, of thousands of chemical compounds.





Ernest Galloway

**Shining like Stove Polish, Mammoth Vein's 50-foot Face Reflects the Camera Flash**

So prized for central heating, this is anthracite, which burns soot-free to a clean ash. Its twisting seams limit machine operations. Shoring-up requires a forest of timbers. These Coaldale, Pennsylvania, miners are preparing to blast a section of the Nation's thickest anthracite bed (page 576).

According to the force and length of the geologic process, the original vegetable matter became successively peat, lignite (brown coal), bituminous, and finally anthracite.

A still later stage in the increasing percentage of carbon is graphite, and at the very end of the cycle is the diamond.

So far as we know today, the largest single deposit of coal anywhere in the United States is in the Fort Union region of Wyoming, Montana, and the two Dakotas. The second largest deposit is in the Green River region of Wyoming and Colorado.

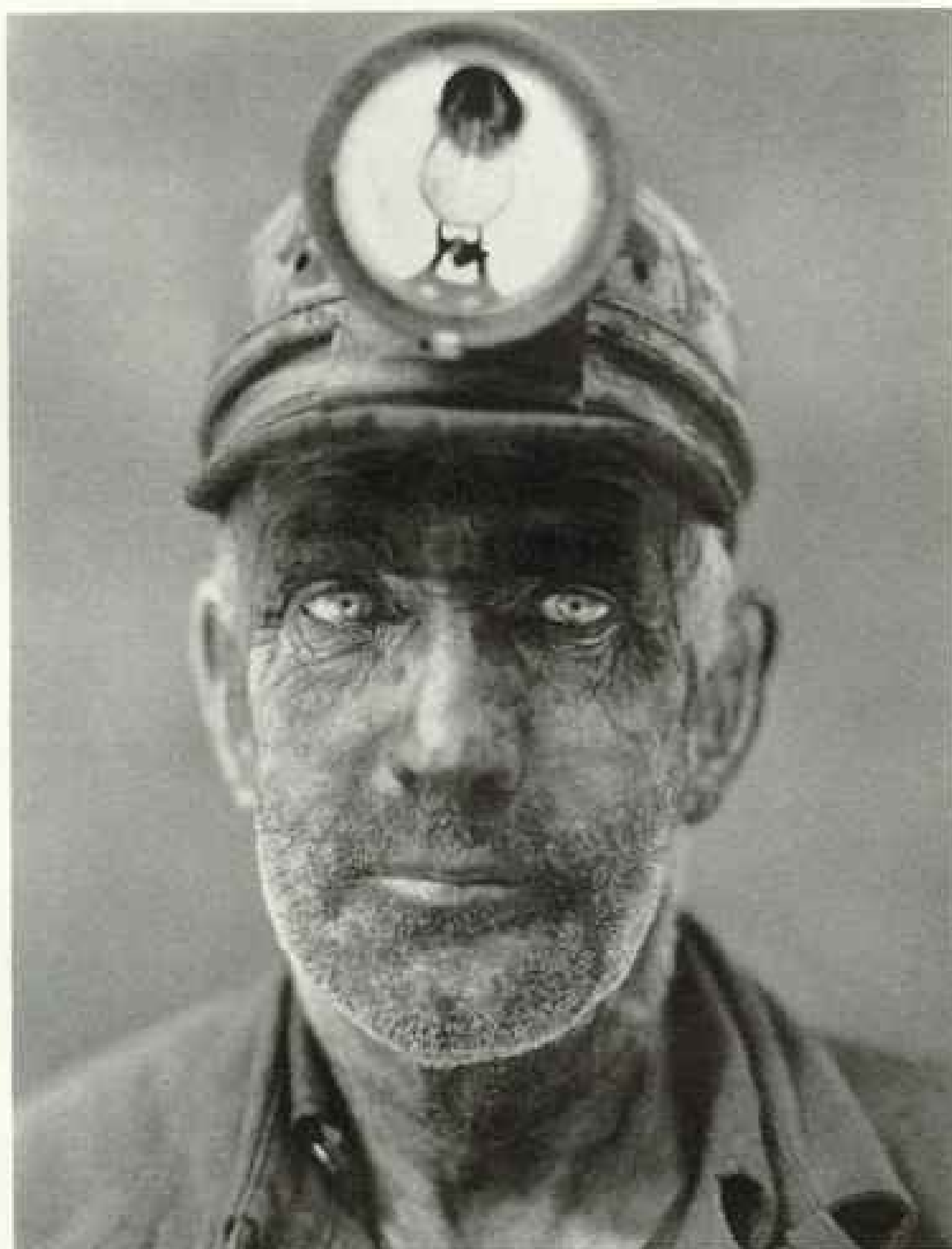
Coal is commercially produced mainly in 26 States, but in actual output Pennsylvania and West Virginia far outshadow all others, with Illinois and Kentucky next in rank.

The Illinois-Indiana field is important, but absolutely paramount in coal production in North America is the great Appalachian region, a long, banana-shaped strip across Pennsylvania, western Maryland, eastern Ohio, southwestern Virginia, West Virginia, eastern Kentucky, Tennessee, and Alabama.

#### On the Plateau of Vulcan

This is a region of high, forest-clad ridges and narrow, winding valleys, a mountain empire, almost an impenetrable wilderness until railroads and coal mines were developed. It might well have been called the Plateau of Vulcan, as suggested by one geographer.

Coal is found in seams, or beds, ranging from a few inches thick to 50 or 100 feet, or even more. But most coal comes from beds 3 to 8 feet thick. It may lie from a few feet to 4,000 feet or more below the surface.



Staff Photographer B. Anthony Stewart

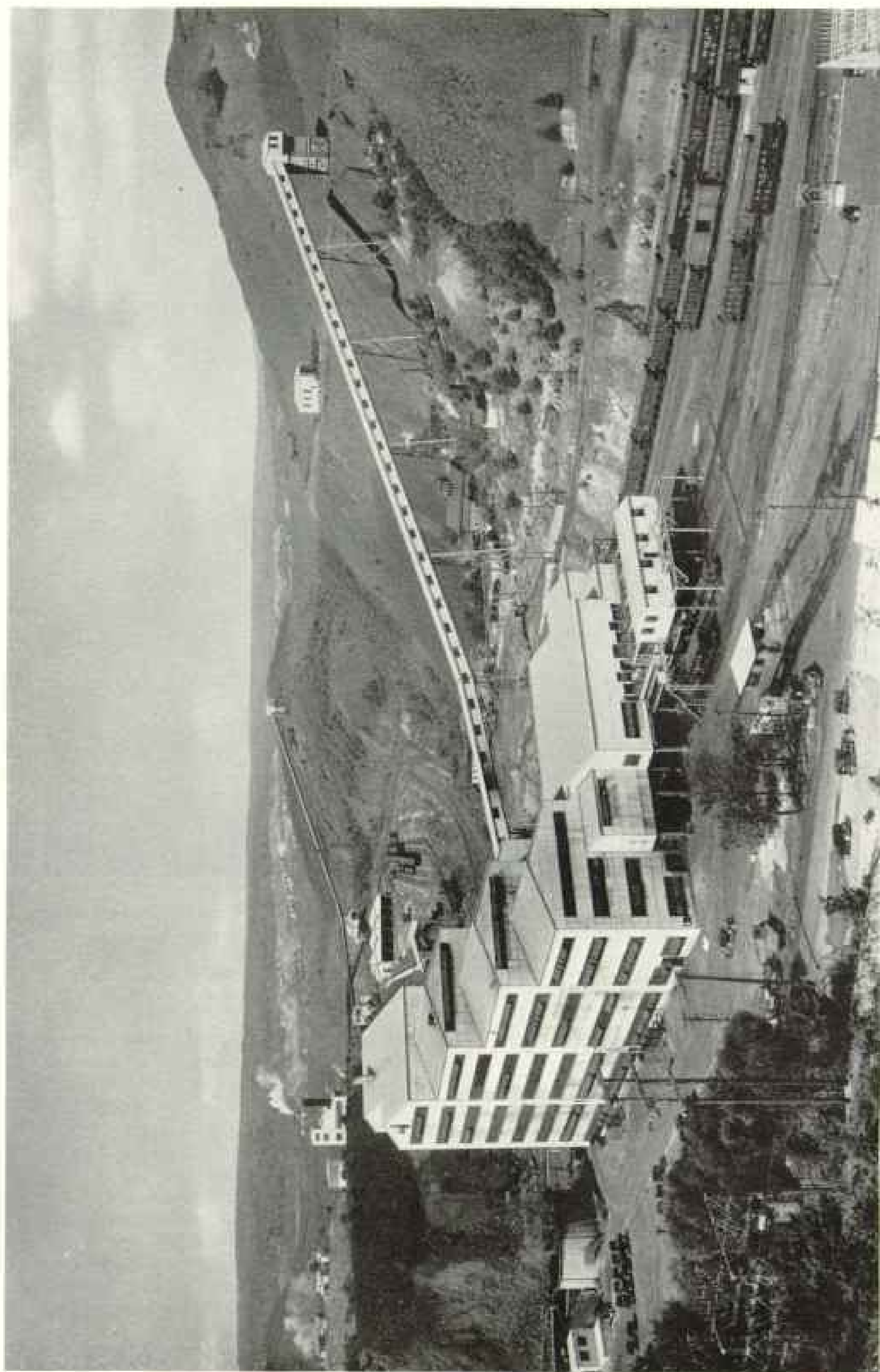
#### Stamped on His Face Are the Years of His "Nights" Underground

Work done, he is on his way to the lamphouse to leave his battery for recharging. Next he will visit the bathhouse, but, scrub as he will, he cannot entirely remove the black badge of his craft. His stubble is not the rule. For easier washing, most miners like to be clean-shaven.

A coal bed is not uniformly thick, nor is the nature of the coal identical from top to bottom. If near the surface, "strip mining" is feasible (pages 575, 578). Also, it may outcrop at some point, permitting "drift" mining, or run deep in other places, requiring "shaft" or "slope" mining.

In the bituminous fields of the Appalachian region many beds are level, or horizontal, and therefore easy to mine. Mine cars run in and out of the hillside horizontally, and the coal can readily be lowered into waiting railroad cars in the stream valleys below (pages 570, 571).

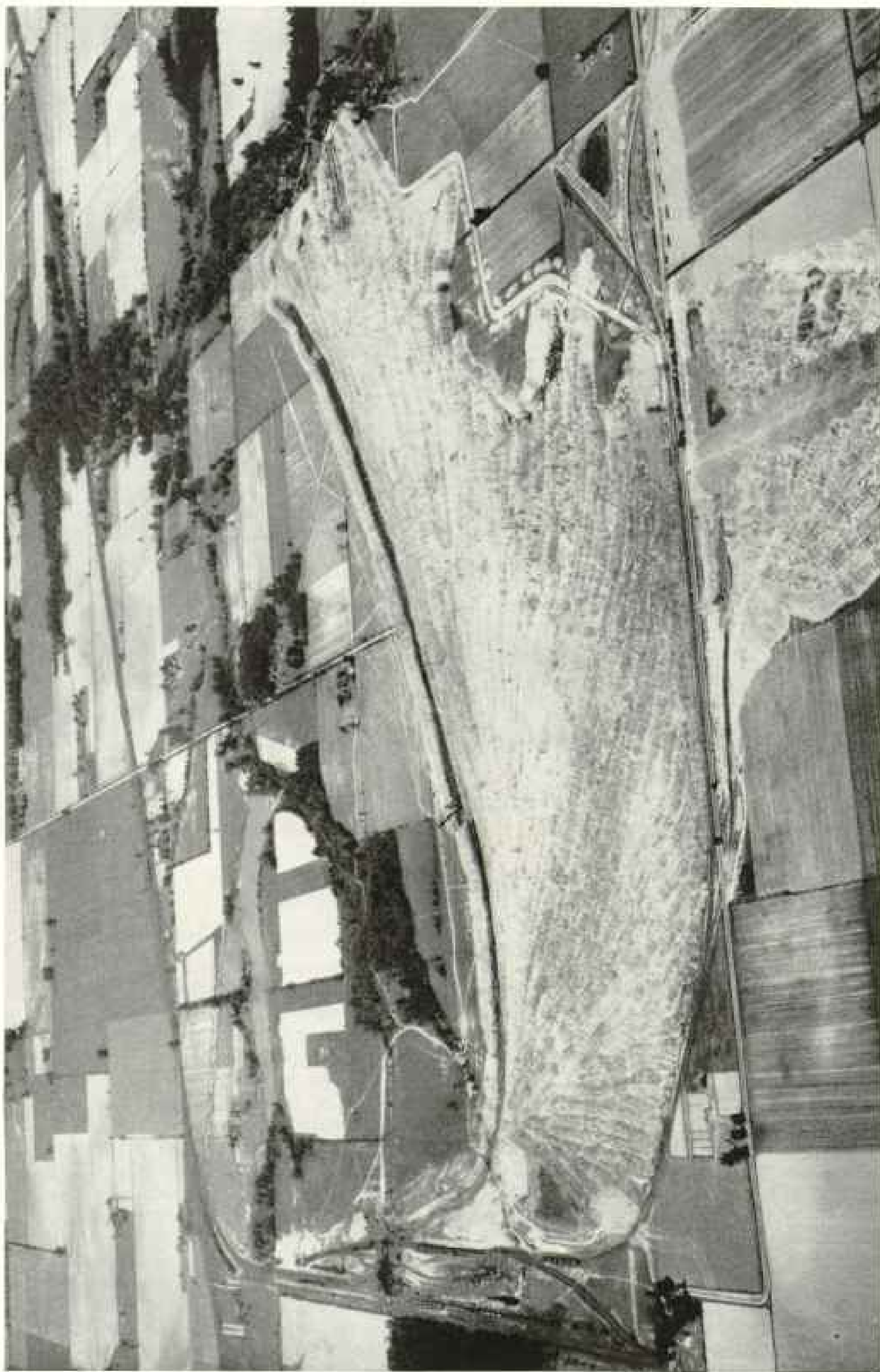
The Pittsburgh Coal Bed in the States of Pennsylvania, Ohio, Maryland, and West



through railway

**In This Gleaning Breaker at Mahanoy City, Pennsylvania, Anthracite Is Screened, Cleaned, and Loaded by Machinery**

In the town of Philadelphia & Reading Coal & Iron Company washes coal in huge cones (page 501). From the platform on stilts, the finished product flows to rail. Above the valley a long conveyer hauls dirt and slate to dump cars. Barren hills in the middle background are heaps of such refuse (pages 576, 582).



Fairchild Aerial Surveys, Inc.

### To Harvest Coal, Surface Miners Plow Level Indiana Farm Lands into Mountainous Windrows

Seen from the air, the coal seam is a long black rut dug by a stripping shovel (page 579). Smaller shovels glean the coal. Soon dirt from a fresh furrow will fill the hole and cap it with a ridge. So economical is strip mining that 80 feet of earth have been removed to get 36 inches of coal.





Dimly Lit Mine Workers

### He Laughs at Coal Bills: His Bin, Always Full, Is a Mine in His Cellar

Both union miner and private operator is this Shawnee, Ohio, home owner. While building his basement two decades ago, he discovered a 14-foot seam. He wields pick and shovel; the big mines use machines.

Virginia, averages 5 to 9 feet in thickness. A bituminous seam, it has produced more wealth than any other single mineral deposit in the world, the Witwatersrand gold reef in South Africa being second.

The mighty city of Pittsburgh was founded on "the Great Seam," as it was called. Curiously enough, the seam's elevation at Pittsburgh is 250 feet above the downtown district of the city itself.

Coal means different things in different parts of the country. The two principal types used in the United States are anthracite and bituminous.

The workable anthracite centers in 484 square miles in nine mountainous counties in northeastern Pennsylvania, 100 miles by air line from New York City and 75 miles from Philadelphia (page 572).

Pennsylvania's large bituminous fields are mostly west of the center of the State.

There are four distinct, rather narrow, canoe-shaped anthracite fields, running roughly

parallel to one another in a northeasterly-southwesterly direction.

### Cities Grow along Coal Fields

In these fields are many cities and towns, such as Scranton, Wilkes-Barre, Pottsville, Shamokin, Hazleton, Mahanoy City (page 574), and others; also many railroads and several important rivers.

Anthracite is usually more expensive to mine than bituminous because the beds are generally more twisted and irregular.

But it is near great centers of population. It does not break, or degrade, easily. It is compact, relatively free from dust and smoke, and does not deteriorate or spontaneously combust in storage.

Anthracite is used in some six million homes, mostly in New England, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the District of Columbia. It is far less of an industrial fuel than bituminous.

The areas in which bituminous coal is mined



Zelma Gallinger

### Eons Ago a Tree Grew in a Bog—Time, Heat, and Pressure Turned Both to Coal

Now that brittle black log is shored up by true timbers. Special crews brace walls with posting and roofs with cribbing. Heads are further protected by fiber helmets. Head-lamp cables run to batteries on hips.

and the remaining reserves are several hundred times larger than those of anthracite.

Though anthracite has been mined steadily for more than a century in its small eastern area, something like two-thirds of the original deposits still remain.

The very fact that bituminous is the more volatile of the two, that it gives off more smoke, makes it more flexible—makes it, in fact, one of the great basic sources of the rapidly expanding chemical industry.

In early days anthracite was the predominant mineral fuel in the United States, important quantities of it going down the Lehigh, Susquehanna, and Schuylkill Rivers in the early 1830's.

But as the country became industrialized and railroads penetrated mountain fastnesses, the cheaper and more widely distributed bituminous assumed supremacy.

Bituminous was poorly named, for there is no true bitumen in it. Anthracite comes from the Greek word meaning "coal," and

coal itself comes from a widespread root meaning "black."

The English and Scots were the first to make practical use of coal, although Aristotle mentioned it, and Marco Polo found it in China.

Outcroppings on the North Sea coast, loosened by wave action, were gathered by women and children and sold as "sea coal," to distinguish it from "coal," which long referred, as it did in the Bible, to charcoal.

Later the terms "stone coal" and "mineral coal" came into use for the same reason. In 1781 Thomas Jefferson referred to "mineral" or "pit coal," and in one of his famous reports Alexander Hamilton spoke of "fossil coal."

The term "mineral coal" was used in our own Government reports as late as 1850, and still appears in some State statutes.

### Coal and the British Empire

The early supremacy of the British Empire was not wholly unconnected with the fact

that England used up her forests earlier than other nations. Progress was hampered by the lack of charcoal for smelting.

In the Elizabethan period, shipbuilding, glassmaking, and saltmaking took large amounts of wood, and the sheep-growing and woolen industries discouraged the planting of new trees. Iron works had to move constantly to find a forest that was not depleted.

In 1709 Abraham Darby, a Quaker, successfully smelted iron ore with coke made from coal. Since then, by the use of coal, man has made iron his slave and by the use of iron has ruled the world.

#### Coal and the Industrial Revolution

It was not, however, until after the perfection of the steam engine by James Watt that coal assumed a position of first magnitude.

The steam engine solved the problems of water control, ventilation, haulage, and hoisting in the coal pits, as the English mines were called. It revolutionized transportation by land and sea, and it made possible large-scale production of textiles and other factory goods.

But the steam engine itself depended upon steel, which in turn depended upon coal. Thus coal was both a cause and effect of the Industrial Revolution.

The large sources of bituminous coal in this country are 200 miles or more from tidewater, making export costly.

But the haul in England and Scotland rarely exceeds 20 miles. Thus from early days good and cheap coal was available for outbound ships, which brought back food from the Seven Seas.

Cardiff in Wales, Liverpool, Newcastle—the last-named well known to us by the saying, "carrying coals to Newcastle"—Grimsby, and Glasgow are some of the great British coal-shipping ports in normal times.

Not only the seaboard but the interior of England and Scotland, except the Scottish Highlands and the London area, have ample coal. Much of it is near the iron ore and limestone needed to make steel. The different varieties are located ideally for different uses.

It is not generally known that the actual commercial production of coal in this country began at Midlothian, 12 miles west of Richmond, Virginia, about 1750, and that this field long remained an important one.

Because of our vast forests, the smelting of iron ore by charcoal continued far longer in the United States than in England. As late as 1850 only four blast furnaces in this country used coke.

It was not until the late fifties that the Baltimore and Ohio Railroad reached Con-

nellsville, Pennsylvania, destined for so long to be our great coking-coal center.

As late as the 1880 census, 65 percent of the population depended upon wood for domestic use.

Vast as the coal industry has since become, it still consists of several thousand small "operators" as well as larger ones. As I write, there are some 6,800 bituminous mines and more than 5,000 companies.

Outstanding combinations, such as those in steel and automobiles, do not exist. It takes comparatively little capital to open a small coal mine, and titles to coal lands are scattered among thousands of different owners.

Yet there are many large corporations in the industry. From a fifth to a fourth of the production is "captive"; that is, produced by large steel and other manufacturing companies for their own use, instead of being sold on the open market.

Subsidiaries of the U. S. Steel Corporation are the largest producers of bituminous coal, usually accounting for about 5 percent of the total supply, all of which they use themselves. The Koppers Company, a leading processor of coal and manufacturer of coke ovens, comes next.

Of the 6,800 bituminous mines, more than 5,000 together produce only 8.4 percent of the coal. Fewer than 300 of the larger mines produce nearly half the total output.

It is believed that the largest single coal mine in the United States, and perhaps the largest single mine unit in the world, is the New Orient mine of the Chicago, Wilmington & Franklin Coal Company in southern Illinois.

New Orient was developed during the middle twenties, and its best day's output was 15,174 tons for an eight-hour day by hand mining. In more recent years, under complete mechanization and in a seven-hour day, it has been turning out between 10,000 and 11,000 tons a day.

#### Strip Mining Increases

Strip, or open-work mining, the removal of coal near the surface by giant steam or electric shovels, which strip off the covering of earth, clay, and shale, is increasing rapidly and is practiced in Illinois and Indiana, especially, and in other States as well. It is adaptable only where the coal seam runs close to the surface (pages 575 and 579).

But the great bulk of the coal is still obtained from underground mines, which are reached by shafts and entries. Indeed, in Cape Breton Island, off the coast of Nova Scotia, coal is actually mined far out under the ocean.



Charles Brullier

### Goliath Strips Dirt, David Does Odd Jobs at a Kansas Surface Mine

Operated by one man, the 1,008-ton electric shovel is designed to cast 24 cubic yards of overburden 100 feet from the center of rotation or to lift it almost an equal distance. Above its caterpillar tracks it sits on jacks which balance it automatically (pages 575, 578).

A large modern mine must be carefully planned in advance in order to give a great number of working places, or rooms, from which the coal can be removed simultaneously to secure adequate production.

Transportation must be arranged for, no matter how far away the working faces are pushed from the "tipple," the name used in our bituminous fields for preparation plant and loading point, where the full mine cars are hauled up and dumped (pages 570, 571).

Main streets, side streets, cross streets, back alleys—these must all be provided for, much as in the plan of a city.

These streets, of course, are the passageways along which the miners go in and out, and along which the coal is removed.

The city layout, so to speak, of one mine I visited was 12 square miles. The map show-

ing it covered the whole side of a large office wall, 15 by 30 feet (page 580).

As mining proceeds, the roof is in constant process of being shored up with sturdy wooden timbers, or props, to prevent slate falls and cave-ins. The roof sometimes proves too heavy for the timbers, but the bending or breaking of the props is likely to give warning.

Clean air for the miners to breathe and for sweeping away noxious gases and dusts must be blown in by huge fans, some mines taking nine tons of fresh air for each ton of coal removed.

Water, sometimes 20 tons for each ton of coal removed, must be pumped out.

In the tipple the raw, run-of-the-mine bituminous is screened for size—block, lump, egg, stove, etc. To remove noncombustible slate,

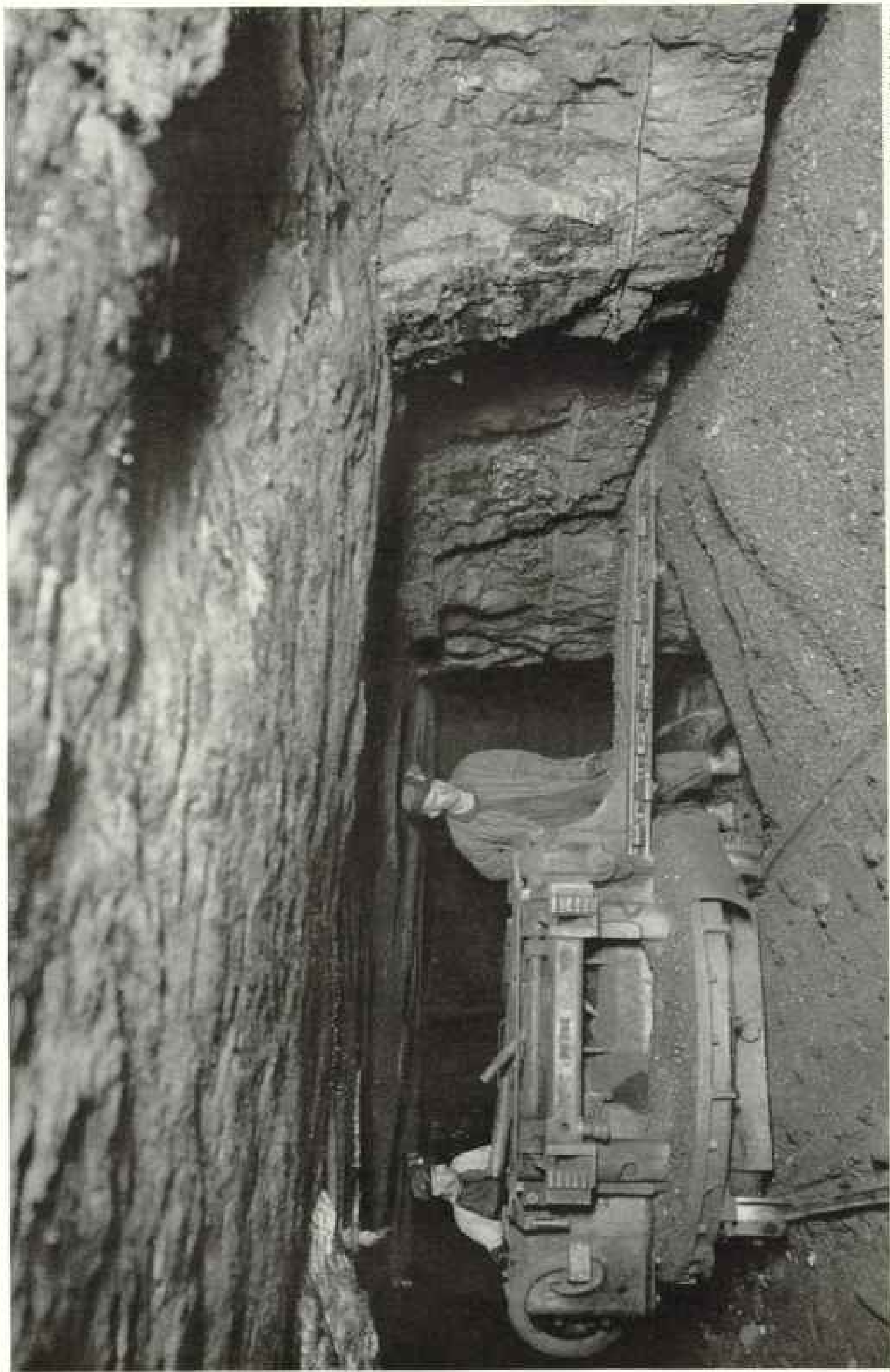




Superintendent and Foremen Meet Aboveground to Plan Each Day's Advance and Retreat in an Underground City

Inside boxes in safety helmets, outside boxes in hats or bare heads—these men coordinate a big mine's operations. A wall map like that of a real-estate development is their guide to new entries being opened and old ones being collapsed. The author visited this Pittsburgh Coal Company office (page 379).

Collar from 1931



Bituminous Coal Institute

**Just as a Mower's Flashing Blade Clips Hay, So Does a Cutting Machine Mow a Bituminous Wall**

In preparation for blasting, the machine saws an undercut. To shield the roof, which appears soft, from the shock of the explosions, the blade will pivot and saw an overcut. Similarly, vertical cuts are possible. Ties and track will be dragged as a unit when the room is worked out (page 583).



Curted Mine Workers

### Tragedy Ever Stalks the Miner and His Family

Grimy and shaking, this man typifies the hazards faced by miners everywhere. An explosion sealed him 2,000 feet below the surface. With 17 companions, he came back to wife and son, but 10 men left their 42 children fatherless. In the last three decades safety measures have reduced explosion deaths in coal mines by 80 percent (page 587).

rock, and other foreign matter, smaller sizes of coal are frequently washed, or cleaned, by air or water; larger sizes are picked over by hand to remove the impurities and, if too large, they are crushed into smaller pieces. In some mines different sizes are often mixed and blended to secure uniform quality for various uses. Coal is also frequently sprayed with oil or chemicals to allay dust and prevent freezing while in transit. Now it is ready to be lowered into waiting railroad cars.

In the anthracite field a similar plant is known as a "breaker." Here the larger pieces are sent to the rolls, metal cylinders with teeth, to be broken into commercial sizes (page 574).

In early days in Scotland, women carried coal out of the pits, as much as 170 pounds at a time. Young children also worked in the pits.

Even in this country young boys formerly worked in coal mines, tending doors and driving mules. Women apparently never worked in American coal mines; in fact, a superstition still persists among the miners that a woman's visit is likely to result in disaster.

### From Mules to Electric Locomotives

Horses and mules were not introduced until the early 1830's, coal being dragged out first on sleds by the miners, assisted by dogs, then in small carts. For a long period mules were widely used, since they were better fitted for mine work than horses.

Stables were usually underground, especially in deep mines, but the mules did not become blind, as



John Cutler from OWI

### Blue Flame Will Flash "Extreme Danger" if Safety Lamp Detects Explosive Methane

A gas pocket, exposed by the roof's having cracked, is suspected. Before miners may enter, the safety man must make this test. A double gauze admits atmosphere but confines explosions to the lamp. Oxygen deficiency extinguishes its flame, which normally is yellow. Canaries are used to a limited extent to detect carbon monoxide (page 587).

ignorant report had it. In the 1925 strike, 50,000 mules were brought to the surface without harm.

But today the "mule" is mostly an electric locomotive, and because of the even temperature in coal mines the year around, 60 to 72 degrees, the underground systems of tracks, with their block signals, sometimes have improvements which are not practical above-ground.

In fact, coal-mine haulage increasingly is being done by elaborate systems of large and small conveyer belts, of rubber, fabric, and steel, up to five or more miles in length.

Actual mining is largely on the "room and pillar" system, the coal being removed from adjacent rooms, with "pillars" between to support the roof. Afterwards these pillars are

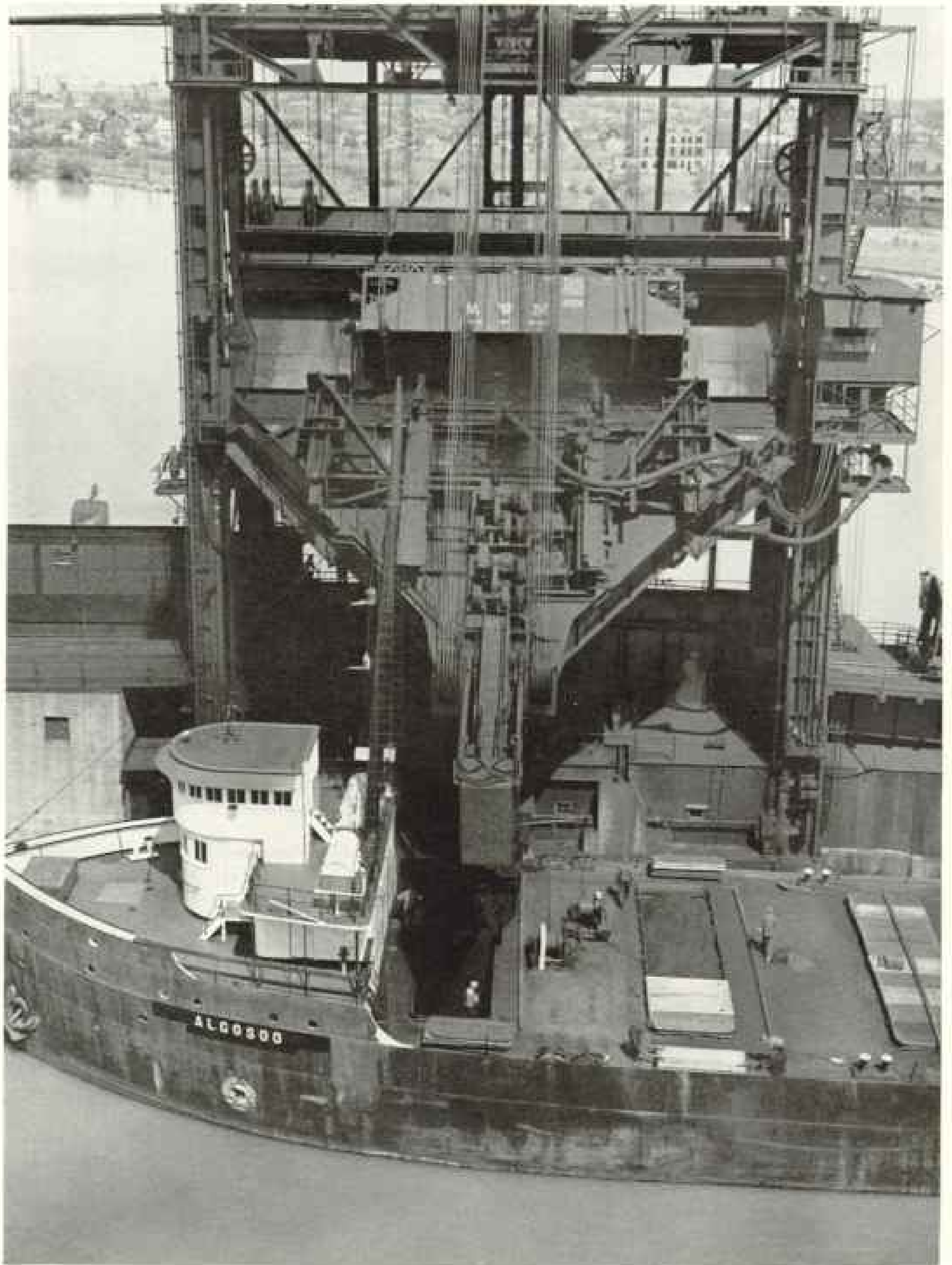
"robbed" (mined) in sections, allowing the roof to fall in behind the working area.

The actual removal of the coal begins with undercutting, which is done mechanically in most of the bituminous mines. A huge alligatorlike machine, with swiftly revolving blades, cuts, in what seems to the visitor an incredibly short time, a gash, or "kerf," at the floor level of one side, or face, of the room (page 581).

This mechanically cut gash, which goes back usually a standard distance of 6 to 9 feet, is only about 6 inches high, or less. In early days the cut was made by the miners themselves, lying in dangerously cramped positions on their sides to use their picks.

The undercutting is done to permit the coal to fall away from the seam with a minimum of breakage. The next step is to drill several





2108 Detail from OWI

**A Toy in the Grip of a Coal Pier, a Gondola Transfers Its Cargo to *Alcosoo***

Quick, forcible feeding is the aim of the flexible funnel known as the telescopic chute. It is about to explore the forward hatch and distribute cargo gently and evenly (page 589). Across the water is a part of Sandusky, Ohio, one of Lake Erie's coal potts (page 587).



WIDE WORLD

### From Coal-tar Building Blocks Come Vitamins Such as These Capsuled Elixirs

About a decade ago chemists began synthesizing certain vitamins, formerly obtained only in foodstuffs, by adding to coal molecules. Petroleum is a similar starting base. Aspirin, benzedrine, ephedrine, sulfas, and arsenicals are other coal-tar drugs relieving man's miseries (page 592).

holes in the exposed face of the coal above the kerf.

In these holes are placed explosives. In a few of the more modern mines they are of a gaseous nature, and dislodge or push the coal away from the seam with a slow heaving rather than with the shattering effect characteristic of certain types of explosives.

In the more mechanized mines the coal is then loaded into cars by loading machines, whose steel arms scoop it up in huge quantities. Hand loading still prevails in 60 percent of the bituminous mines.

### Big Mines Are Labyrinths of Passageways and Rooms

A large mine has so many passageways and rooms that a visitor is impressed chiefly by its solitude and impenetrable darkness. If an occasional train rumbles by, or if the visitor is in or very near a room where shots are being fired or undercutting and loading are under way, he hears some noise, but the rest of the underground city is silent.

Lighting is by the miner's forehead lamp, which the visitor must also wear. Originally candles were used in mines. Sir Humphry Davy's invention of a safety lamp, in which

the flame was enclosed by wire gauze, has been called nearly as great an event for humanity as the Battle of Waterloo in the same year.

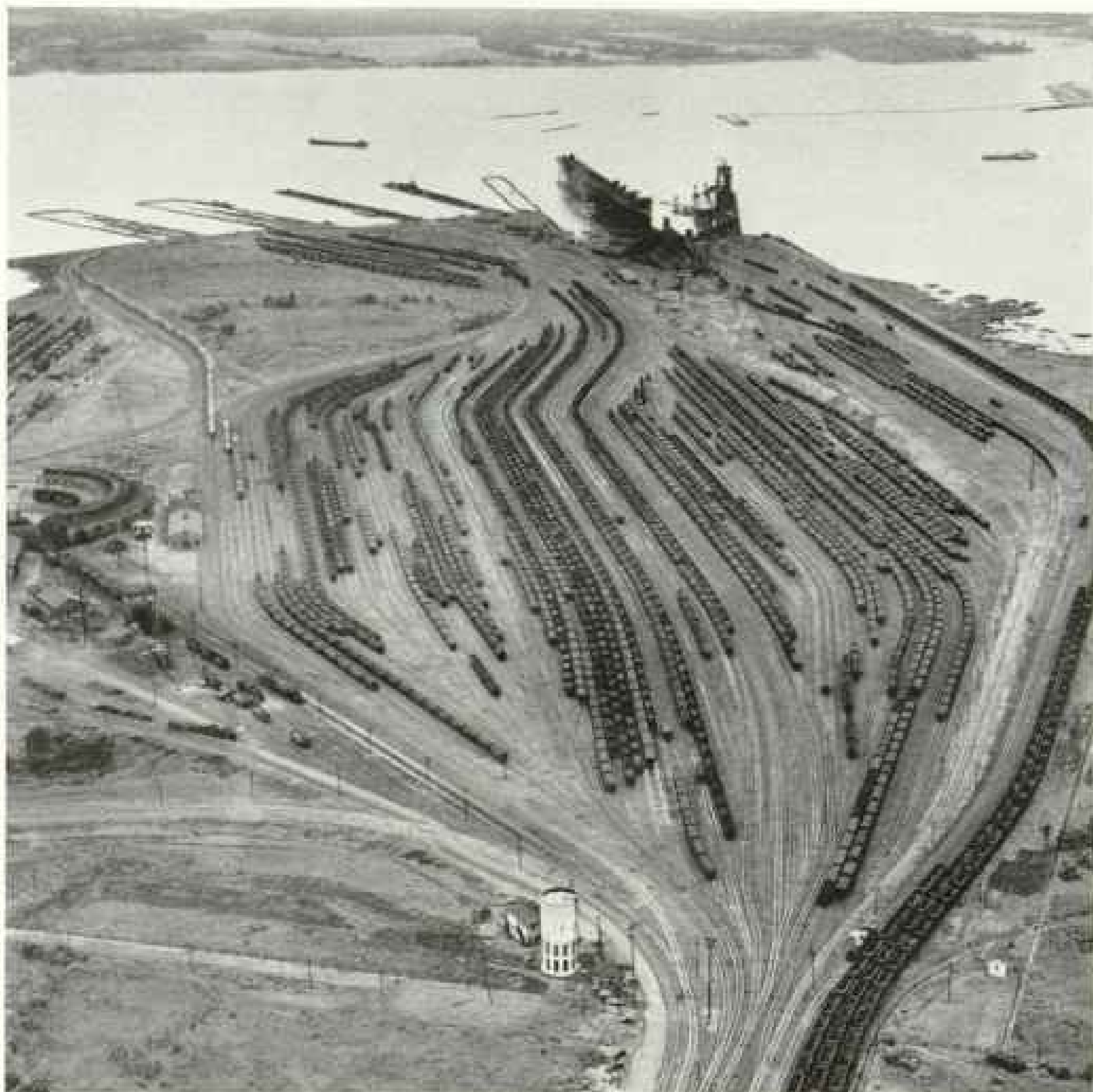
Later came the oil lamp; then the acetylene, or carbide, lamp; finally the electric lamp, with a storage battery worn on the miner's back at the hip.

### "Hard Hat" Saves Author's Head

Required also of all who enter a coal mine is a helmet, or hard hat. It saved my head from at least four heavy bumps against overhead timbers, but it is mainly intended, of course, to protect the miner against falling coal or slate.

Only 60 to 65 percent of American miners are actual coal getters, or hewers, or colliers, as the British would say. This is because there are so many collateral duties, such as timbering, maintenance, pumping, hoisting, transportation, cleaning and sorting, and power-plant work.

Both in Britain and in this country the nature of the coal miner's work has made him independent, proud, clannish, aloof, and resentful of restraint. He has to be resourceful to do the work at all, and his attitude is, "It takes a he-man to do the job and I'm it."



Norfolk and Western Railway

### A Switchman's Maze, This Classification Yard Can Hold 6,100 Coal Cars

Much Virginia, West Virginia, and eastern Kentucky coal comes down to tidewater at Norfolk's Lambert Point. Locomotives classify the cars according to their cargoes' grades and sizes for quick dispatch to the piers. In 24 hours these giant unloading devices can transfer 40,000 tons into ships (pages 584, 589).

For centuries coal mining was a handicraft, the miner being an independent, skilled contractor, providing his own tools and powder, and working singly or in pairs.

Even in modern mechanized mines, with larger crews and more specialization, the working groups seem remarkably small, scattered, and free from supervision. More than in most occupations, the coal miner is his own boss.

In visiting a mine I was struck by how far the foreman's station was removed from the nearest working face. But, after all, distances are very great in a coal mine.

One critic has described coal mining as an "inefficient child of the old craft system." At

any rate, perhaps because of the very nature of the miner's occupation, improvements in the form of mechanization have come very late in the coal industry, although at a rapid pace in the past ten years.

The American miner now produces some 5 tons of bituminous and 3 of anthracite a day, as compared with 1½ in Britain.

The British coal seams are thinner, deeper, and more twisted than in America; also, the shallower, and therefore cheaper, seams were exhausted earlier there than here. In this country the bituminous mines lend themselves to mechanization more readily than do the anthracite.

Possibly also, the hazards of his daily life tend to make the coal miner independent, for in all countries mining, in all its branches, is the most dangerous of major industries (pages 582 and 583). In coal mines there are explosions from the ignition of gas or coal dust, fires from spontaneous combustion, falls of roof strata, haulage and traffic accidents, falls down the shaft, and injuries from the use of explosives and machinery.

Successful efforts have been made by the Federal and State governments and by those in the industry to reduce accidents. The numerous serious disasters in 1906, 1907, 1908, and 1909 almost amounted to a national scandal and led to the establishment of the United States Bureau of Mines in 1910.

The average deaths per million tons of coal mined were 4.76 in 1911-15, but by 1936-40 had fallen to 2.71. The largest single mine disaster was on December 6, 1907, at Monongah, West Virginia, when 361 men were killed, but there have been many so-called major disasters (five deaths or more).

Major disasters, or explosions, however, are not the chief killers. The large totals of dead come from falls of roof and coal and from haulage accidents in which only one or two men may be killed at a time.

The idea that coal dust itself could cause a violent explosion was scoffed at 25 years ago. But Dr. George S. Rice of the Bureau of Mines not only proved that coal dust did cause great disasters but was the first in this country to advocate the use of "rock dusting."

Many disasters are now prevented by the simple device of covering the mine walls with a fine powder (chiefly limestone) known as rock dust.

#### Coal Must Be Kept Moving

During strikes and other national emergencies, such as war, the public becomes painfully conscious of one of the peculiarities of the industry: namely, that by and large coal is not warehoused or stored.

Large consumers, such as electric and gas utilities in great cities, normally keep several months' supply on hand. But the mines themselves, even the largest and most modern ones, store only very limited quantities.

Thus coal is not so much a commodity as it is a service. It must be kept moving constantly from mine to consumer. If it stops rolling for more than a few days, the country practically stops. Coal is of no use to anyone unless there is regular, continuous railroad transportation.

The railroad in its beginning was merely an adjunct to coal mining, and the two industries

have of necessity remained inseparable ever since. The first railroads were tramways, or "plateways," of wood in the English mining regions.

The standard gauge of today is the distance between the wheels of a coal wagon of 150 years ago.

In 1808 Benjamin H. Latrobe, in a footnote to a report on public roads and canals made by Secretary of the Treasury Albert Gallatin, mentioned only two instances where "rail roads" could be economically employed. One was to carry coal from the mines near Richmond, Virginia, to the James River (page 578).

Today, coal requires nearly one-third the total tonnage of railroad freight in this country, being by far the largest single item and more than triple iron ore.

On the other hand, the railroads are the largest single users of coal.

A single railroad company devotes 100,000 freight cars to this one commodity. Another railroad normally builds an "open top" steel coal car every 20 minutes in an 8-hour day in one of its shops. Still another railroad has as many as 50 miles of coal cars at one time waiting to be unloaded at one of its terminals.

Although coal travels in practically all directions, certain major movements stand out conspicuously. The greatest single example of mass transportation in the United States is the exchange of coal and iron ore at the so-called "iron ports" of Lake Erie.

From mid-April until the Great Lakes freeze over, late in November or early December, several hundred vessels of deep-sea size bring down from the mines of the Lake Superior district iron ore for the steel mills of Ohio, Pennsylvania, Indiana, and elsewhere.

As return cargo, they carry coal which the railroads have brought from the Appalachian region to the ports of Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport Harbor, Ashtabula, Conneaut, Erie, and Buffalo.

The great inland sea between Canada and the United States has been free from aerial and submarine attack. Through the locks at Sault Ste. Marie goes twice as much cargo tonnage in eight months as through the Panama Canal in an average peacetime year.

Ralph Waldo Emerson spoke of coal as a means "to make Canada as warm as Calcutta." Coal goes up the Great Lakes to heat part of the far reaches of Canada and our own Northwest through the long winter months.

In one of the iron ports it now takes 10 minutes to do what took 12 hours in 1894. A carload of coal is poured into a waiting vessel every minute.



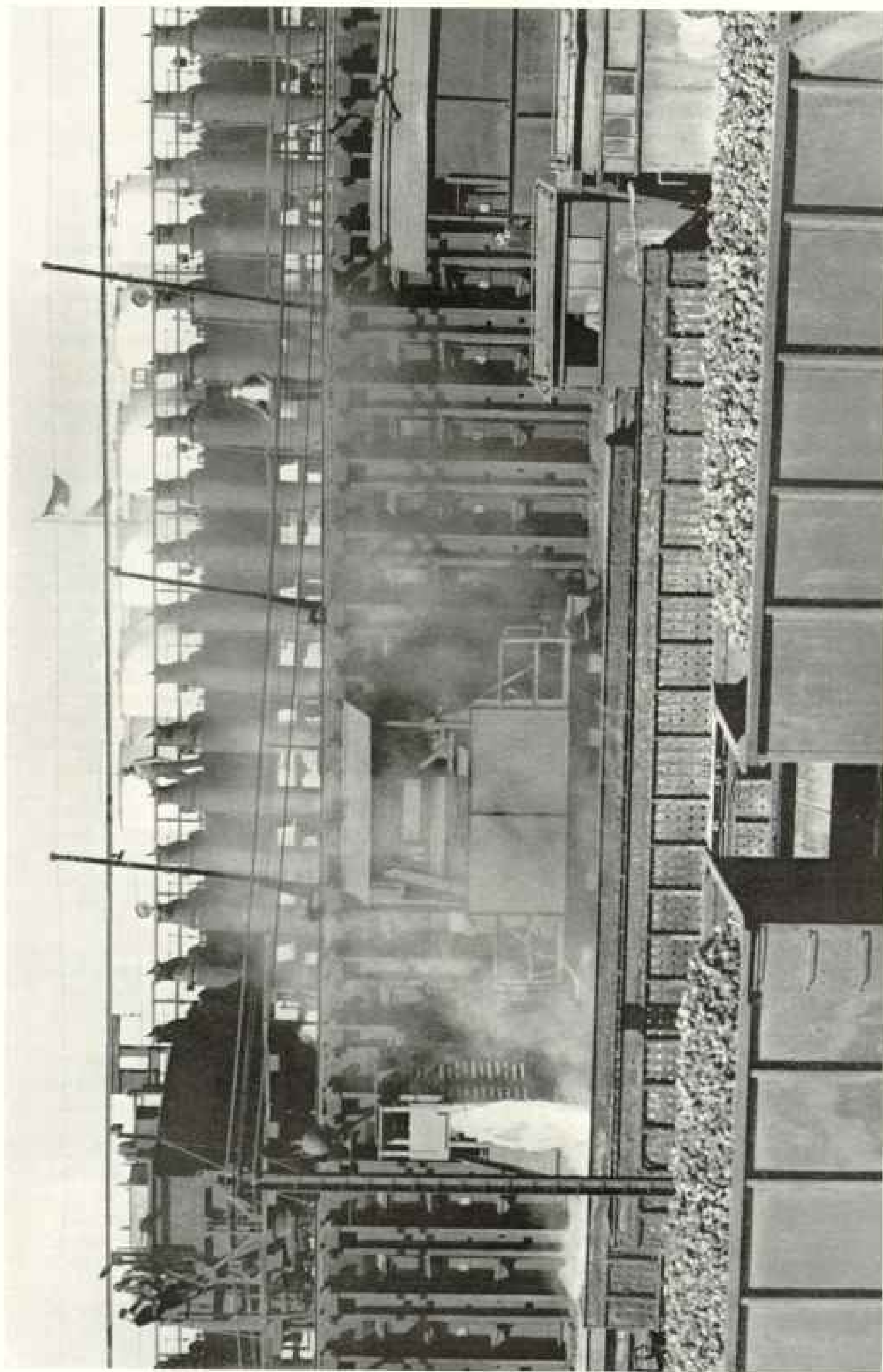


Illustration 1111

**Baking: Coal into Coke, These Ovens Extract By-products Essential to Thousands of Chemical Compounds**

Piped off from the top cylinders are gases and distillates wanted by old-style beehive ovens. Mounted on rails, a charging car drops coal into the ovens. Below it, incandescent coke shoots into a car for quenching. Two cars carry coke, the porous, partly-consumed residue of coal (page 589). Coke consists largely of carbon.

It is not dumped roughly into the hold, but spread out carefully upon any spot which the operator may select, by means of a telescopic chute weighing several hundred tons.

#### Saving Seconds in Loading

Many of the ships carry 10,000 tons, a few more than 15,000. I watched the operators of the giant telescopic chutes, stretching out their great machines, vulturelike, waiting a chance to save a few seconds in the loading and unloading job (page 584).

The second largest movement of coal is to New England. Because transportation is slow when ice and snow clog yards and switches, coal must be forced at high pressure through the New England "gateways" during spring, summer, and fall.

From the Appalachian region much coal moves not only to the Great Lakes but in the opposite direction to the Atlantic ports of New York, Philadelphia, and Baltimore, and particularly to the specialized coal ports of Norfolk and Newport News, for transshipment by boat to New England (page 586).

Freight rates are a big item in the final cost of coal. In past years, the average cost of a ton at the mine has been less than the freight upon it.

In the past coal has been shamefully wasted. The best qualities were consumed when lower grades would have done as well. As Secretary Ickes has said, it was like using some rare and expensive wood to build a shack.

Coal is not a uniform material, and it lends itself to numerous adaptations. It differs from mine to mine, from bed to bed in the same mine, from field to field. There are differences in ash, sulphur, and moisture content.

One company sells coal from 6 States, 28 fields, 53 seams, and in 71 sizes.

Increasingly the coal companies are ceasing to be mere aggregations of mines and are becoming factories which size, grade, clean, and oil-treat their product to keep it from freezing and from giving off excessive dust (page 582).

Formerly there was great waste in leaving much of the coal in the ground and in burning it improperly.

But recovery of coal in mining is improving, and the large users, especially, including railroads, utilities, and steel manufacturers, have learned highly economical methods of combustion in the past 20 years.

It is probable that the present annual production of nearly 600 million tons of bituminous does as much work as 800 million would have done in the last war, assuming that such an amount could have been mined.

One great improvement has been the introduction of automatic stokers. Another is the widespread use by large consumers of pulverized coal.

In time even more small householders than at present may use the automatic stoker, which burns coal smokelessly no matter how volatile it was to begin with.

As yet, only very small amounts of coal are being used in this country experimentally to manufacture gasoline by what is known as the hydrogenation process, although for some years England, France, Germany, and Japan have obtained some of their motor fuel in this relatively costly manner.

It is comforting to know that Nature has provided these United States with coal so lavishly that if petroleum and natural gas do give out, the necessary motor fuel, or gasoline, can be made from coal.

Whether this will become necessary, and when, is a question. Fortunately, the almost untouched lignite of our own West, the oil shales of the same region, and the "tar sands" of Canada will all provide gasoline.

#### From Coal to Coke to Steel

It is impossible to say which of the many uses of coal is most vital to man. But in war, steel is paramount. To get the coke to make a ton of pig iron to make steel, it is necessary to use substantially 1½ tons of coal.

First, the coal must be made into coke by heating it in an oven without enough air for complete combustion. Also, the volatile elements, or so-called by-products, must be taken off. The hard substance remaining is coke.

The largest single user of bituminous coal for manufacturing purposes in the United States is the Clairton By-product Coke Company's plant of the Carnegie-Illinois Steel Corporation, on the Monongahela River, 15 river miles south of Pittsburgh. To keep this plant in operation it is necessary to supply from 31,000 to 32,000 tons of coal a day.

This is such a vast quantity that coal mined in the heart of Pennsylvania's bituminous field today will be burning in the Clairton ovens not later than tomorrow, brought to the plant—as I witnessed it—mostly in a fleet of gigantic steel barges.

The 1,482 coke ovens are arranged in long batteries. When the coking process is complete, rams mounted on electrically driven "pushers" force the red-hot mass of coke out of the ovens into the waiting side-dump hopper cars which then move the coke to a quenching tower, where it is sprayed with water (page 588).

If one day's production of this plant were



RALPH PIERSON

#### Exchanged for Overalls and Helmet, Street Clothes Shoot Ceilingward for Storage

Warm air above the bathhouse locker room protects garments against floor-level dampness. Operated by pulleys, the baskets contain smaller possessions. Bulky apparel hangs from hooks. Generally, a bathhouse is a convenience for miners having far to walk.

loaded into cars and made up into a solid railroad train, almost 550 cars would be required, and the train would be about four miles long.

Before the advent of the by-product coke oven, coke was made in beehive ovens, which look like beehives or igloos. All the volatile elements were wasted, being allowed to drift off in rich yellow smoke to foul the landscape.

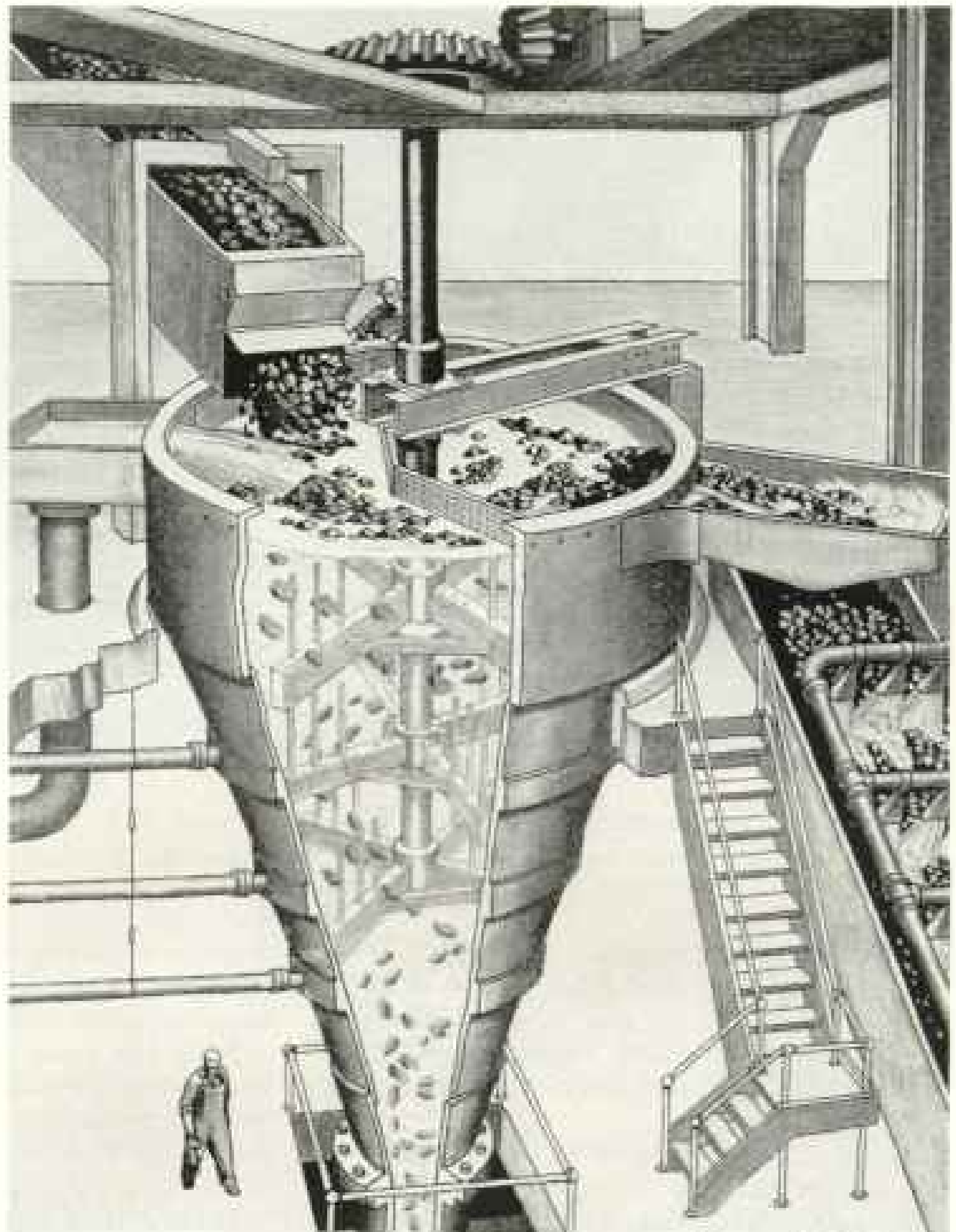
The obsolete and utterly prodigal beehive oven had about disappeared by the beginning of the present war. But the inordinate demand for steel, and consequently for coke, has brought many thousands of them back into temporary emergency use.

The by-product oven gets its name from the fact that it conserves the gases and vapors liberated when coal is coked. It is not only essential to steel, but is the foundation of a large part of such war industries as explosives, plastics, synthetic rubber, and medicinals. By-product coke ovens are thus in a very real sense the arsenals of democracy.

In addition to coke, four primary by-products come from these ovens: gas, coal tar, light oils, and ammonia. An average of 11,000 cubic feet of gas is generated from each ton of coal coked.

Gas is the least glamorous of the by-products, but it heats the ovens themselves, and what remains is carried off to steel mills to heat open-hearth furnaces or to city gas mains for domestic and general industrial use.

Returning from the Royal College of Chemistry for his Easter vacation in 1856, William Henry Perkin, then just 18 years of age, improvised a laboratory in his English home and attempted to make synthetic quinine. He



Drawn by Edwin E. Adams

#### Stirred in a Giant Cone, Coal and Slate Part Company

Driven by gears at the top, water and sand form a bath of such specific gravity that rock and dirt sink while coal floats into the chute at the right. The cone is primarily for hard coal. Some metal mines employ it.

failed, but produced instead the first synthetic coal-tar dye.

Young Perkin's discovery helped to mark the beginning of a new kingdom for the benefit of mankind, that of synthetic chemistry. Previously, man had only animals, vegetables, and minerals; now he could use Nature's raw materials to make wholly new products.\*

When it is said that any one of thousands of products is "made from coal," or "starts with a lump of coal," it means that one of several intermediates used in making the product is in turn made from a derivative of coal.

Coal tar is first of all a fuel in itself; some-

\* See "Chemists Make a New World," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, November, 1939.





Robert Yamall Dettie

### Scrubbed Faces Beaming Like Their Lamps, Miners Ride a Cage to Jobs in the Depths

Despite shortages of tools and machines, they feed war's appetite for coal. To do so, bituminous workers spend more than 50 hours a week, including travel time, in the mines.

times as much as 50 percent is burned in open-hearth furnaces. But from it are obtained such products as road tars; creosote oils, used to preserve wood; pitch; naphthalene, used to make moth balls and plastics; and carbolic acid, or phenol.

With these beginnings chemistry goes on and derives not only dyes, perfumes, disinfectants, and insecticides, but aspirin, atabrine (the substitute for quinine), the sulfa drugs, arsenical drugs for treating venereal disease, laxatives, sedatives, certain vitamins and hormones, and the new drug, phenothiazine, used to treat animal diseases (page 585).

From the third of the coking by-products, light oils, are derived benzol and toluol, among others. Blended with gasoline, benzol produces a superior motor fuel. From it comes styrene also, one of the two necessary constituents of Buna-S rubber, major item in the synthetic-rubber program.

Benzol is used in paints and varnishes.

Toluol, from coal or petroleum, is the hydrocarbon base for TNT.

From it comes saccharin also. This is the diabetic's substitute for sugar and also a cheap substitute in the manufacture of candy, with its sweetening power of from 300 to 500 times that of sugar.

The fourth by-product of the coke oven is ammonia. A starting point for explosives, it is also used to make vast quantities of am-

monium sulphate, one of the most important fertilizers, since it contains nitrogen, an element essential to plant growth.

From the River Rouge plant, where Henry Ford normally makes coke to make steel to make automobiles, the ammonium sulphate goes to the Ford farms to help grow soybeans, which also are used in the motor industry.

Pages of fine type would be needed merely to name all the products that stem from the coke oven, first or last. There is "coke breeze," dustlike particles of residue used to make "dum-dum," a sound-deadener compound for the interior of automobiles.

There is the Du Pont fiber, Nylon, with its apparently endless series of ever-new uses. There is embalming fluid, laughing gas, a material used by soapmakers to prevent rancidity, another to enable dyes to penetrate fibers more quickly, and still another to inhibit the sulphuric acid used to remove scale from steel from injuring the steel.

There is a seemingly inexhaustible list of compounds based on coal.

Locked in these black lumps are other treasures still uncounted, among the great hidden assets of the future.

Coal is usually looked upon as a prosaic, matter-of-fact substance. But we have found it a veritable Aladdin's lamp, which, when rubbed, pours forth more and more services for the benefit of mankind.

# The Isles of Greece

BY LT. RICHARD STILLWELL, U.S.N.R.

ONE SPRING when I was living in Athens, I received a letter from a friend who wanted to go cruising in the Cyclades. Would I make the necessary arrangements?

Would I! No other sea in the world is so rich in history and legend as the Aegean. This island-flecked, tideless sea is the zero milestone of Western geography and civilization.\*

In all, there are about 24 large islands in the Cyclades group. The ancients believed that they lay in a rough circle about Dēlos (map, page 596). The name Cyclades comes from the Greek word for circle, *kyklos*.

Aside from some large islands along the coast of Asia Minor, there are two other principal groups of Aegean islands, known as the Sporades from the way they are scattered like seeds. The Southern Sporades include the Dodecanese and Rhodes.

The ancients hardly ever sailed at night. The custom was to put ashore at dusk—even to draw the ships up on land. An ancient voyage must have been a leisurely affair. We followed the custom of those times.

## Aboard the "Roaring Noise"

Seven of us made our way down to the Piræus one sunny afternoon and went aboard the good ship *Phloisbos*, a 60-foot caique, fitted for cruising. Although rigged as a schooner, her sailing powers were not remarkable.

In a heavy breeze we could barely make steerageway; so thereafter we relied on a powerful Diesel engine which made us wonder whether the name of the ship (*phloisbos*—a roaring noise, as of the sea) had been given her with more than a sentimental reason.

All afternoon, as we coasted south along the shore of Attica, we watched the changing profile of Mount Hymettus, and late in the day we dropped anchor in a little bay just below the gleaming marble columns of Poseidon's Temple at Cape Sounion (Sunium).

Few ancient temples have so fine a site or can be seen from so far. The cliffs, dropping steeply to the sea, form a magnificent pedestal for the milk-white ruins. When he wrote of "Sunium's marbled steep," Byron was not indulging in poetic license. The description is accurate.

We went ashore and scrambled up the steep rise in time to see the sun go down in a purple glory behind the distant mountains of the Peloponnesus, across the Gulf of Aegina.

Early next day we chugged away to Kéos,

only a few miles off. Kéa, the principal town, was once known as Iulis, and not far from it is a lion, almost 30 feet high, cut out of the native rock.

Kéos was the birthplace of Simonides and his nephew Bacchylides, two famous poets of ancient Greece. Simonides is best remembered for his epigrams commemorating those who died in battle, and especially for two epigrams on the Spartans who died at Thermopylae.

"O passer-by," he wrote, "tell the Lacedaemonians that we lie here obeying their orders." The other begins, "Of those who died at Thermopylae, glorious is the fortune and fair the fate; their tomb is an altar; instead of laments, memory is theirs, and pity becomes praise; such a tomb neither mold nor all-conquering Time shall waste away."

## A Poet Escapes "Retirement" at 60

Simonides did not stay too long in Kéos, however, for one of the laws of the Kean legal code (much admired in antiquity) was that anyone who reached the age of 60 should be required to drink a cup of hemlock and die. Well before he reached that dangerous age he went to live honorably at Athens. In Sicily he reached the ripe age of almost 90. Simonides is said to have been the first poet to accept pay for his poems.

It was late afternoon when we reached Tēnos (page 597). In the town, not far from the shore, is the Church of the Evangelistria, built over a well where, in 1823, a miraculous icon of the Virgin was found. Supposed to have been painted by St. Luke himself, it has the reputation of effecting marvelous cures. The icon is kept in the church and is so heavily encrusted with jewels that nothing can be seen of the original painting except the age-darkened faces of the Virgin and the Angel Gabriel.

To Tēnos, every year on the 25th of March and again on the 15th of August, came thousands of pilgrims, hundreds of them seeking miraculous cures. Gathered from all parts of Greece, they crowded into the shrine to sleep and perhaps be healed of their affliction.

There is ample evidence of many cures, attested by the large number of thank offerings

\* See "Greece—the Birthplace of Science and Free Speech," NATIONAL GEOGRAPHIC MAGAZINE, March, 1944, also by Lieutenant Stillwell, who formerly was Director of the American School of Classical Studies at Athens. Also, in the same issue, "The Greek Way," by Edith Hamilton, and "The Glory That Was Greece," 32 paintings by H. M. Herget.



Portrait of a Woman at Skýros

© N. Bograpian

Her everyday costume has little color. But on feast days she puts on old silks with swirling skirts which reflect the bright skies of the Aegean.

hung in the church. Hundreds of little gold, silver, and wooden reliefs of legs, feet, hands, and arms, as well as other parts of the body, bear witness that the sufferers' faith had won its reward.

Another offering was a small model of a boat which had been speared by a fish (presumably a swordfish). Many small reproduc-

tions of various craft bespoke escape from storm or shipwreck. An elaborate silver model of an out-of-date motorcar seemed to tell of an escape from a driving accident.

#### On the Island of Churches

Mýkonos, which we visited the next morning, is one of the most fascinating of the small island towns (page 598). Virtually every building is whitewashed and has a flat roof, so that there is an endless variety of combinations of blocklike masses which attract the artist and make even those without artistic ability long for a sketch pad or a box of paints.

At the head of one street, which rises steeply up a hillside, a huge windmill deliberately swings its wide-sleeved arms against the deep-blue sky. On a windy point are other windmills.

My wife and I climbed up into one which was grinding merrily away and found ourselves in the upper room, with big wooden cogwheels grating around us. From the heavy beams hung a century's accumulation of cobwebs, and, near some meal sacks, a cat sat patiently alongside an empty

mousetrap, apparently unconscious of any deterrent effect she might have on venture-some mice.

There are several hundred churches on the island. Almost every retired sea captain has put up a small shrine or chapel when he has finally returned safe from his wanderings. Some of these edifices are charming; others are



**Venders in Brightly Painted Rowboats Greet a Ship off One of the Cyclades**

Their "bag and bazaar" may be anything from sheep to a bell-horned phonograph. The Cyclades (N. Kykladen) are so named because ancients thought they clustered in a circle (*kyklos*) around Délos.

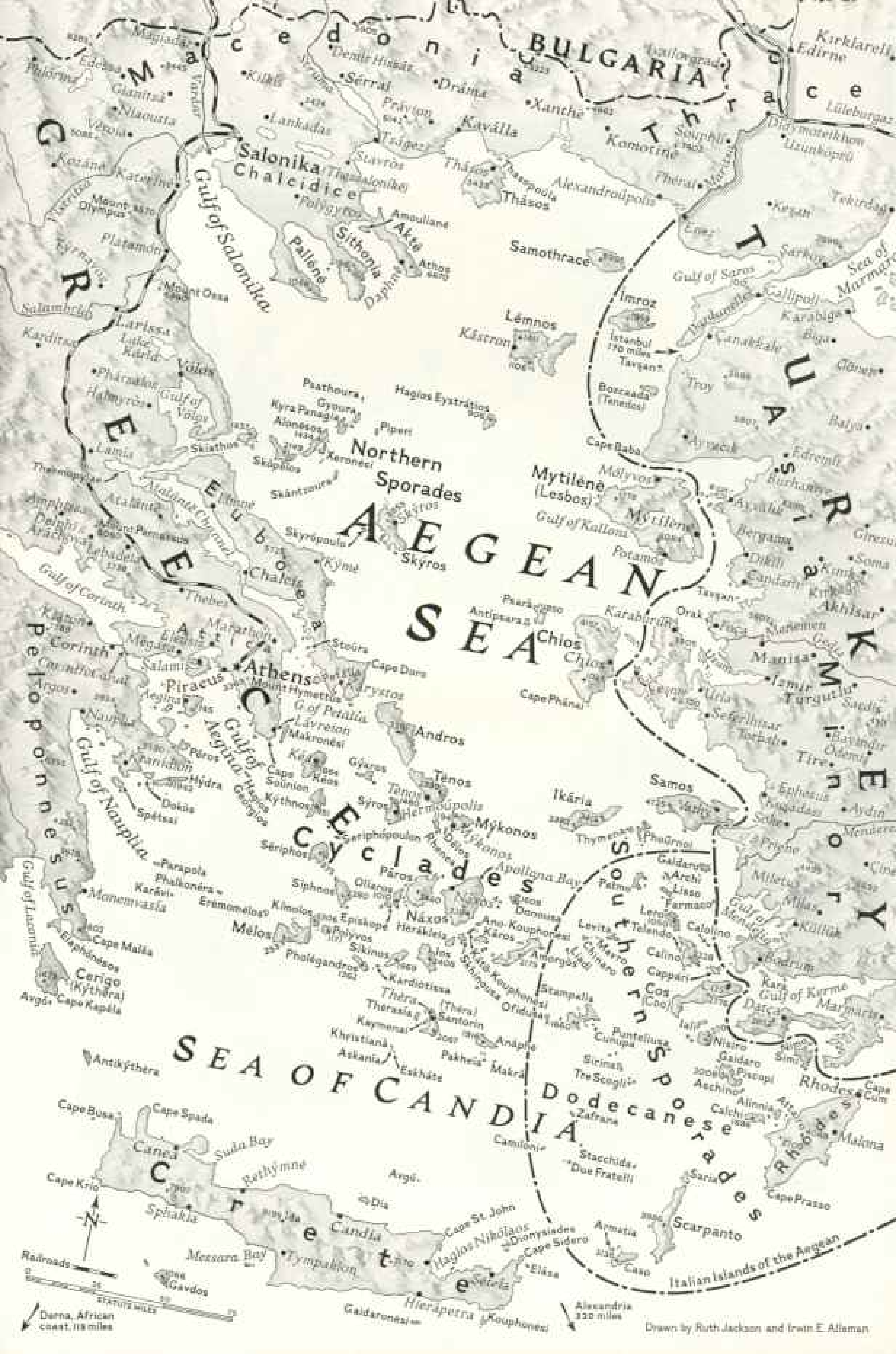


Walter Rees from G. Lambridis

**For Such Sponges the Mediterranean Is Not Too Large a Tub**

Greek sponge fishers reap a rich harvest in the Aegean, where their boats are seen in many a harbor. Greek-American sponge fishers have a large share of the Florida-coast sponge trade.





# AEGEAN SEA

Roads  
20 40 60  
STATUTE MILES  
Derna, African coast, 118 miles

Drawn by Ruth Jackson and Irwin E. Alliman

**BULGARIA**  
Sofia, 1492  
Plovdiv, 1117  
Varna, 1099  
Ruse, 1156  
Kavalla, 1438  
Thessalonika, 1054  
Kozani, 1928  
Larissa, 1838  
Athens, 1834  
Corinth, 1328  
Argos, 1374  
Nafplio, 1715  
Monemvasia, 1423  
Cape Malda, 1403  
Cape Karella, 1403  
Cape Suda, 1403  
Cape Krio, 1403  
Spartakia, 1403  
Messara Bay, 1403  
Tympanion, 1403  
Gaidaronisi, 1403  
Hierapetra, 1403  
Rouphonesi, 1403

**Thrace**  
Edirne, 1350  
Lüleburgaz, 1350  
Diyadin, 1350  
Uzunkopru, 1350  
Kocaeli, 1350  
Tekirdag, 1350  
Kesan, 1350  
Sarkis, 1350  
Biga, 1350  
Gönen, 1350  
Balys, 1350  
Edremit, 1350  
Burgaz, 1350  
Gineci, 1350  
Soma, 1350  
Kizilirmak, 1350  
Kirmak, 1350  
Akhisar, 1350  
Manisa, 1350  
Samsun, 1350  
Tire, 1350  
Aydin, 1350  
Menidi, 1350  
Cine, 1350

**Salonika**  
Thessalonika, 1054  
Lankadas, 1403  
Sithonia, 1403  
Akti, 1403  
Amouliani, 1403  
Athos, 1403  
Pallene, 1403

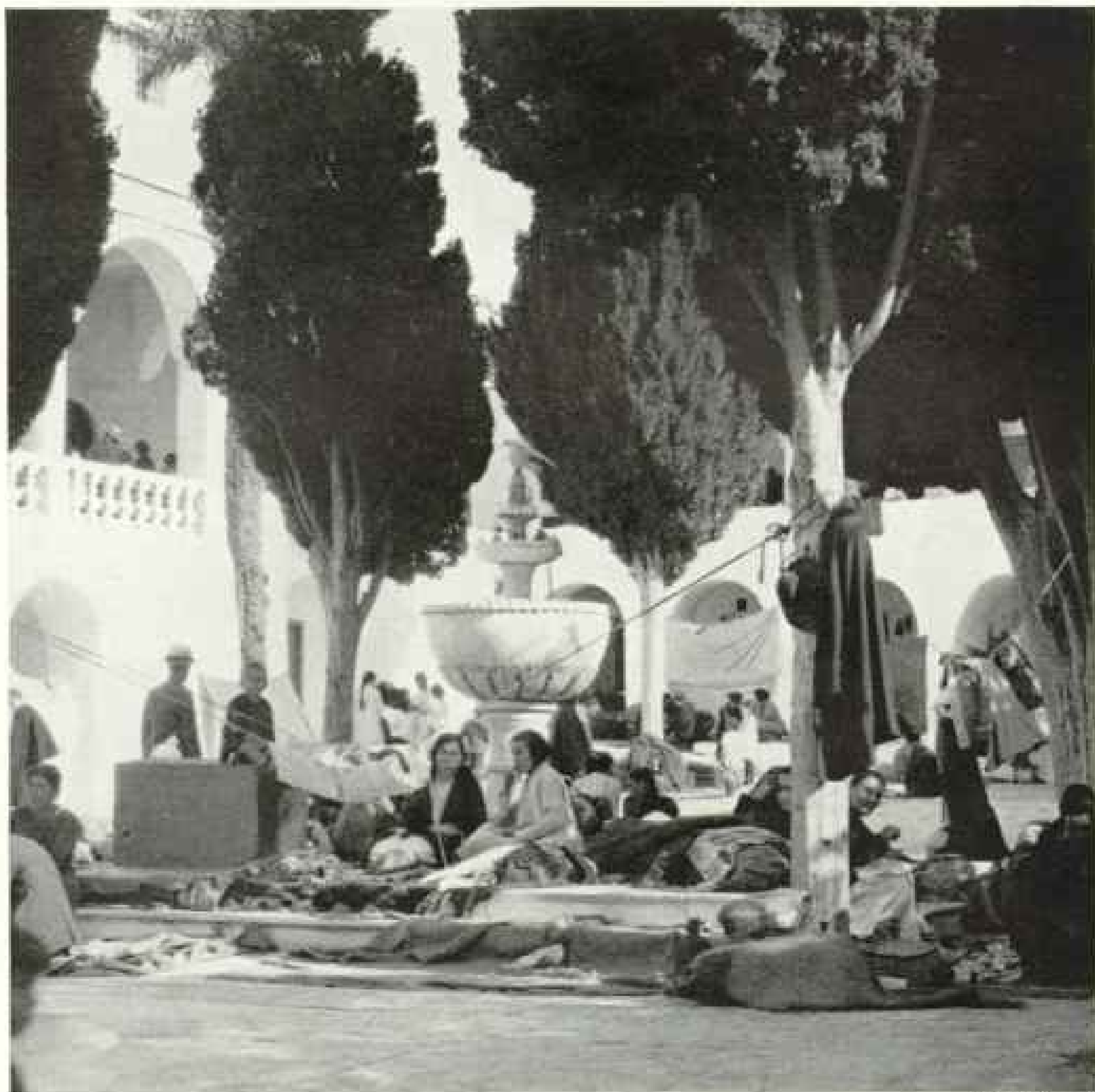
**Northern Sporades**  
Psathoura, 1403  
Gyroura, 1403  
Kyra Panagla, 1403  
Alonissos, 1403  
Xeronessi, 1403  
Skopelos, 1403  
Skantzoura, 1403  
Skyropoula, 1403  
Kyme, 1403  
Skyros, 1403

**Cyclades**  
Andros, 1403  
Tinos, 1403  
Sifnos, 1403  
Mykonos, 1403  
Naxos, 1403  
Melos, 1403  
Santorin, 1403  
Thira, 1403  
Kythira, 1403  
Siphos, 1403  
Paros, 1403  
Naxos, 1403  
Melos, 1403  
Santorin, 1403  
Thira, 1403  
Kythira, 1403  
Siphos, 1403  
Paros, 1403

**Dodecanese**  
Rhodes, 1403  
Kos, 1403  
Leros, 1403  
Kalymnos, 1403  
Karpathos, 1403  
Kos, 1403  
Leros, 1403  
Kalymnos, 1403  
Karpathos, 1403  
Rhodes, 1403  
Cape Prasso, 1403

**Italian Islands of the Aegean**  
Samos, 1403  
Ikaria, 1403  
Chios, 1403  
Samos, 1403  
Ikaria, 1403  
Chios, 1403

**Other Islands**  
Samos, 1403  
Ikaria, 1403  
Chios, 1403  
Samos, 1403  
Ikaria, 1403  
Chios, 1403



H. D. MacDonell

### Amid Cypress Trees and Surrounded by the Sick Is the Curative Fountain of Tēnos

Under a summer sun, the Feast of the Assumption of the Virgin is celebrated on August 15 at the Cathedral of Our Lady of Good Tidings. Thousands of Greeks crowd the corridors and camp out in the courtyard, where priests pass healing water from a dove-topped fountain. Later, offerings are hung up before a time-tanned lion, ascribed to the brush of St. Luke (page 593).

plain. One which I explored, a favorite subject for visiting photographers, contained five separate chapels, built at different levels and angles.

Another feature of the island is its elaborate towerlike dovecotes, with a lacy sort of upper story where pigeonholes are made by rows of thin tiles set in inverted V's like a house of cards.

### The Center of the "Circle"

From Mykonos it is but a few miles to Dēlos, uninhabited now save for the guards of the excavations.

It was the legendary birthplace of Apollo and Artemis, born here under a sacred palm tree to Leto after she had fled from the anger of Hera. The island was considered so holy that it was forbidden to be born or to die on it. The near-by island of Rhenea, just across the harbor, was reserved for these natural events.

Near the ancient temple of Apollo lie part of the remains of one of the earliest of Greek statues, a colossal male figure, or "Apollo," which must have been about 16 feet high when it was complete.

It is said to have been wrecked when a



Staff Photographer W. Arthur Howard

### Katina's Emporium Whispers, the Street Vender Shouts, in Spotless Mykonos

In a door sign, modest as a calling card, Katina K. Zouganeli advertises her shop. On the Greek mainland, arrival of the vegetable man is a signal for brisk barter. Here, where everyone knows everyone, transactions over the donkey vegetable counter are peaceful and routine.

strong wind blew down the great bronze palm tree dedicated by the Athenian Nicias to commemorate the birth of the god.

Many authorities now believe the so-called Apollos were probably statues of athletes or funerary monuments.

Delos' great period came in the second century before Christ, when the Romans made it a free port under the management of Athens. All the trade of the eastern Mediterranean passed through the tiny harbor, bringing with it foreign merchants of all races: Greeks, Italians, Egyptians, Jews, Syrians, and Phoenicians.

Many of these settled on the island, and

along the water front we can still see the remains of their warehouses and docks, their elaborate houses and places of assembly, and numerous shrines and temples. On this holy island of Apollo and Artemis there were temples to all sorts of foreign gods: Isis, Anubis and Serapis, Hadad, Atargatis, Jehovah, and many others.

### Slave Market Succumbs to Piracy

Delos was one of the greatest slave markets of ancient times (page 599). Pirates ranged the seas, harrying the coasts and seizing the natives of any communities not strong enough to protect themselves. These unfortunate



Felix Gallows

#### A Few Stark Columns Perpetuate Cleopatra's Name on Délos

Here, in a rich residential quarter, is Cleopatra's Well in the ruins of the House of Cleopatra. Beside the well two youngsters hold water jars similar in shape to those of ancient times. There is no evidence that this Cleopatra was Shakespeare's heroine, beloved of Caesar and Mark Antony.



slaves were brought to Dēlos, where as many as a thousand were sold in a single day. Piracy brought destruction to the island. One of Rome's greatest generals, whose eyewitness reporting is known to every boy and girl who ever studied Latin, was captured and held for ransom by pirates.

Their prisoner was Julius Caesar. While waiting to be ransomed, he cheerfully promised that he would return some day and crucify them. The pirates took the chance, together with the ransom, but Caesar kept his word. He liquidated that particular band.

For an entire day we wandered over the ruins, which had been excavated by the French School at Athens. Back from the harbor lies a closely packed mass of buildings: remains of temples, altars, *exedrae* (commemorative semicircular benches), statues, vast porticoes, built by Hellenistic kings.

Farther up the hill toward a large theater is a rich residential quarter, full of the houses of the wealthy merchants. The exteriors were severely plain, but inside the houses were elaborately finished with richly stuccoed walls, mosaic floors, and usually a square court surrounded by columns, almost always of marble. Many of these courtyards covered a large cistern where rain water was collected, since there was little or no water supply on the island.

Many of the Greek islands depend today on cisterns for water, and elaborate precautions are taken to keep the supply pure, just as in the old days.

By the water front are remains of storehouses and merchants' business houses. We found stone bollards to which long-forgotten ships were once made fast, but much of the ancient water front has been swallowed up by the land.

#### Marble Tub Big Enough for a Family

In one ruined warehouse we found a marble tub, carved from a single block. Though literally hundreds of gallons of water would have been needed to fill it, it would have made a marvelous bath, large enough for an entire family at one time.

Near the shore of the harbor we came on some fishermen who had been spearing octopuses, which were now hung out in rows along the long spars of the boats. Our cook, Mitsu, bought several for the galley, and that night we were treated to a delicious octopus salad. It was so greatly enjoyed that curiosity could no longer be restrained, and the nature of the treat was made known. The desire for another helping faded away.

Our cruise carried us on down to Naxos

(page 621), where Theseus abandoned Ariadne after she had saved his life by giving him a long thread which he unwound as he sought the Minotaur, or Bull of Minos, through the mazes of the Labyrinth, and thus was able to find his way out. At Naxos she was found and consoled by Dionysos, god of wine, who made her wreath into the constellation of Ariadne's crown (*Corona Borealis*).

Dionysos was taken over by the Orthodox Church as Saint Dionysios, and it is only natural that there should be a modern Naxian story about him.

On a journey from Mount Olympus to Naxos the Saint noticed a vine, which he planted three times, first in the bone of a bird, then in that of a lion, and finally in that of an ass. From the grapes of the vine he made wine. The intoxication which it caused went through three phases. First, the drinker sang like a bird, then he felt as courageous as the lion, and finally acted like an ass.

At the northern extremity of Naxos, near Apollona Bay, a huge figure of Apollo had been roughed out, but never removed from the quarry.

#### One of Homer's "Birthplaces"

The weather was so contrary that we ran on down past Páros (page 618) to a snug little harbor, where we anchored securely for the night on the leeward side of Ios. The island is full of tiny chapels, but an older tradition has cast its spell. Ios is one of the several places which lay claim to being the birthplace of Homer, and is also reputed to be his burial place.

Before dawn next morning we left the shelter of the harbor for a rough sea, kicked up by a strong northeast wind. The *Phloisbos* bounced around in a lively manner.

Just as the wind was rising to an uncomfortable pitch, we found ourselves in a dead calm, floating in Santorin's (ancient Théra's) great landlocked bay, surrounded on all sides by high, vividly colored cliffs seared by volcanic fires.\* Black, red, and yellow banded the rock slopes between blue sky and bluer sea. On the edge of the sheer precipices stood a dazzling-white town.

From the center of the bay, which is about

\* See "Santorin and Mýkonos, Aegean Gems," 8 natural-color photographs, NATIONAL GEOGRAPHIC MAGAZINE, March, 1940. Also, in same issue, "Modern Odyssey in Classic Lands," by Maynard Owen Williams; "Today's Evidence of Grecian Glory," 22 natural-color photographs by B. Anthony Stewart, and Map Supplement, "Classical Lands of the Mediterranean." For many other articles on Greece and the Aegean Regions, see those headings in "Cumulative Index to the NATIONAL GEOGRAPHIC MAGAZINE."

## The Isles of Greece



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Kodachrome by B. Anthony Stewart

### Santorin Island Women Meet the Boat, Afloat in a Volcanic Crater

On a little pier at the foot of the inner wall of a half-drowned volcano, a colorful group awaits. The steamer does not drop anchor, since the water is too deep. More than one sailor has lost his anchor a quarter-mile deep in what was once the heart of a mountain. Santorin, north of Crete, was occupied by the Germans.

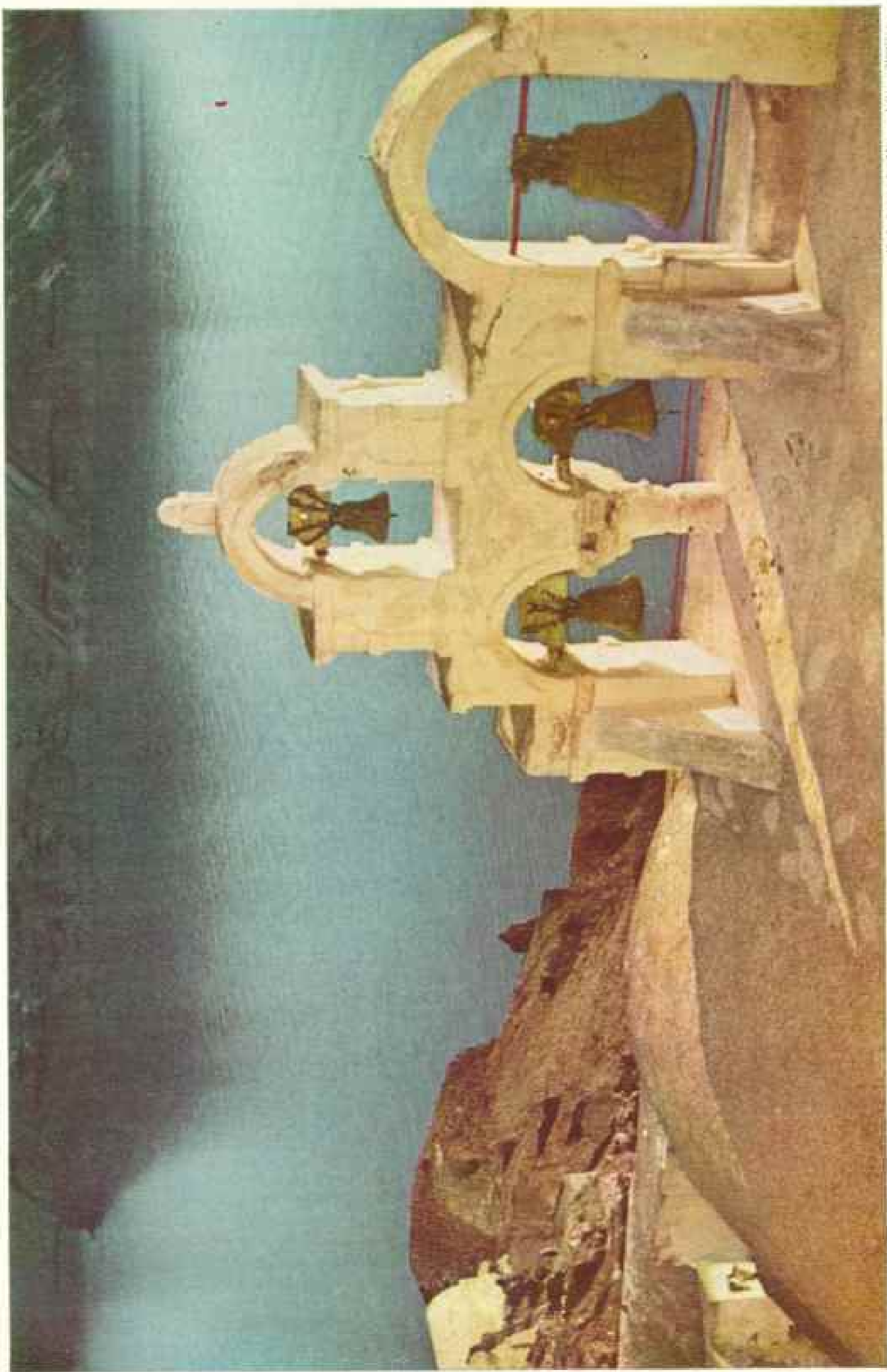


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Illustration by Merrett Cross Williams

### A National Geographic Photographer and His Interpreter Amble Along the Crater Edge Toward Théra

In the anxious days just before the war, foreign travelers had to be accompanied by an official guide. B. Anthony Stewart, while photographing Greek women in gorgeous costumes, had the help of Miss Cavourides. Here, after a day's work in white-frosting towns on chocolate cliffs, they ride home to dinner.



© National Geographic Society

Illustration by Myron Gurn-Wallace

**A Golden Bellry, Backed by New Lava, Symbolizes the Change of Thera's Name to Santorin, in Honor of St. Irene**

Originally, Thera, as a Phoenician colony, knew the cruel pagan gods Melkart and Astarte. Then came immigrants from Crete, land of the Minotaur and the Snake Goddess. Egyptian Ptolemies had an outpost here. Now, when war threatens or the volcano thunders again, the round of church bells sweeps the lava slopes.





**American Girls, Cruising the Aegean, Ride Tandem on a Marble Lion of Delos**

This tiny, rocky island, almost without water and with no adequate harbor, was one of the most famous sites in all Greece. Five such slender beasts face the sacred lake, sanctuary for Apollo's swans.



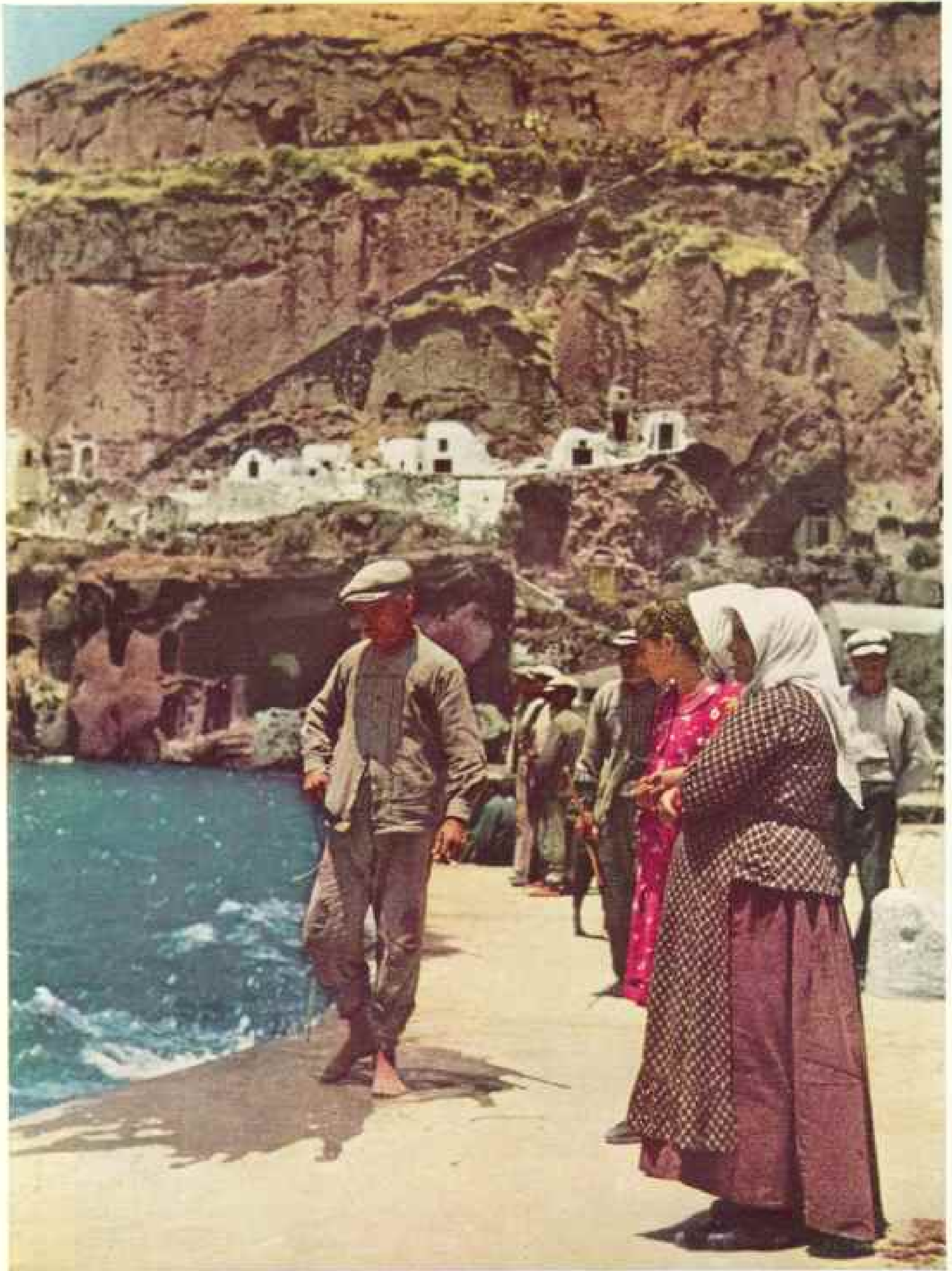
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Reproduction by Margaret Owen Williams

**Under the Spreading Sycamore, Hippocrates Prescribed**

Legend has it that this huge plane tree on the island of Cos was standing when the father of medical science exacted from his disciples a promise of ethical practice. It still survives in the Hippocratic Oath.

## The Isles of Greece

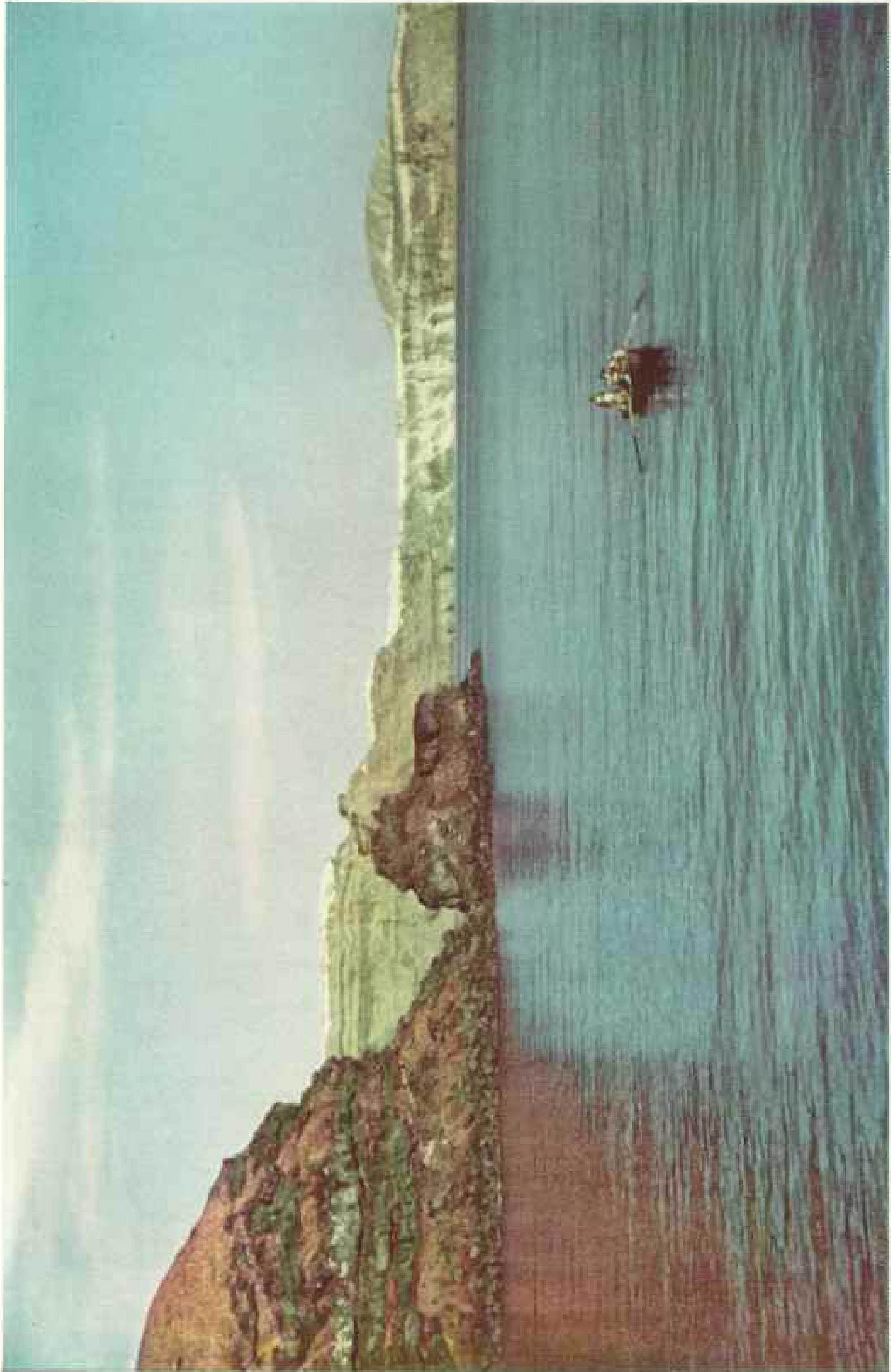


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Illustration by H. Anthony Hawley

### Cave Homes and Stores Are Cut in Lava Cliffs Beside the Port of Santorini

The main village is high on the crater edge, and cargoes, landed on this narrow pier, must be carried up on muleback. In the Aegean, where earthquakes are common, Santorini is a symbol for volcanic activity. In the center of the drowned crater a new cone is slowly growing to the hiss of lava and tall clouds of steam.



© National Geographic Society

Illustration by Howard Chaney Williams

**A Tiny Rowboat Floats in the Cavity Which Opened When the Volcano at Santorin Blew Off Its Head about 3,500 Years Ago**

Larger vessels navigate the hot, sulphurous waters near Burnt (Kalymental) Island to clean their bottoms, while pumice stone floats in the sea.



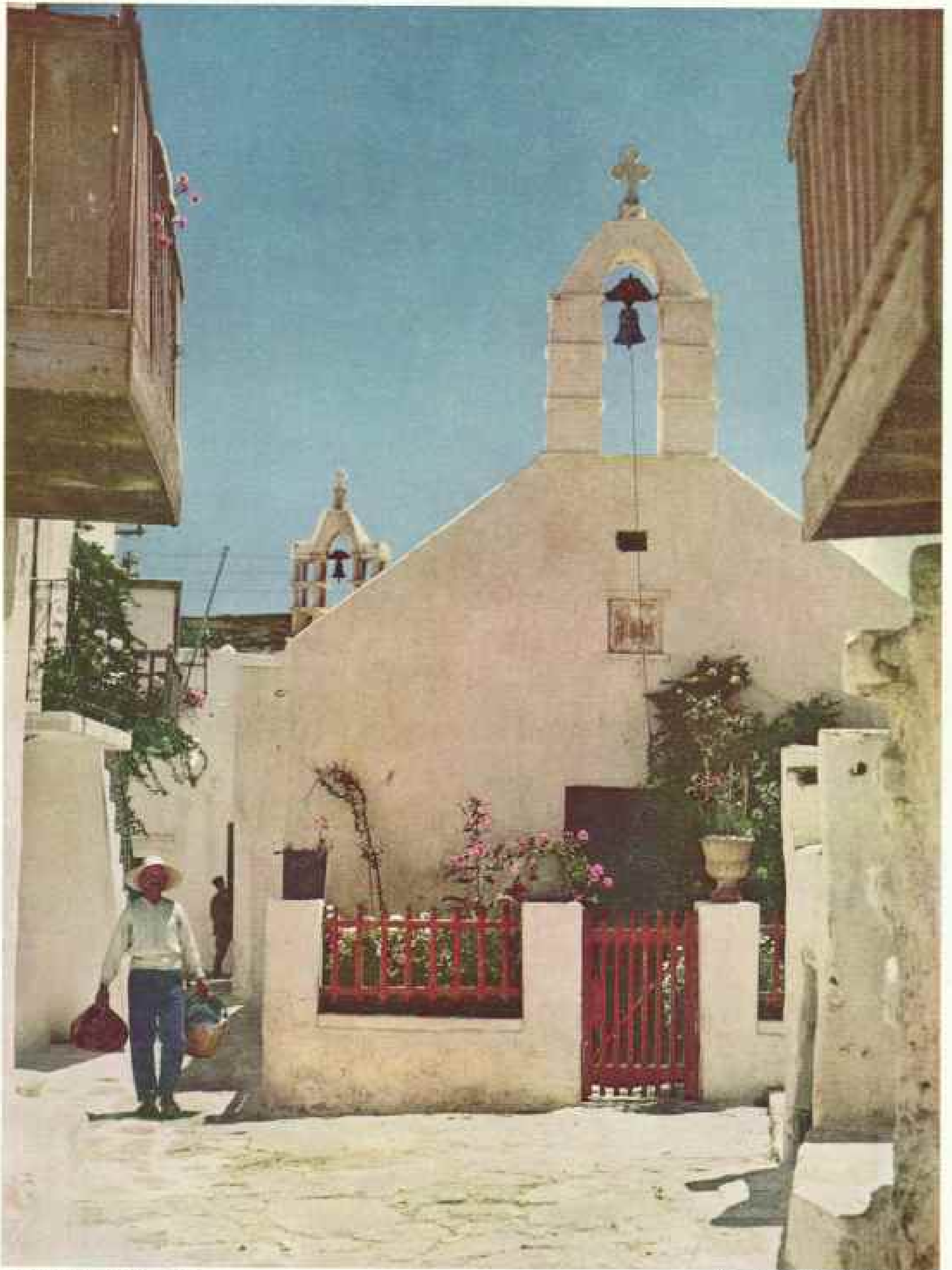
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Illustrations by D. Anthony Howard

**Santorin's Traffic Climbs 1,200 Steps Up a Brown Cliff from Skála (the Harbor) to Théra, the Crater-top Town**

Facing forward and standing up, the boatmen row out to the steamer. At the pier, bag and baggage are transferred to muleback for the 670-foot climb. From time to time the whole island shakes and lava hisses in the sea. But the people stay on in their earthquake city. It is their home.





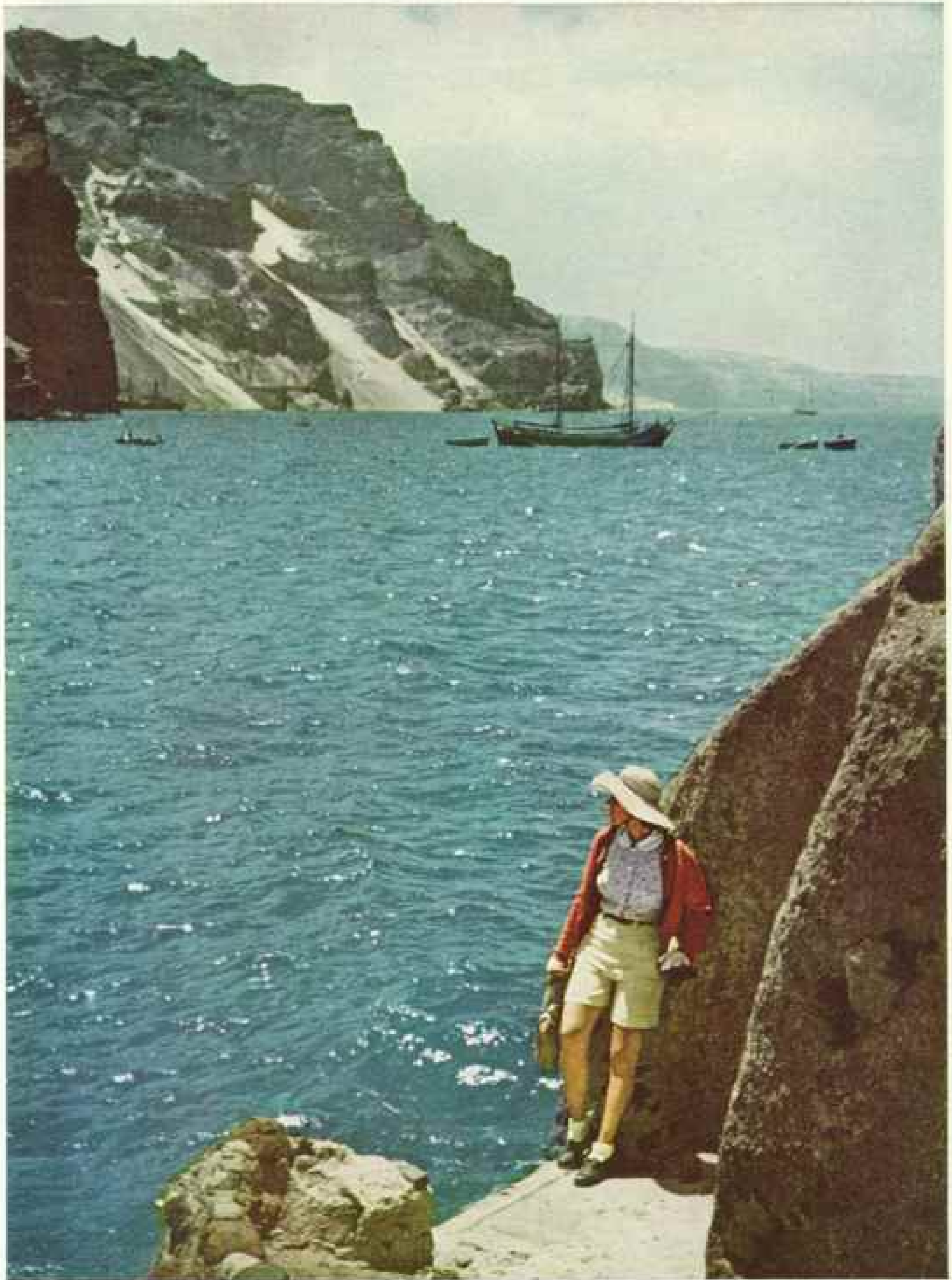
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Illustration by E. Anthony Stewart

**On a Feast Day on Mykonos the Air Trembles to the Sound of Hundreds of Chapel Bells**

Sailors, home from the sea, build family chapels in their spotless town. Within sound of Mykonos' Christian bells lies Delos, around which wheel the Cyclades, which take their name from the Greek word *kyklos*, meaning "circle." The islands are the outjutting peaks of a submarine plateau.

## The Isles of Greece

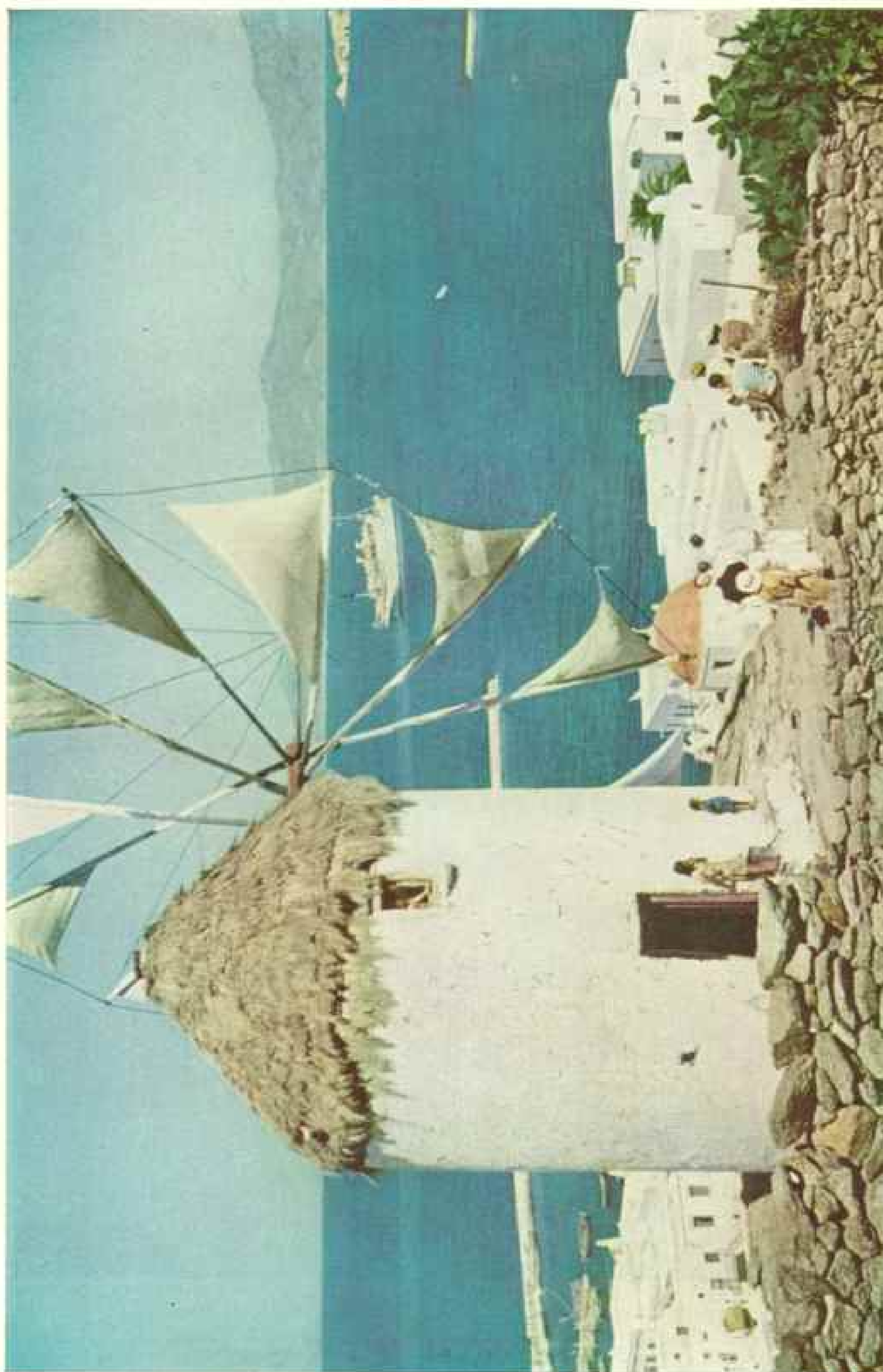


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Kodachrome by Margaret Owen Williams

### Pumice from Drowned-out Fires Slides down the Slopes of Santorin

In the foreground is the tiny quay where cargoes are landed at the entrance of a warehouse cave. Beyond are anchored small steamers where natural glass, once ashes from Hephaestus' (Vulcan's) forge, is shipped away as pumice. Locally known as "Santorin earth," it is used for polishing and for lightweight cement blocks.

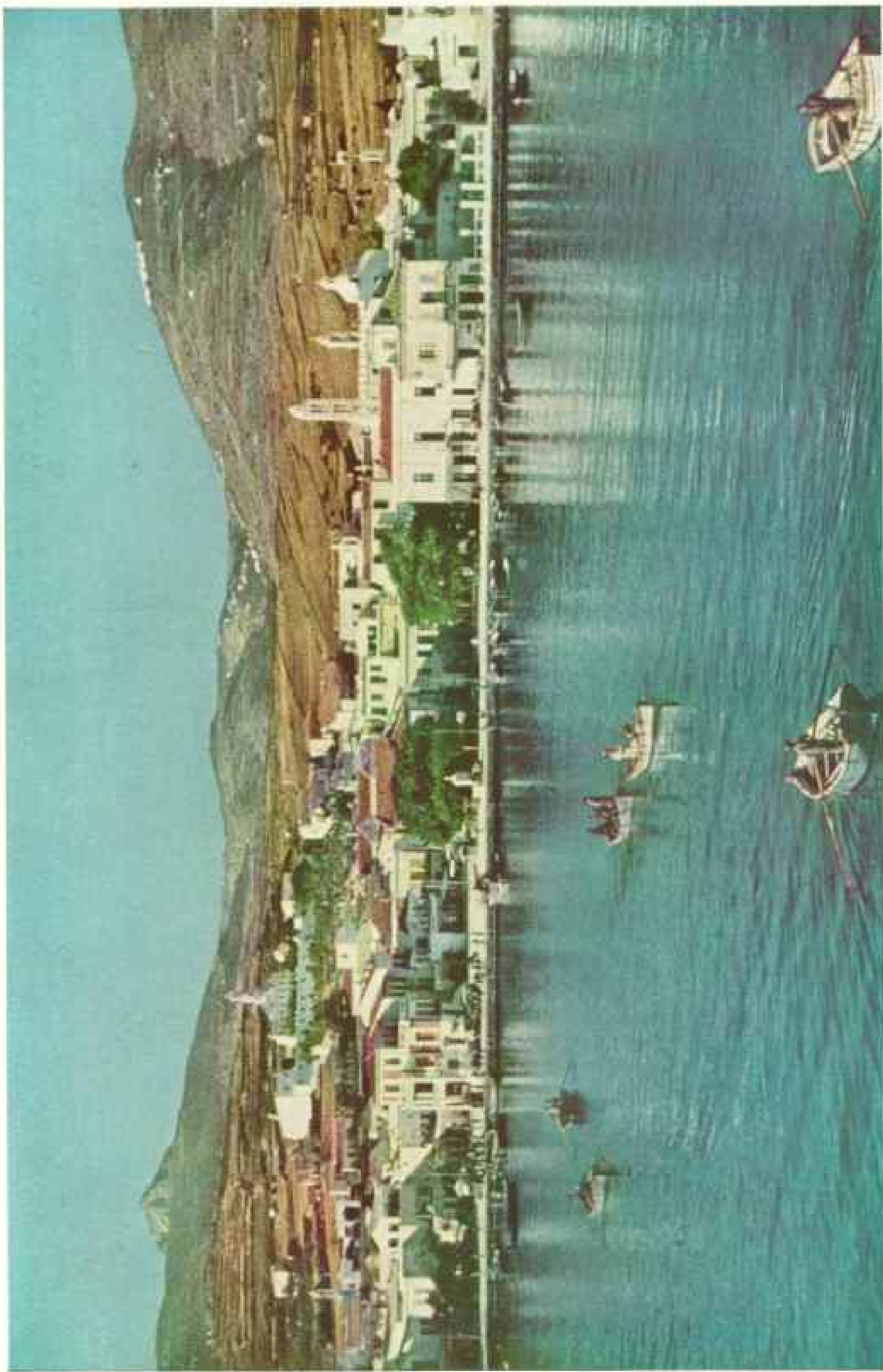


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### Half-furled Sails, on Mykonos, Frame the View of a White Ship in the Blue Aegean

When the breeze is indolent, each triangular sail is spread to the limit. Now a wind sweeps the Cyclades, and sail is shortened by wrapping it around the arms of the mill, which uses idyllic zephyrs to grind its grist.

Redesigner by Maynard Owen Williams



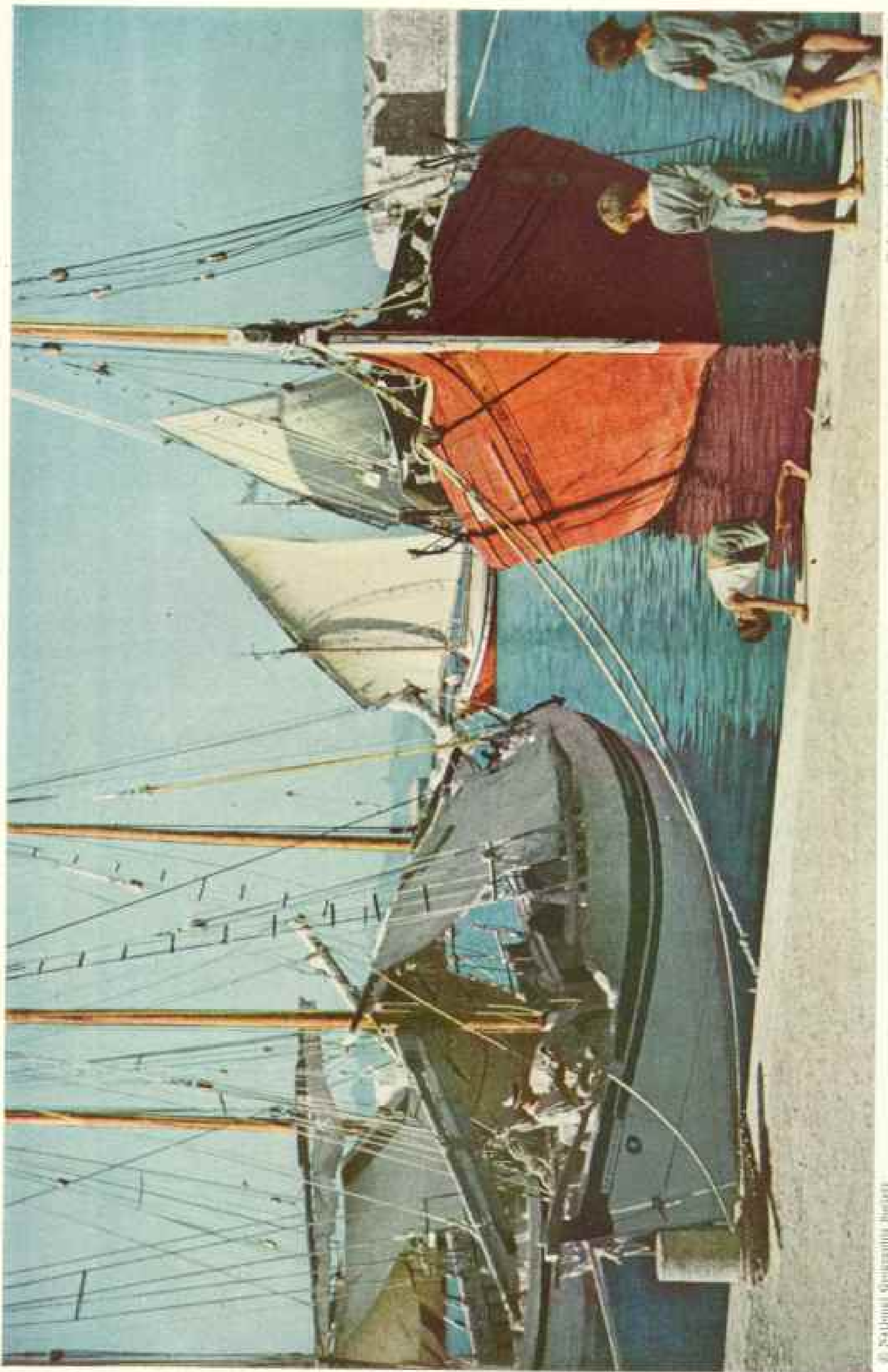
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**On Ténos, a Wonder-working Icon Has Taken the Place of Amphitrite, Goddess of the Sea**

Once Ténos was a haunt of Poseidon. Now, twice a year, the halt and the blind lie prostrate on the steps leading to the shrine of the Virgin. Between the May and August festivals, pilgrim houses on Ténos are thronged by beauty lovers, come to bathe in the clear sea.

Illustration by H. Arthur Bremer





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**Perhaps These Very Boats, Huddled at Cos, Helped Nazi Troops in Their Swift Invasions**

When Mussolini capitulated, British troops, as a strategic move, joined the Italian garrison on the neighboring island of Lero, a submarine base. Beginning November 12, 1943, Stukas based on Cos helped wrest Lero from Allied hands.

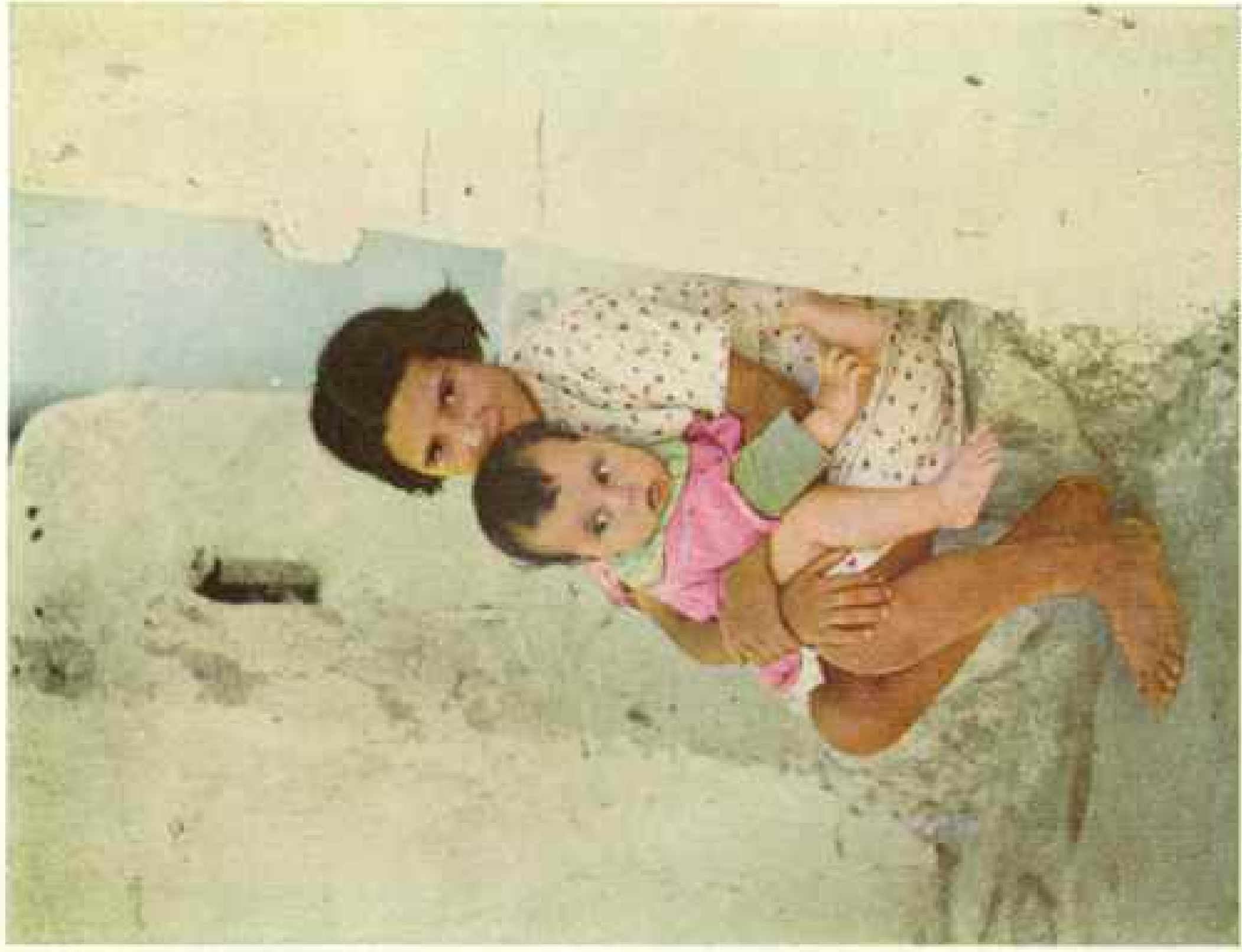
Illustration by Howard Chappell Williams



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**A Long, Cool Smoke at Cos**

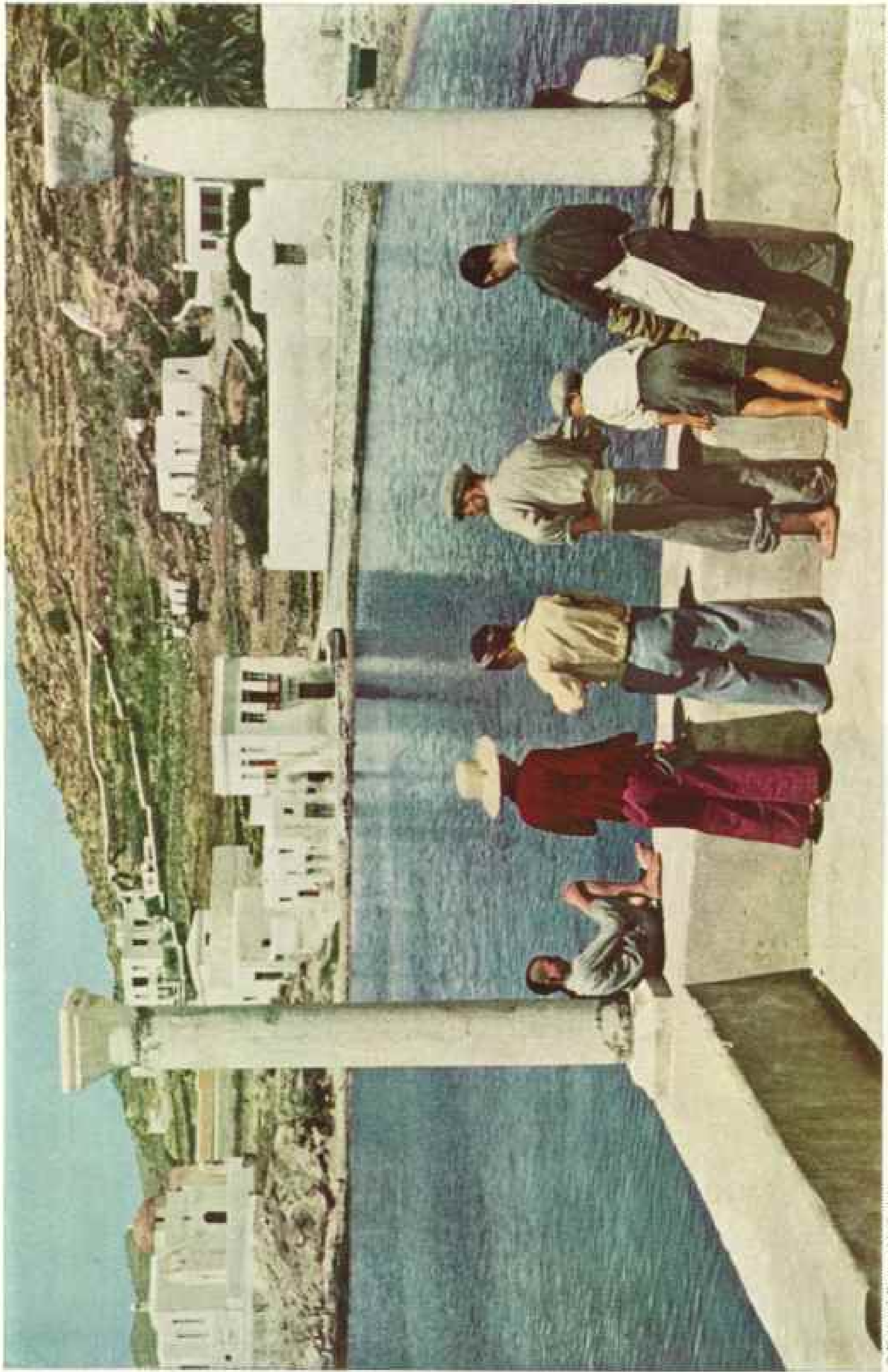
Seated just opposite the scene in Plate XII, this complacent islander sucks a water pipe, favorite of the Levantine.



Photograph by Margaret Helen White

**A Smiling Ward of St. Irene**

Seated in a niche at Thèrn, this young nursemaid smiled. Her little brother was afraid. Date: July 25, 1939.



© National Geographic Society

Redesigned by Margaret Owen Williams

**"Maybe He's Caught a Fish" Was News at the Cubist Town of Mykonos in the Cyclades**

On the restaurant terrace a visitor from Athens, wearing slacks, watches the simple life of the local fishermen. From here one may cross the narrow strait to "Little Delos," great in ancient times.



© National Geographic Society

Illustration by H. Anthony Brown

**Bread by the Armful at Santorin**

Mercy ships now carry food to starving Greece, where bread was almost a luxury a month before the war.

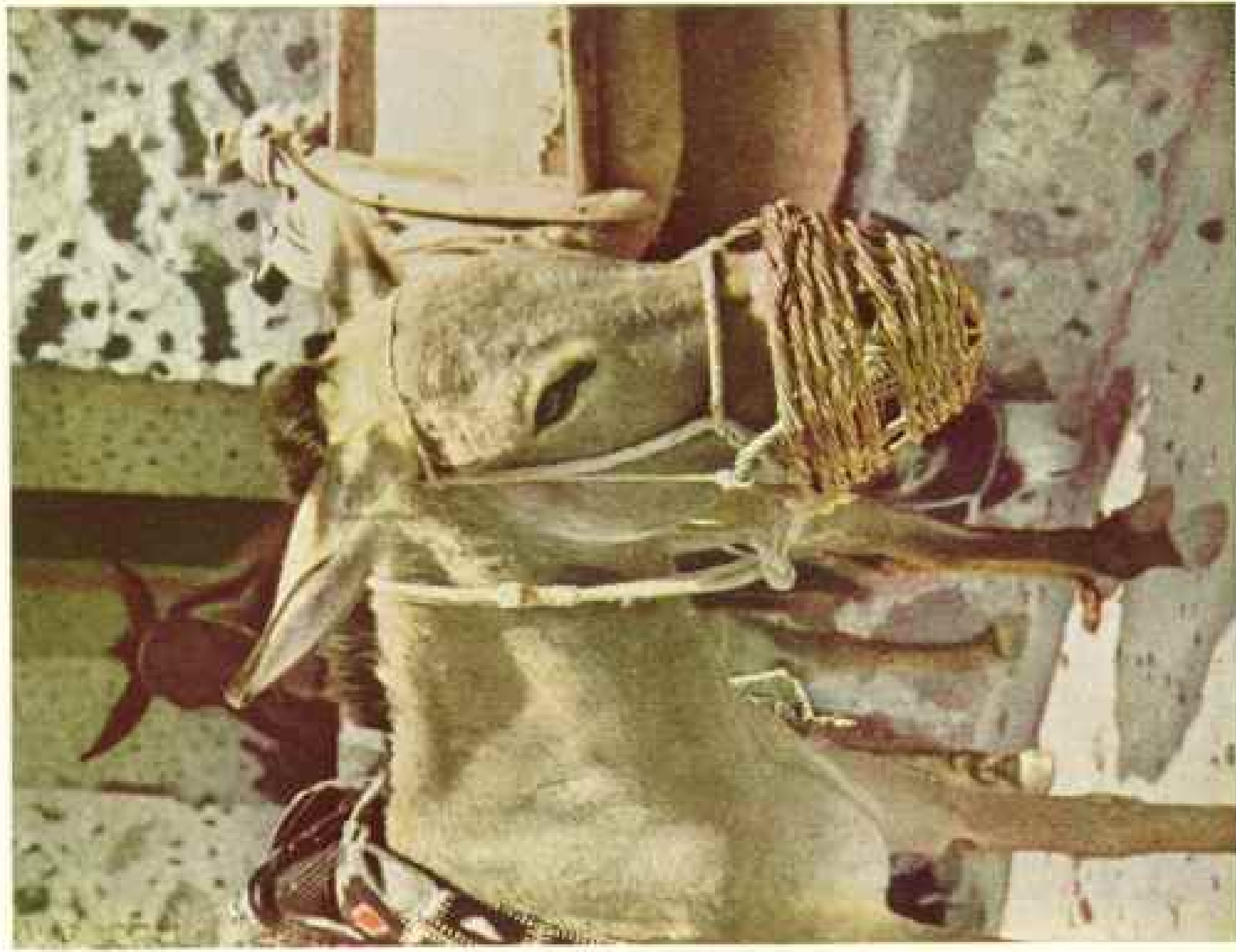


Illustration by Howard Ross, Williams

**This End, at Least, Is Safe**

Some visitors to Santorin are timid about these placid animals. The woven muzzle inspires calm while a colorful saddlecloth attracts custom.





**They Love to Ride the Ferry to Dēlos:**

Daughters of the boatmen between Mýkonos and Dēlos sold post cards and textiles to peacetime visitors.



© National Geographic Society

Redrawn by Margaret Owen Williams

**Life Is Earnest, Even at Tēnos**

Having won the race to the ship's ladder, the boatman has to back up for one more passenger. But when the ship sails on, peace reigns again at Tēnos, where the Madonna has a shrine and the wonder-working icon is attributed to the brush of St. Luke.

7 miles across and, save for two breaks in the surrounding rim, entirely landlocked, rise three volcanic islets. One is thought to go back to prehistoric times, when what was once a single great volcanic cone apparently erupted with terrific violence. It has been suggested that this may have occurred from 2,000 to 1,500 years before our era.

Strabo, the geographer, describes the eruption which occurred about 197 B.C. Other important eruptions are recorded A.D. 726, 1570-3, 1650, 1707-12, and finally in 1866-8. There have been lesser outbursts since, during which the islets in the center of the old crater hiss and steam.

Even near the shore, at the Skála, or landing place, the water is too deep for ships to anchor. Occasionally small craft take precarious hold of a narrow submarine shelf there. We made fast to a buoy and rowed ashore to the quay at the foot of the cliffs. In a small basin, fishing boats seemed to be imbedded in rock or gravel. Actually, the stony surface was a layer of floating pumice stone.

#### Santorin Famous for Its Wine

It is a long climb to the town, up numerous dizzy, hairpin turns. From the top we had a wonderful panoramic view over the water-filled crater of the old volcano, and, to the other side, looked off over the sloping lava-strewn fields which nourish some of the richest vineyards to be found in that region. Santorin is justly famous for its wine.

In some of the narrow streets, flying buttresses bolster up adjacent buildings. Other sections are entirely vaulted over to support a terrace above. From shadowy tunnels, lighted with wide bays, we looked out on the clear, blue expanse of the sun-drenched harbor, broken only by the sinister mass of the infernal islets.

All day we explored the odd corners of the town, and at last, worn out, limped down the long stone zigzag to the Skála and went aboard. Our captain moved the *Phloisbos* out to the lava islet and made fast to some stone bollards set there. Other captains sometimes anchor here until the sulphurous waters kill the barnacles and clean the hulls of their ships.

At evening we went ashore and walked over the barren black rock. This, in places, was almost too hot to touch, and everywhere there was a powerful stench of sulphur. There was no sign of any kind of life save for some weirdly croaking ravens which hovered around, looking for I know not what and talking an uncanny sort of language fit only for such birds of ill omen.

The rapidly falling night, black as the rock, silenced them, however, and then we actually missed hearing some sounds of life; even the cawing of the ravens was better than the dreadful stillness which might be interrupted any moment by subterranean fires, hissing their warning of another eruption.

Before breakfast we swam in unmixed currents of water, now hot, now cold, and sharply divided like fat and lean on a slice of bacon. The sun was reflected from millions of shiny, suspended particles in the water. It was like swimming at night in a phosphorescent sea.

Northwestward from Santorin we ran past Sikinos and the barren cliffs of Pholégandros, crowned by a row of windmills. Our next stop was Siphnos, famous in antiquity for its gold and silver mines. These mines were owned by the people of the island in common, and at the end of every year any surplus in the public treasury was divided among the citizens.

Two days later we sailed into the crowded harbor of the Piræus. About us were ships of all sorts and sizes, rusty tramps and tiny Greek steamers with imposing names.

I recall especially *Keravnos* (Thunder), a mild and ancient-looking tub, an ocean liner, a graceful steam yacht, and a former American warship with a basket mast.

The present war, strewing the Piræus with wrecked ships, laying desolate the peaceful Greek countryside, and dumping paratroopers and gliders on Crete, the island of Icarus, seemed impossible—then.

The present war has already ruined Greece far more than the last, but even after World War I there were a number of memorials to be found in strange places.

#### A Spot That "Is For Ever England"

Once in Skýros three of us came on a grave in a valley near the sea where "There's some corner of a foreign field that is for ever England."

Rupert Brooke wrote the lines, and a bronze figure has been erected to his memory in the town, some miles away (page 620).

We saw it on a bright December day at Christmastime, on a holiday visit to an artist friend who had married a girl from Skýros and had taken up his residence there.

Skýros is one of the most striking and unspoiled of all the Greek islands.

The cubical houses of the whitewashed town are piled up on the spur of a steep hill, and a climber obtains strange views as he looks down on the intricate pattern of flat-terraced roofs.

On each roof is a series of little hummocks



### So Fades "The Glory That Was Greece"

Carefully tooled marble slabs, blocks, and drums, once part of a classic Greek temple, go helter-skelter into the walls of a humble home on Páros. This island supplied the pure white marble from which the famous Venus de' Medici was carved.

arranged in neat rows, perhaps a dozen or more, depending on the size of the area. These are formed by small heaps of a bluish clay placed on the reed matting which forms the ceiling of the room below.

During the rainy season the clay washes down slowly and keeps the roof watertight. Usually at the corner of a terrace is a chimney, often made from a great reddish clay jar which gives a bright color accent to the white-washed walls.

Most of the stairs are on the outside of the houses and lead up directly from the narrow streets. To save space they twist and turn at strange angles. Sometimes they are cut away below so as to give room for people to

pass through the narrow lanes.

Flimsy balconies project from the second stories, their age-darkened beams standing out sharply from the white walls. Occasionally there is a bit of ornamental iron-work.

Inside, the ground floor of most of the houses is of trodden earth, neatly sanded, with a broad white-washed band making a border at the base of the walls.

The focal point of the room is the corner fireplace, with an elaborate rounded hood over it. Built onto the hood are shelves on which is often a display of old Turkish, delft, and majolica ware, or old, brightly polished copper vessels.

Some houses, especially the oldest ones, have a single room with a big ceiling, and, at the end, a wooden screen divided into two stages. Above is a gallery where the family sleeps. Below is a storeroom, or perhaps another sleeping alcove.

Two or three large clay *amphorae*, two-handed jars, rest snugly on wooden racks, cushioned with brushwood. They contain water, much of which has to be fetched up the long road from a fountain in the lower part of the town. It is a common sight to see a woman trudging up the narrow streets with a beautifully proportioned water jar balanced on her head. Cisterns also furnish a large part of the water supply.

### A Pipe of More Than Arm's Length

Our artist friend took us to the house of a relative. Royally entertained, we did our best to appreciate the rich collection of plates, jugs, copper bowls and dishes, and huge round copper trays which adorned the walls.

I was struck by the sight of a long, straight staff. This I took to be a cane of some wood that resembled rose-wood.

"What is that?" I asked.

"A pipe. Would you like to try it?"

A large clay bowl, about as big as my fist, was brought out, and also an amber, pear-shaped mouthpiece nearly an inch in diameter. The pipe was assembled and the bowl filled before I discovered that my arm was not nearly long enough to light it.

My host showed me how to take a coal from the fire with a special pair of brass tongs and lay it in the bowl.

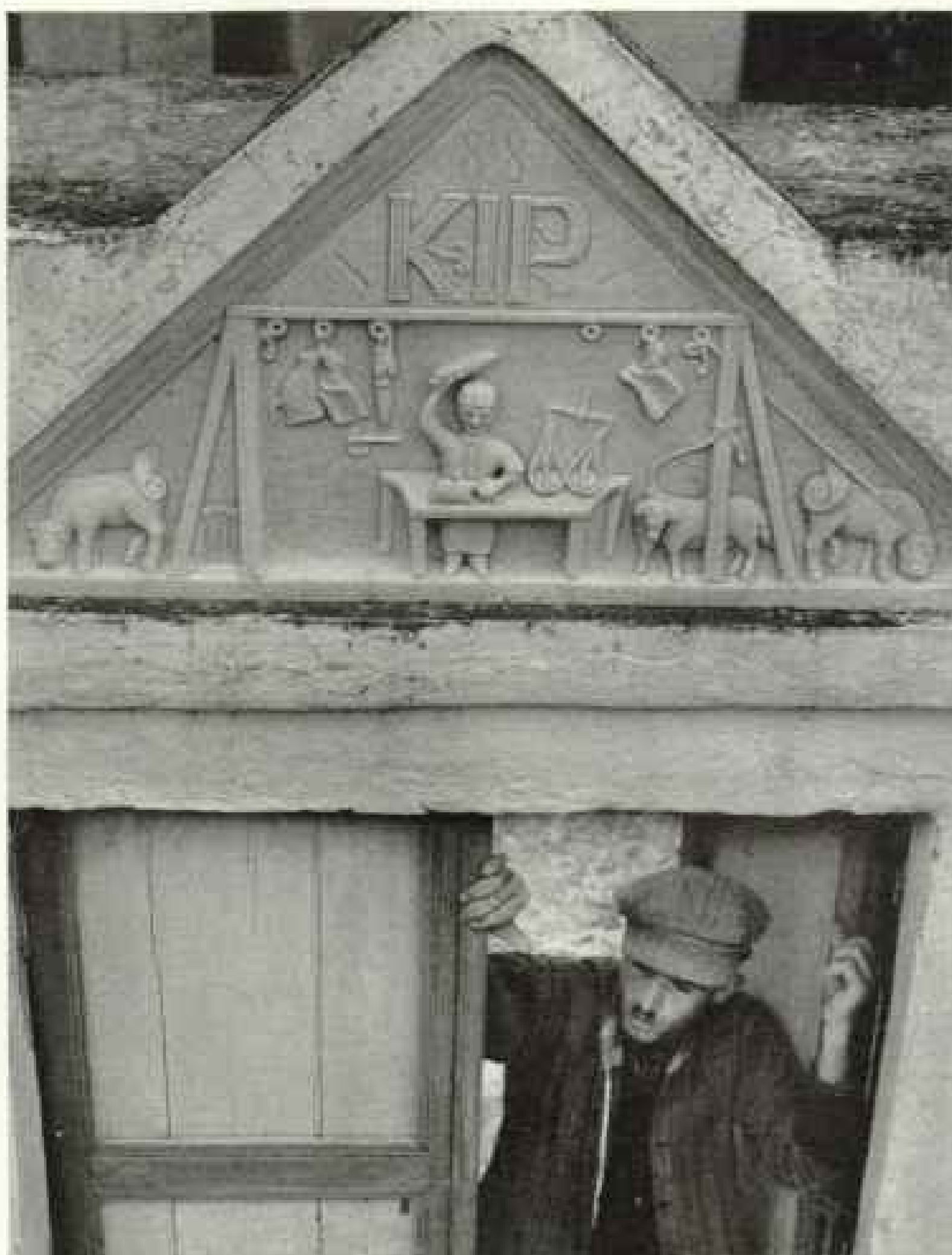
Then he gave me a small Skyriote chair, only about a foot high, and I sat and puffed away. In olden times only important people could smoke such a pipe, since the smoker had to have the constant services of a pipe boy.

That evening our host's wife told us blood-curdling stories of Nereids, apparently the name they gave to a sort of cross between a witch and a vampire.

"They always dig suspected people up after a year. If the flesh has left the bones, all is well; but if the body is still well preserved, then it is either that of a saint or a vampire and must be taken and laid in a church.

"Then," she continued, "if the flesh still has not left the bones by a certain length of time, the person is most certainly a vampire and must be buried face down, with a stake driven through the heart. Sometimes they scream and struggle."

As we sat near the fire and heard the wind rising outside, rattling the shutters and driving the waves against the cliffs far below the town, we felt as if we had



Staff Photographer H. Anthony Stewart

#### A Modern Greek Butcher-shop Frieze in Concrete

Villagers at Théra could not explain the KIP over the doorway to this walled courtyard, although a date showed it was built only 57 years ago. Probably the initials are those of the owner for whom the gateway was constructed. From within, visitors look down into the drowned crater of the volcanic island.

reached a remote part of the world indeed.

Skýros produces, among other things, some excellent goat's-milk cheese of a particularly strong variety. We had some and enjoyed it, but when we learned that the cheeses were ripened by being buried beneath the cobbled gutter which runs down the middle of every small alley of the town, our appetite lost its keen edge.

There were large flocks of goats on the island, and we learned of a curious custom observed at carnival time.

"Some of the young men dress themselves in goatskins, make a mask from the skin of a black and white kid, and then come dancing into town. They sling all the available goat

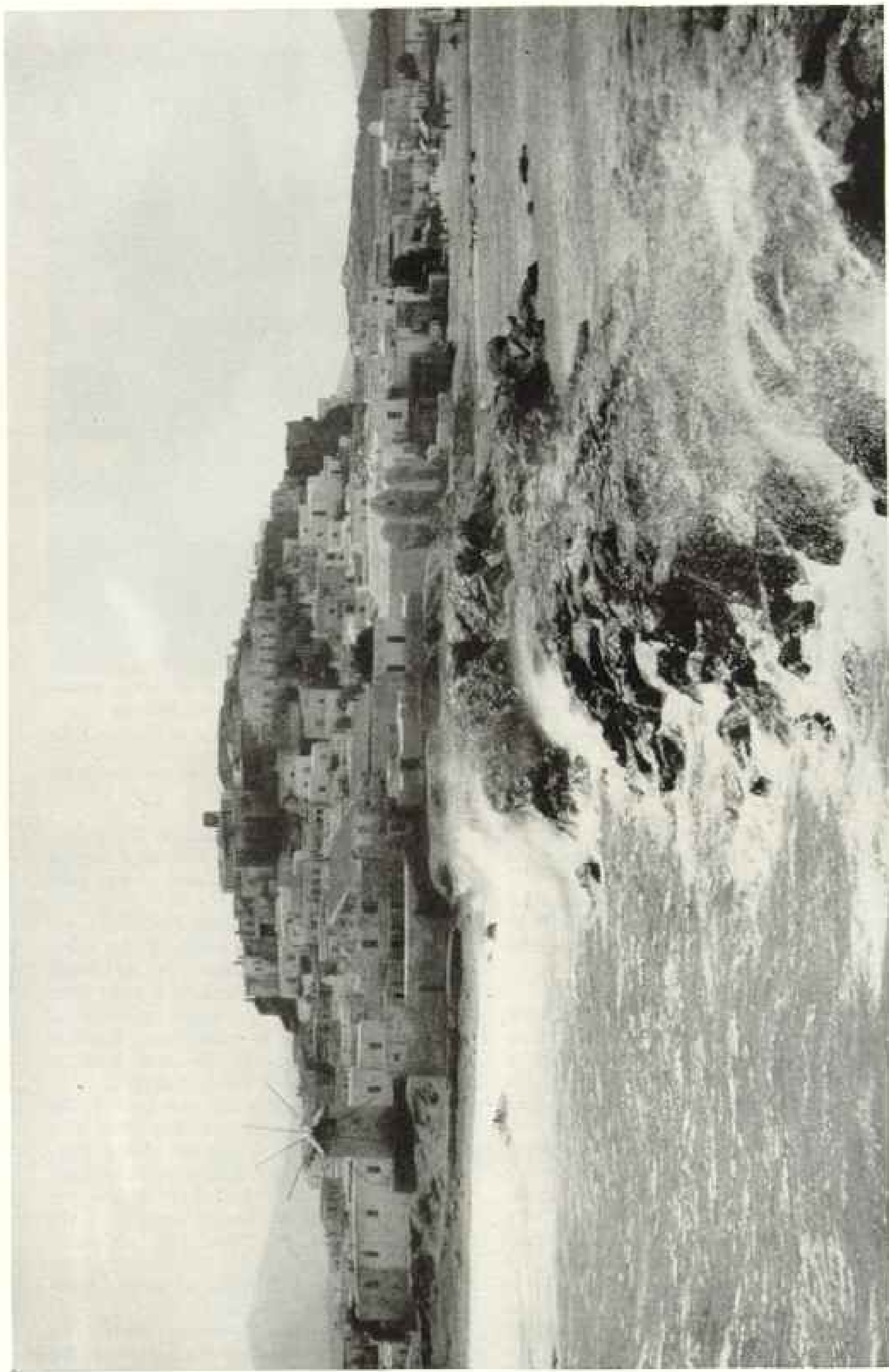




**Like a Glittering Waterfall, Skýros Spreads Wide Below a Crumbling Acropolis**

Near the top of the cubist town is a monument to Rupert Brooke, young English poet and naval officer who died on Skýros in 1915. Shortly before his death he wrote the war poem, "1914," describing his grave as destined to contain a "richer dust . . . that is for ever England." He is buried in the near-by hills.

Staff Photographer Malcolm Green, Williams



B. P. Macdonald

**Largest and Best-watered Island of the Cyclades, Fertile Naxos Exports Fruits, Grain, and Wine**

Famed for their historic importance and barren beauty, few of the Aegean islands produce an excess of food. Harbor works here were completed shortly before the war. Near the top of Naxos, the capital, are centuries-old Catholic schools, from whose high terraces there are impressive views over the island-studded Aegean.



Gift Photographer Margaret Owen Williams

#### Demetrios Yialouris, Retired Los Angeles Businessman, Returned to Skýros

His four admiring sisters spent hours putting on the old silk gowns, festival costume of the island, for this photograph. After being sunned and aired, the dresses will go back into an old chest, decorated with medieval troubadours, to await another special occasion. Yialouris wears shepherd's attire, and sandals cut from old tire treads.

bells about them. Then the people chase them about and finally drive them away from the village."

It may be that the custom originated as a means of keeping off the forces of evil by driving away a representation of the demons.

#### A Wailing Procession at the Cemetery

One windy day I went out to visit the local cemetery. As we stood there, a wailing procession came down the winding road. Most of the mourners were women, dressed in the voluminous blue skirts and red or brown shawls of everyday wear. Their holiday costume, far more elaborate, is very beautiful.

As they reached the cemetery, the whole group scattered, each going to some particular grave and putting up piercing howls. It took the priest some time to gather his flock again and assemble them around the grave for which the procession had been headed.

I shall not easily forget the effect of the colored garments of the mourners scattered among the whitewashed tombs, with the sugar-pile town rising up behind them and a few

funereal cypresses leaning under the strong wind. Later on, the artist painted a picture of the scene, and it is now one of my most prized possessions.

We passed a week visiting the island, exploring the little crooked alleys of the town, photographing, and sketching. Also we bought things: brightly striped blankets, a great four-foot copper tray, and a curiously carved small chair or two. When we finally went down to the little harbor to take the boat back to Euboea, we were laden down with spoil.

It was only a three hours' run back to the mainland, but we made it in the teeth of a near gale, and our little steamer rolled scuppers under. We were a disheveled crew when we disembarked, and must have looked not unlike a native party moving away from the island, laden as we were with obviously Skyriote furniture.

A fellow passenger hailed us at the landing. "Are you compatriots?"

Full of happy island memories, we felt it a compliment to be mistaken for natives of the glorious isles of Greece.

# Ascension Island, an Engineering Victory

BY LT. COL. FREDERICK J. CLARKE

*Former Commanding Officer, 1st Battalion, 38th Engineer Combat Regiment*

**Y**OU couldn't blame the birds for not leaving. There was no other place to go.

Pilots who sang, "If we don't hit Ascension, my wife gets a pension," were having their own little joke. They had been briefed with the assurance, "You'll find it. Can't miss it—ain't nothing else nowhere near it."

So the birds stayed. The first regimental formation on April 28, 1942, named the incipient airfield in their honor, "Wideawake Field." And when the war hawks came riding in on the Ascension Island beam, the wideawakes (sooty terns) added their noisy cries to the roar of the planes headed for Africa and combat (page 639).\*

This tiny speck of volcanic lava, 6 miles wide and about 9 miles long, astride certain shipping lanes from the Americas to England and Africa, was vital to the success of Allied strategy in those days of Axis victories.† Few of our long-range bombers could carry a payload of much-needed supplies from Natal to West Africa unless there was a refueling station somewhere along the route.

The American chapter of Ascension Island's volcanic history began on an early spring afternoon in 1942, when out of the South Atlantic its towering profile broke on the sight of an Army task force (pages 626 and 631). The mission of the task force was to construct an airfield on the plane-transport route from Brazil to Africa.

"Build an airfield on a volcano? Impracticable, if not impossible," the Americans had been told. But a preliminary survey showed they could. And they did. On July 10, less than three months after the first piece of equipment dug into the rock, a U. S. plane sat down on a runway more than a mile long.

## United States Engineers Vie with Volcano in Earth Moving

From that time on, the wideawakes had to share their roost. Three hundred and eighty thousand cubic yards of rock and ash were to be cut from the mountain hump in the biggest job of earth moving since the volcanoes themselves lifted Ascension out of the sea (page 636).

\* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Sindbads of Science," by George Finlay Simmonds, July, 1927, and "At Home on the Oceans," by Edith Bauer Strout, July, 1939.

† See Atlantic Ocean Map Supplement, NATIONAL GEOGRAPHIC MAGAZINE, September, 1941.

United States Army Engineers have seldom taken on a more difficult assignment.

The one bright spot on Ascension was Green Mountain, where a patch of tropical vegetation hung in a lofty bowl (page 628). The rest of the island was made up of numerous volcanic hills. Large, thickly scattered rocks everywhere prohibited the passage of vehicles and made even walking difficult.

The only two settlements on the dun-colored island were Georgetown, where the offices and employees' homes of a British cable company were located, and the patch on Green Mountain, where fruit and vegetables were raised for Georgetown's families (page 635).

There were no natives. The servants for the British families came from Napoleon's island of St. Helena, eight hundred miles away. But with planes needed desperately at Suez, Ascension's rust-cindered isolation halfway between South America and Africa suddenly became explosive in importance.

Temporary lighting systems rigged up by the Engineer soldiers to allow for night-and-day unloading and round-the-clock construction were shielded so that they could not be seen from the sea. The building of the airfield was to be one of the war's best-kept secrets.

Unloading was the first big job. Huge rollers, sweeping in from sea at unpredictable times, raised the water level as much as 3 to 10½ feet in a powerful surge of waves (page 633). This made it difficult to tie lighter barges to the one small pier.

On one occasion, while the pier's steam boiler was under repair, three of the Engineer air compressors were connected to the winch and used to power the loading booms.

With the only fresh-water sources needed by the permanent residents, the Engineers set up sea-water distillation units to provide their drinking water (page 624).

Mess halls and kitchens at first were sited near the ocean; and the shower baths installed later were salt-water showers. Soldiers washed their mess kits and kitchen pots in the ocean—a quick but wet expedient, since the waves 50 feet away at one moment were waist-deep the next.

The runway was the highest priority project. A fortnight after the landfall had been made, three miles of road, built by hand, stretched up the hillsides to the airport site. Only one site was possible, across a saddle between two of the hills.





U. S. Army Air Force, Official

### He'll Wash His Face in Distilled Sea Water

Spring and reservoir on Ascension Island provide just enough water for British cable company employees and their families; so United States Army Engineers installed distillation units and built their own water tanks to assure an adequate supply for American forces. At right, the island's "house rules" are posted for the constant stream of stopover Air Transport Command pilots.

Because the prevailing wind never varied more than a few degrees and blew almost constantly, only one runway was needed.

Time was so pressing that the completed landing strip was left with a slight hump in it. More precious weeks would have been consumed in digging out enough volcanic rock to make it absolutely level.

Incoming pilots, looking down at the sea, hugged the hump, so as not to overrun it, like a cat looking for a place to put its feet down.

#### Bulldozer Springs Broke Like Toothpicks

Mechanics and drivers of the bulldozers literally "lifted themselves by their bootstraps." The rock was so large and hard to handle that front springs broke like toothpicks; so cables were rigged over the top of each machine, attached to the rear end, and the front of the bulldozers would be suspended to cushion the constant and terrific shock.

Truck drivers and mechanics worked overtime to change the big dual-wheel jobs over to front-wheel drive, with the axle assembly in front of the motor and driver. Testimony to the success and judgment of these men is revealed in the record of the trucks, the average haul per day per truck being 36.2 miles.

Racing against time (the first contingent of planes was to set down by mid-July), the Engineers began fine grading and surfacing of the roads, runway, and taxiways late in May.

Paving this field close to the Equator required a mix made with volcanic ash and rock instead of the usual sand and stone, unavailable here.

Large quantities of water had to be used—and water had to be hauled four miles by truck. There was only one water tank-truck available, and its absolute 12-trip maximum capacity was 16,800 gallons a day.

Faced with this dilemma, drivers and me-



U. S. Army Air Force, Official

### Last Night—Africa; Tonight—Ascension; Tomorrow Night—America!

Air Transport Command crews and passengers, landing on the island steppingstone, check in at Charge of Quarters tent for assignment to sleeping quarters. Ground crews took over their plane on arrival for checking and refueling.

chanics set to work to supply the balance of the 60,000 gallons needed daily. Three ponton sections, used in the landing operations, were brought up from the beaches, placed in trucks, and assigned to 24-hour service alongside the one already working. Within two days, these Engineers were furnishing all the water needed, for each one of the sections was capable of hauling 1,200 gallons a trip.

Next biggest project on the priority list was the tank farm, for the military value of Ascension Island lay in serving as a refueling point on the bombers' jump across the South Atlantic.

The layout for the tank farm had to be located in detail immediately before landing the equipment, and the unloading of all materials had to be spotted the first time in order to save rehandling of the large amount of sheet steel and bulky pipe. The rough terrain surrounded by volcanoes was excellent for camouflage but not the easiest of sites to work in.

The tank farm was raised so quickly that many of the soldiers could not believe the miracle had taken place.

The lieutenant in charge of its construction explained: "The tubs came in knocked down, 6 rings to a tub. Having 8 tanks and 48 rings, we named each of the rings after one of the 48 States. We put Alabama on the bottom of the first tank, went up with Arizona, Arkansas, California, Colorado, and topped it off with Connecticut. The second one started with Delaware, the third with Iowa, and so on, until when we got Wyoming in place and welded, the field was complete."

### Camouflage Confuses Even Truck Drivers

The camouflage of the tank farm was elaborate. Each tank was surrounded by a fire wall built to a height of 25 feet. The truck drivers had to be a bit wide-awake themselves as they dumped rock and cinders on top of the narrow rim of the walls.



Ascension Island, Halfway Across the Atlantic—"Ain't Nothing Else Nowhere Near It"

That's what Air Transport Command pilots hear when they set off for this land speck in mid-ocean between South America and Africa (page 623). On this British possession, 34 square miles in area, U. S. Army Engineers carved a landing field and refueling station out of volcanic rock.

Air Transport Command, (07004)



U. S. Army Air Force, official

### Army Engineers Try Egg Hunting on the Ascension Island Nesting Plain of the Sooty Tern

Wideawakes' eggs have been eaten by islanders on many South Atlantic breeding grounds for years, but so far as the American soldiers were concerned, they were not edible. If an egg is taken while it is fresh, the bird will lay another. Ascension's wideawakes nest facing southeast, heading into the trade winds.





© Reuters News Agency

### Down the Sides of Green Mountain, Pipes Carry Water into a Storage Tank

Dampier's Springs, which have gone dry, were Ascension's only source of fresh water aside from rainfall. The springs are named after William Dampier, famous British navigator, whose ship foundered off the island in February, 1701, on the way from Timor to England. With his crew he reached shore safely. Six weeks later an East Indiaman picked them up.

The camouflage work was performed with the same care used in shielding construction lights from the sea. The aim was not only to build an airfield on a volcano but to do it without disturbing the appearance of the island. One bomb-storage building was so well camouflaged that it was invisible from the air.

The wideawakes served as "stooges" for us in this work. The Engineers went on the theory that if their camouflage fooled the birds by its natural appearance, then it would fool enemy aviators, too.

Camouflage or no camouflage, the birds continued to rule Ascension. One connecting road built between certain installations was dubbed "Wideawake Road," since it was a favorite nesting place for the birds.

There is a story that, in despair at trying to shoo the birds off one end of the runway, the Engineers imported some cats to prey on the birds. The wideawakes, so the yarn goes,

contentedly ate the cats! This fanciful tale grew out of a misinterpretation of Engineer terminology. When the Engineers reported that they brought "cats" to the island, they were talking about their own "caterpillar tractors."

Countless tons of guano, accumulations of centuries, testify to the popularity of Ascension with the wideawakes. Rock clusters are white-topped with the wind-scattered and rain-driven deposits, left by huge colonies of the birds. Boobies and man-o'-war-birds also come to the island, but in smaller numbers.

All heavy equipment, whether on the runway or on the roads, was worked 22 to 24 hours a day, and serviced during mealtime while the men ate on the job. The track treads of the tractors were broken so often by the rock crust that they appeared to be fabricated completely from welding rods.

Perhaps the Engineers' impatience helped



© Eastwire News Agency

**Green Mountain's "Waterworks"—Concrete Catchment and Reservoir**

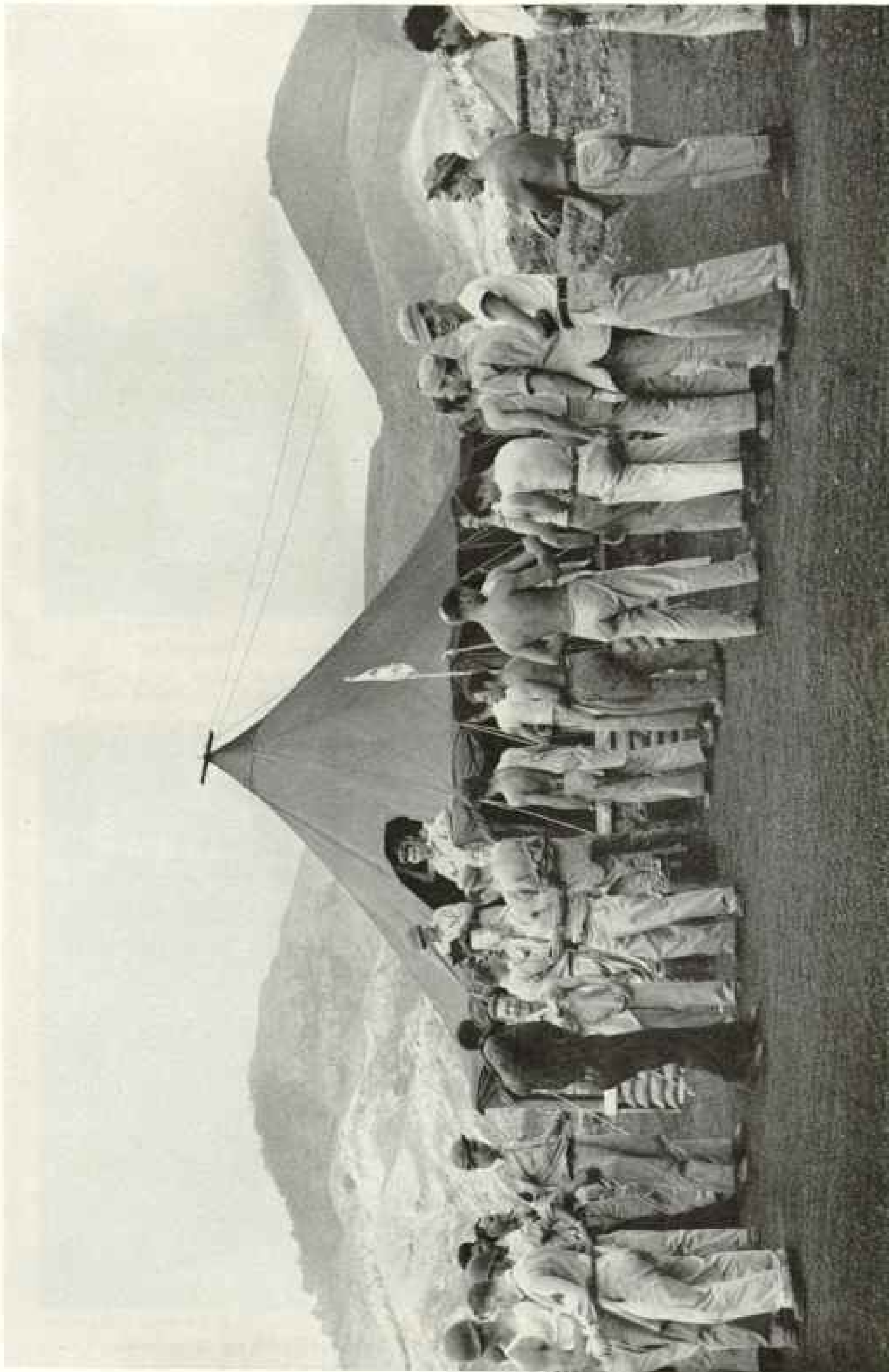
Rainfall is hoarded to supply water for Ascension's farm (page 635), and to be piped down to Georgetown, on the coast (page 632). This project was completed many years ago by the British Navy.



U. S. Army Air Force, Official

**Salt Water Is Good Enough for Laundry and Shower Baths on Ascension**

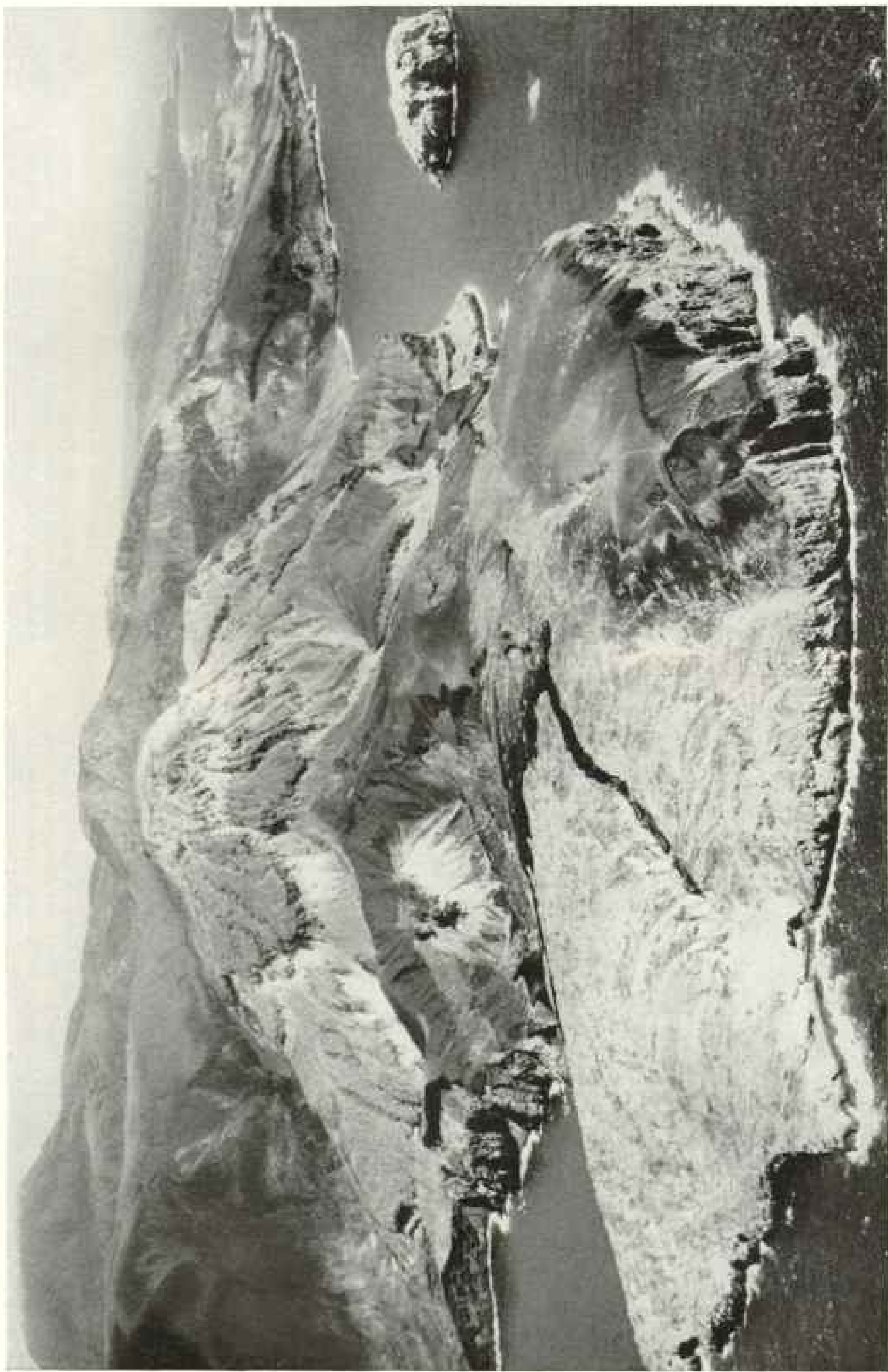
Distilled water is reserved for drinking, cooking, and washing hands and faces. Rainfall on the mountain slopes averages only 20 inches a year; most of it comes in March and April (page 624).



Air Transport Command Official

### Even on Healthful Ascension Island, Soldiers Must Have Immunization Shots

The Army takes no chances, although the only hospital cases recorded by the Engineers who built the island airfield were men with stubbed toes and mashed fingers. Only ailments were told imported from the mainland. Ascension lies due east of Pernambuco, Brazil, and is in the path of the trade winds.

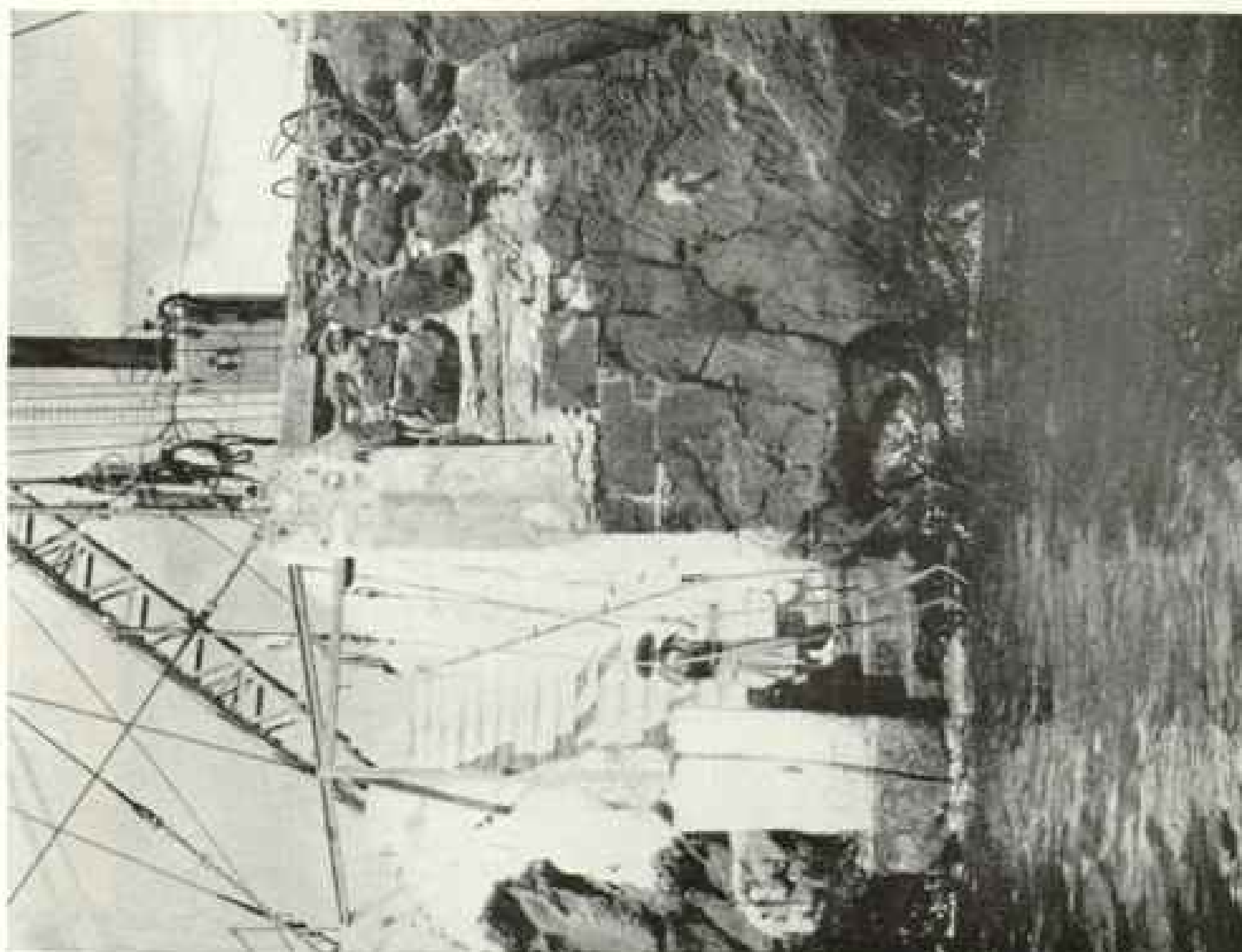


Air Transport Unlimited, Official

Here's What Air Transport Pilots See When They Swoop Down on Volcanic Ascension Island from the North

Steep ravines, lined with masses of barren lava, and in small bays. Highest point on the island is Green Mountain, a huge elliptical crater, 2,817 feet above sea level. Tops of some of the hills are covered with sparse vegetation.





**Low Water at Georgetown Landing**

When a small boat pulls alongside, passengers swing themselves up on the steps by the rope. At normal high tide, the water rises three or four steps. When the rollers come in (page 633), the sea break over the top of the jetty. Ships anchor in Clarence Bay and put passengers and freight ashore in lighters.



**He Died in the Service of "H.M.S. Ascension"**

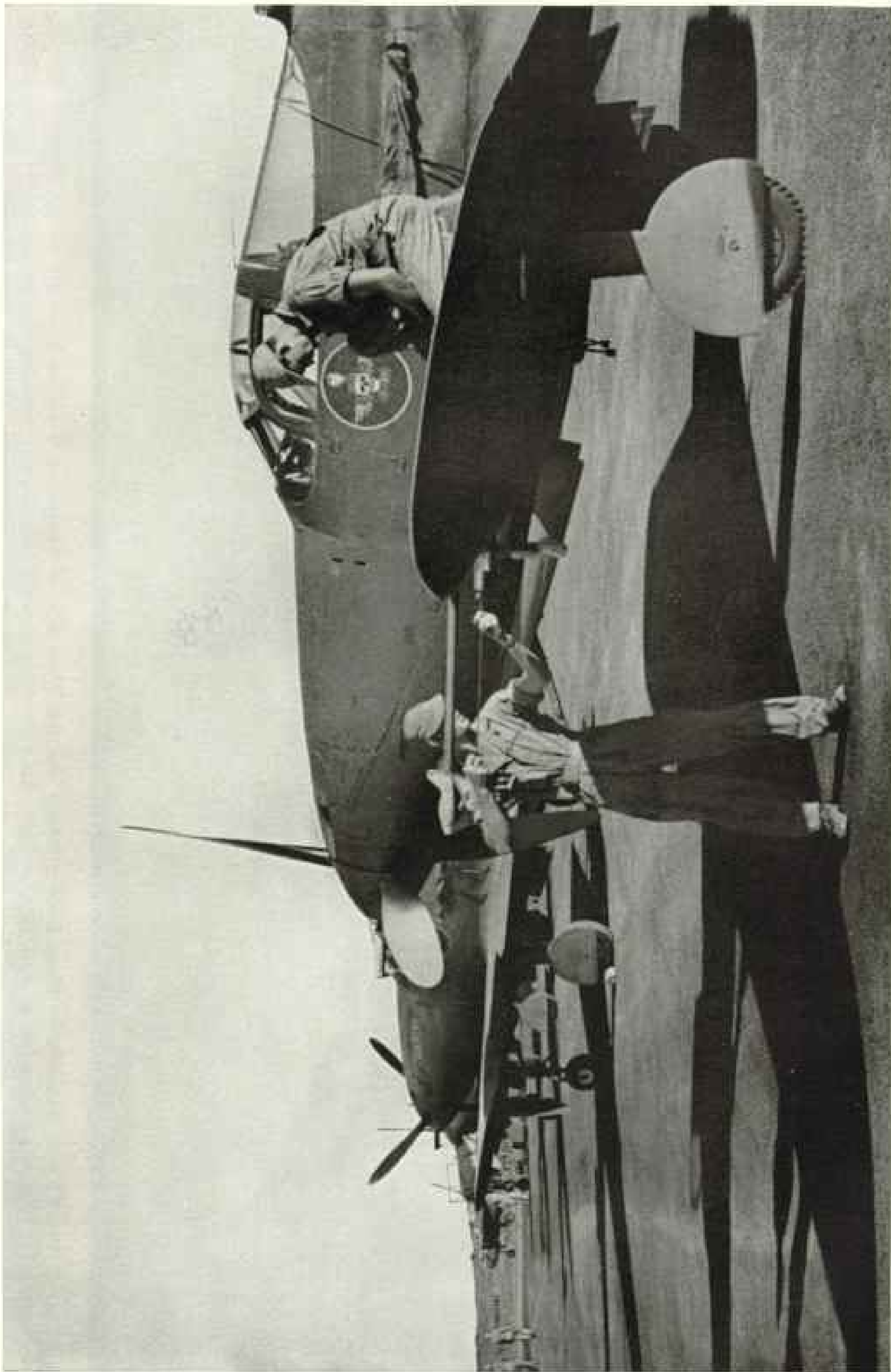
When under British Navy control, the island was classed as a ship and administration was strictly nautical (page 640). The seaman named on this marker was a Krooman, or Krumat, member of a Liberian tribe of Negroes. Many of these tribesmen are found in crews of European vessels.



Air Lieutenant Dammasch, Official

**About Every Two Weeks Huge Rollers Sweep into the West Side of Ascension, Breaking Violently on the Shore.**

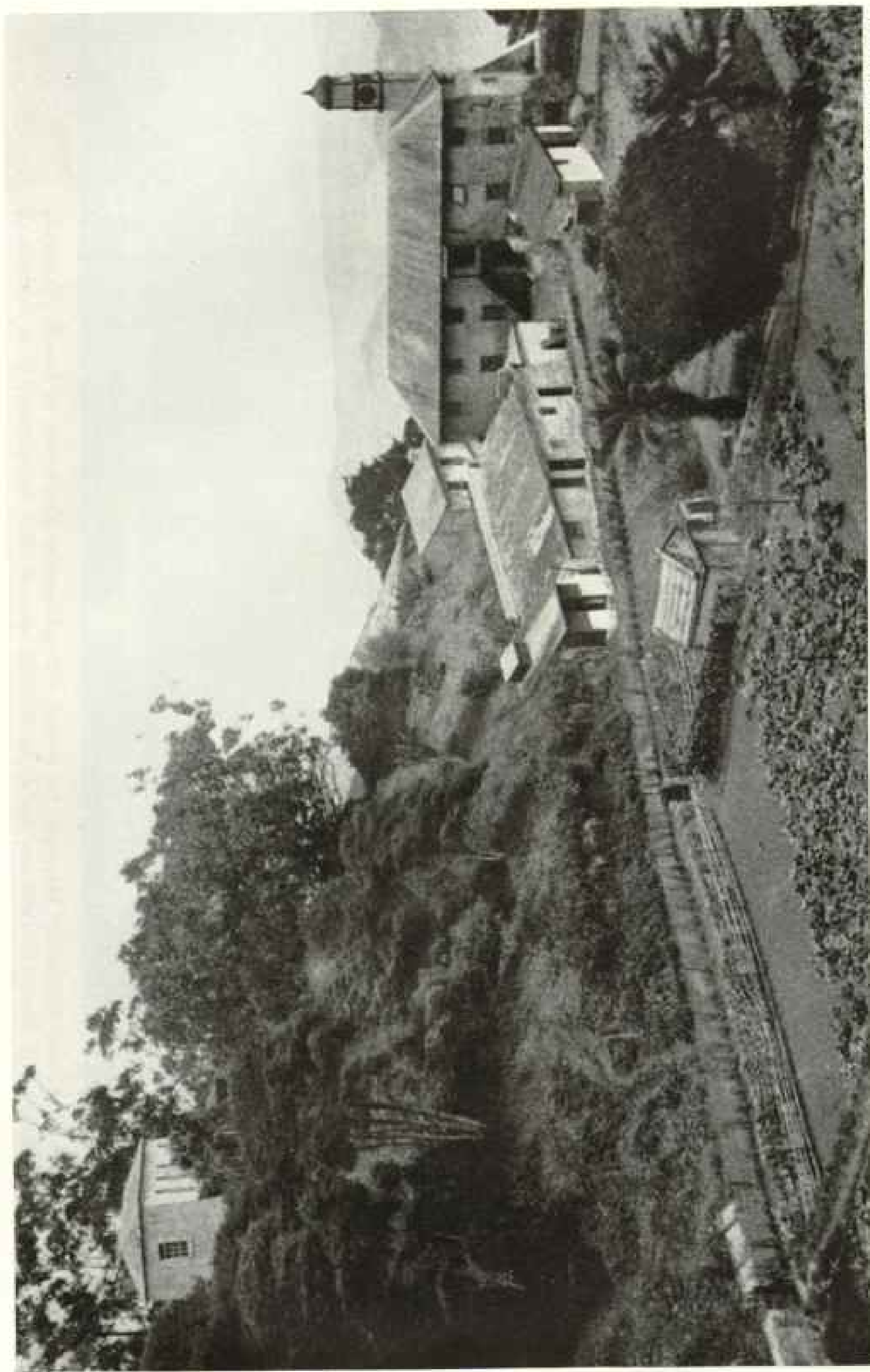
Sometimes they build up a rushing wall of water 10½ feet high. Often the rollers disrupted Army Engineers' unloading schedules, since the exact time of their approach is unpredictable. Georgetown, home of British cable company employees and their families and servants lies along the coast at the right.



Air Transport Command. Official

### Mechanics Overhaul a P-39 During Its Brief Stopover on Ascension Island

Fighter planes could not fly overseas and bombers could not carry capacity loads from Natal, Brazil, to West Africa, without a refueling base en route. That is why Army Engineers built this modern airfield "on a volcano" in three months—a feat considered little short of impossible (page 623).

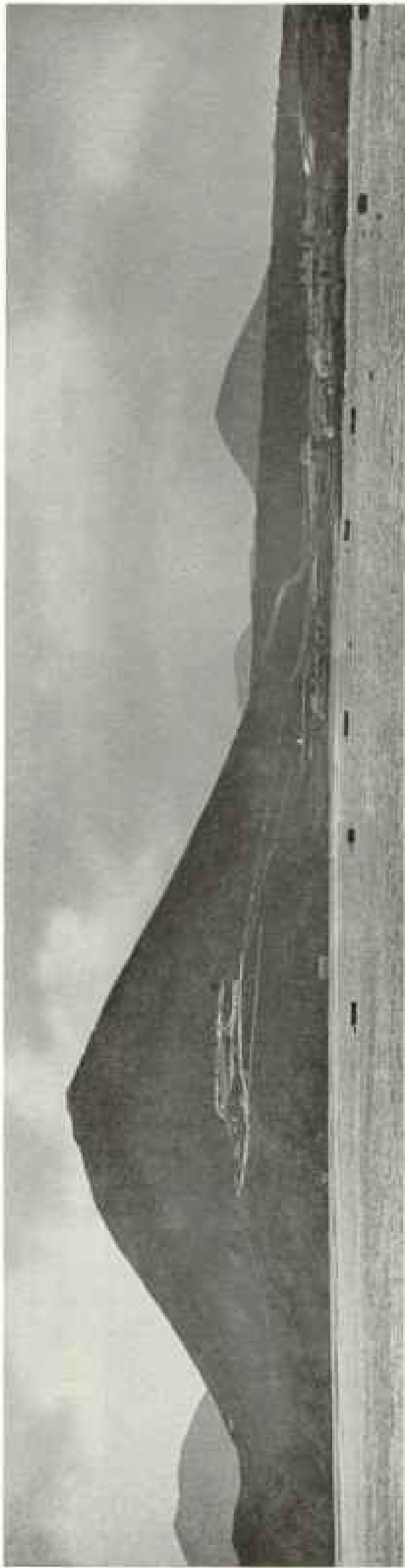


© Dorothy Stone Aurnby

**Oasis in the Laval Red Lion, Island Farm on Green Mountain, Is a Patch of Green Surrounded by Volcanic Cinders**

Here vegetables grow to supply Ascension's permanent residents. A few cows furnish milk and butter, but their fodder must be brought from South Africa. Here the islanders also maintain a reserve herd of sheep, for use when supply ships are kept away by storms for protracted periods. Two members of the National Geographic Society have lived on this isolated island for years.

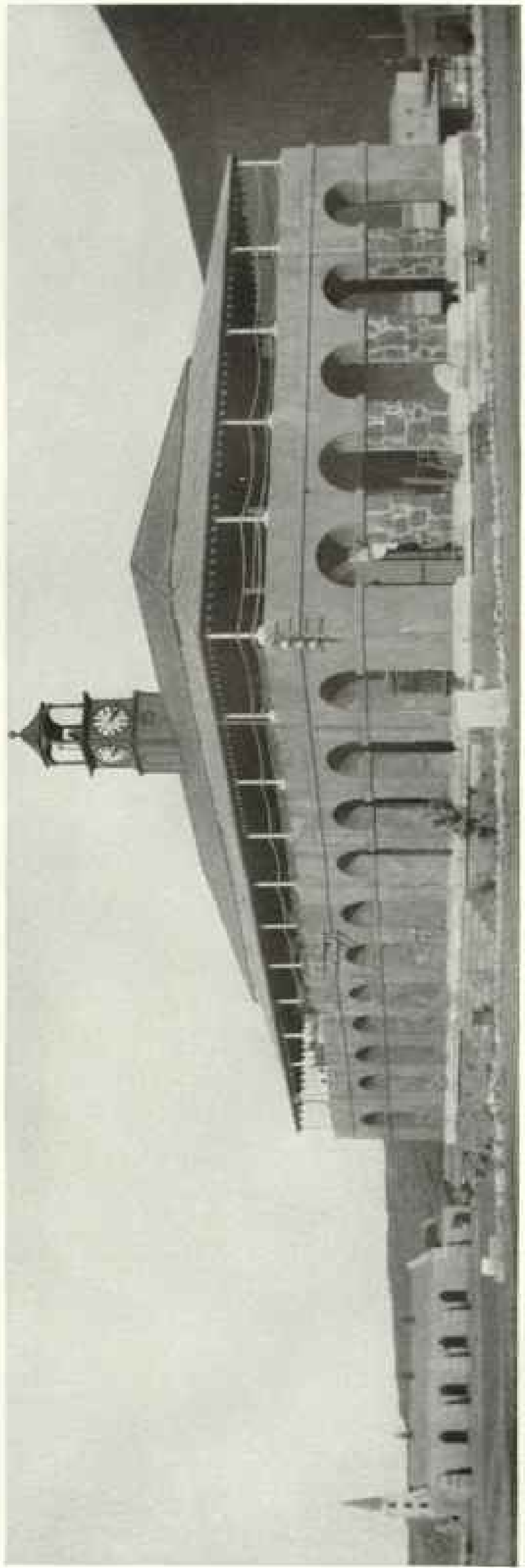




W. T. Lorraine

**Forty Cones of Extinct Volcanoes Dot Ascension Island, Proof of a Former Upheaval in the South Atlantic**

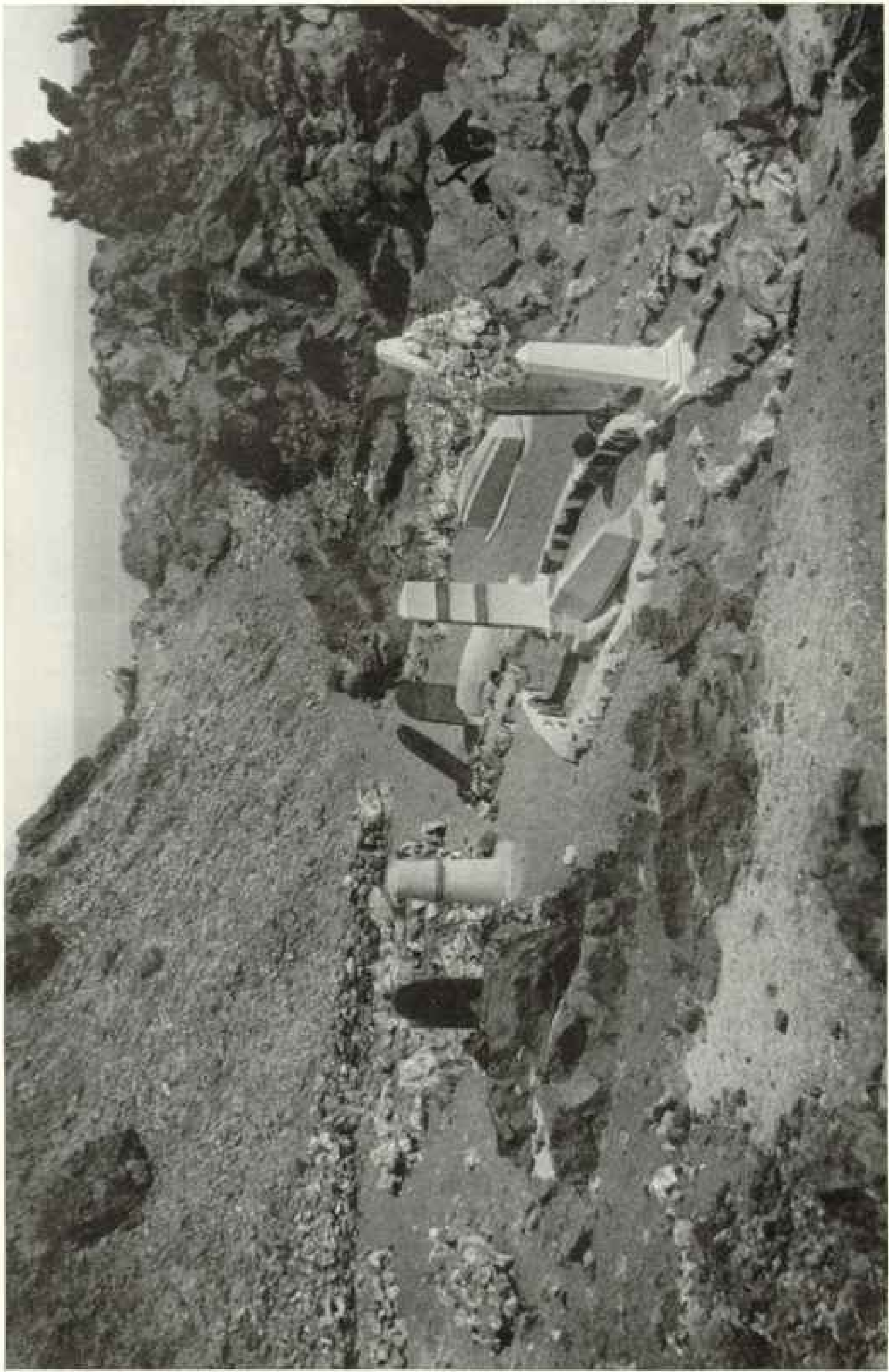
Landmark on the slope of the hill in center is Redpole Monument, a white obelisk 15 feet high. Georgetown at right.



© Exclusive News Agency

**This Clubhouse Breaks the Monotony for British Cable Company Employees on Lonely Ascension**

Normal population is about 200. Cable men sign up for three-year tours of duty. In background is the settlement church.



© Easton News Agency

### In Comfortless Cove Old Memorials Recall a Century-old Yellow Fever Epidemic

The small marble shaft at right marks the grave of a United States sailor. He was a member of the crew of the famous frigate, U.S.S. *Constellation*, commanded by Capt. Thomas Truxtun, which fought historic battles with the French frigates *Jaurguette* and *Vengeance* in 1799 and 1800.



H. K. Tracy, Official

**Admiral J. H. Ingram (right) and the Commanding Officer Inspect Progress**

Col. Robert E. Coughlin commanded the 38th U. S. Army Engineers, which built the mid-ocean refueling base for the Air Transport Command in record-breaking time (page 623).



H. K. Tracy

**British Soldiers Dug This Old Tunnel to Link Island Fields**

They stand on Green Mountain, highest summit, which once was barren but finally was covered with vegetation after a hundred-year struggle by Englishmen on duty on Ascension. More rain falls on the mountains than in the ravines and valleys, which still are bare rock.



U. S. Army Air Forces, Official

### A Man-made Bird Bores Its Way Through Myriad Wideawakes Over Ascension

When this U. S. Army Air Forces plane lands, it will scare up another winged cloud on the field runway. Army Engineers christened the landing field "Wideawake" in honor of the birds, known more officially as sooty terns. They nest on the island by the thousands. The soldiers have resorted to many ingenious devices to shoo them off installations, but have been only partially successful.

prompt the big blow of May 19 when 14 tons of high explosives were set off in 17 tunnels bored in the runway cut. The tremendous "fire in the hole" threw 50-pound rocks for over a mile, and the construction camp area suffered from the falling debris. But the wideawakes stayed on.

Altogether, in addition to the more than 380,000 cubic yards of rock removed from the cut, more than a quarter-million cubic yards were placed in fill, 165,000 yards of rock were blasted in excavation work, and the Engineers used 13,000 blasting caps and 35½ tons of high explosives before they had finished.

Some tall and fancy figuring went on in the carpenter shop.

Building material had been restricted in the original shipment to Ascension, and when it was found that more installations were needed than the plans called for, makeshift designs were born.

The magistrate of the island was prevailed upon to allow the wrecking and salvaging of an old fertilizer plant. A few days later, when he was inspecting some of the newer installations, he was surprised to hear that three of the buildings had been made from the badly dilapidated sheds that he had thought "utterly useless."

### Sandbags Face Bomber Revetments

Taxiways leading from dispersed revetments to the runway, and truck roads linking all the military installations on the island, were among the last "big" jobs to be completed. One taxiway was designed as an emergency runway for fighter planes. Revetments for the big bombers were "faced" with as many as 37,000 sandbags per bunker.

On slopes varying in grade from 75 degrees to vertical, soldiers hammered and blasted a road around the skin of a cold volcano.





R. J. STONE

### Cannon of Queen Victoria's Day Still Point Seaward

For many years Ascension was governed by the British Navy and attempts were made to colonize it. In 1922 its administration was turned over to the company which operates the cable relay station. The island has direct cable connections with Sierra Leone, Rio de Janeiro and La Plata; connections with Capetown via St. Helena, and with England via the Cape Verde Islands.

Grader men and bulldozer operators stood up on their machines, ready to jump at a moment's notice.

In one particular mile, 18 inside turns were drilled on the face of the mountain.

Weather on the mountain was often foggy and rainy, causing the red volcanic earth to loosen and slide. One man was detailed to watch the outer track of the bulldozer working around one curve so that it wouldn't "go over the edge too far." The road was later named "Reecer Road" in honor of the dozer driver.

### Laying the "Little Inch"

Probably the most exciting day of the entire venture for the men of the 38th Engineers was the 16-hour shift when the regiment laid the sea line from the tank field to the tanker buoy. The "Little Inch" had been assembled in a snake hundreds of feet long. Floats and buoys had been laid out for this task.

When the volunteers who were going to get the line "down under" were stationed at their posts, and the expert riflemen in boats had taken up their positions, two files of men, each holding onto one end of a two-by-four placed under the pipe, began inching toward the ocean. Every man had to move in per-

fect coordination, so an Engineer with a powerful voice was stationed on shore with a megaphone, to shout orders. His voice was so effective, he soon discarded the megaphone as unnecessary equipment.

Several times shots rang out when sharks tried to approach the men in the water.

### A "Shark Bait" Lesson

Work was not relaxed for a moment. When the line had been laid and the Commanding Officer complimented the men, one of the volunteers was overhead to say: "Being shark bait one day has made up my mind about fishin'. I'm goin' to be mighty sure I've got a boat wrapped around me from here on."

Two and a half months after the Engineer regiment sailed away from the completed Ascension base, we had successfully invaded North Africa, and other Engineers, with their helmets on, were building combat airfields along the Mediterranean.

But the wideawakes, watching ground crews use the Ascension breeze as power to recharge electric batteries on the incoming planes, knew that their island would never be the same again.

The Engineers had come and gone.

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## ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

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, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 17,395 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 forest 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.

# UNION CARBIDE REPORTS

*first full-year's production of*

## BUTADIENE

for the Government's Synthetic Rubber Program

(INSTITUTE, W. VA. PLANT)



*Night view of the immense butadiene plant at Institute, W. Va.*

**A LITTLE OVER A YEAR AGO\*** the first tank car of butadiene was shipped from the Government's large integrated rubber project at Institute, W. Va. This historic shipment came from the immense butadiene plant which was designed and built by CARBIDE AND CARBON CHEMICALS CORPORATION for the Government's Defense Plant Corporation—and is being operated by this Unit of UCC, for the Rubber Reserve Company.

**FIRST YEAR'S PRODUCTION OVER THE RATED CAPACITY—** that is the record of this huge 80,000-ton-per-year plant during its first twelve months! This has been accomplished in spite of the many inherent problems that had to be solved in starting a wholly new project of this magnitude.

Over 3/10 of a short ton of butadiene is required to make about one long ton of Buna S type synthetic rubber. Butadiene from this plant during the past year has provided more than 90,000 long tons of synthetic rubber for the Nation's requirements, both military and essential civilian. The delivery of this all-important ingredient also has made possible early production of synthetic rubber under the Government's program.

\*The first tank carload of butadiene from Institute was shipped on February 18, 1943—less than one month after Unit No. 1 of the four large butadiene-producing units had started operating. Subsequently, Unit No. 2 started producing in March, Unit No. 3 in April, and Unit No. 4 on May 25, 1943.

**NOW HUGE BUTADIENE PRODUCER—** although originally designed to produce 80,000 tons annual capacity, the Institute plant is now delivering butadiene at a rate of more than 100,000 tons per year. An identical plant using Carbide's process was put into operation by the Koppers United Company in September, 1943, at Kobuta, near Pittsburgh, Pa.

**OVER 75% OF THE TOTAL PRODUCTION OF BUTADIENE** for the Government's synthetic rubber program in 1943 came from the alcohol process developed by CARBIDE AND CARBON CHEMICALS CORPORATION.

In addition to the plant at Institute, Carbide made available plans for the large plant at Kobuta, which was built and is being operated for the Government by Koppers United Company.

CARBIDE AND CARBON CHEMICALS CORPORATION also has designed and built for the Defense Plant Corporation, and is operating for the Rubber Reserve Company, another large butadiene plant at Louisville, Ky.

*Business men, technicians, teachers, and others are invited to send for the book E-5 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.*

## UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street  New York 17, N. Y.

*Principal Units in the United States and their Products*

### ALLOYS AND METALS

Electro Metallurgical Company  
Raynes Stellite Company  
United States Vanadium Corporation

### CHEMICALS

Carbide and Carbon Chemicals Corporation

### ELECTRODES, CARBONS & BATTERIES

National Carbon Company, Inc.

### INDUSTRIAL GASES AND CARBIDE

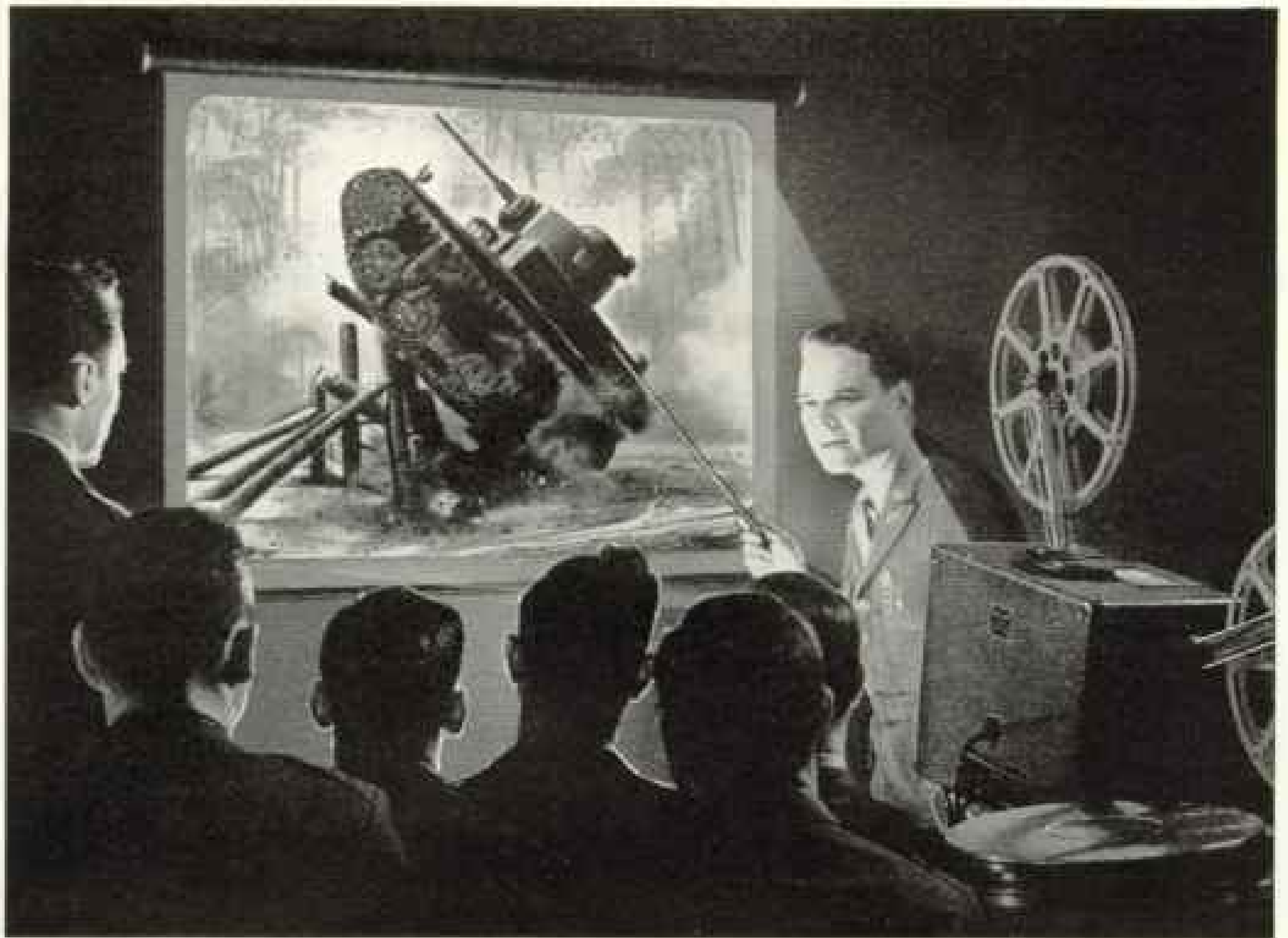
The Linde Air Products Company  
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The Prest-O-Lite Company, Inc.

### PLASTICS

Bakelite Corporation  
Plastics Division of Carbide and Carbon Chemicals Corporation

*The material herein has been reviewed and passed by the Office of Rubber Director, the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.*

BUY WAR BONDS AND STAMPS



## “How to STOP a Tank!”

*“A RAZDOOKA will do it . . . if you know how to use it. A barricade will do it . . . if you know how to build one.*

*It is knowing how that is important if you are to win a war with the least possible losses . . . and you've got to acquire that knowledge fast.”*

To do the job of imparting that kind of *know how . . . fast . . . and thoroughly . . .* all arms of the service are using sound movies. That's why thousands of Bell & Howell Filmosound Projectors are in the training camps . . . to teach, quickly and convincingly,

the lessons that men in training *must* learn swiftly and unforgettably.

When these men are trained . . . and reach the fighting zones . . . Bell & Howell weapons . . . secret devices of many kinds . . . help them do their grim jobs better—in planes and tanks or behind a field piece.

And that's why there aren't any Filmo Cameras and Projectors for personal movie making just now . . . but our postwar products will be well worth waiting for. Bell & Howell Co., Chicago; New York; Hollywood; Washington, D. C.; London. *Established 1907.*



\* Trade-mark registered

\*Opti-onics is OPTics . . . electrONics . . . mechanICS. It is research and engineering by Bell & Howell in these three related sciences to accomplish many things never before obtainable. Today, Opti-onics is a WEAPON. Tomorrow, it will be a SERVANT . . . to work, protect, educate, and entertain.



\* WHAT YOU SEE YOU GET \*

# Bell & Howell



... some things never change



## For 30 years . . . Generals have always been *Worth the Extra Price*

● Year after year, for more than a quarter of a century, millions of car owners have gladly paid *more money* to buy The General Tire.

Experience has shown these millions that General's longer mileage, greater safety and dependable performance were worth many times the extra price.

*And today*, people realize that you may pay less but only General gives you its famous Top-Quality.

The tire crisis is *still acute*, of course, and you must *conserve* the tires you have. Ready with expert help—at Quality Tire Headquarters—is your General Tire Dealer. See him—for repairing, General Tire-Kraft System recapping and mileage advice. He is a mighty good man to know.

BUY MORE  
WAR BONDS

*The*  
**GENERAL  
TIRE**



*— goes a long way to make friends*

# Remember when you said "I Do . . ."

*To have and to hold . . . to love and to cherish . . . for richer, for poorer . . . remember?*

The hallowed words were few and simple, but their meaning shone like gold in your heart. And thus for you and your beloved began new lives . . . thinking and working for each other in glorious partnership.

The husband who fulfills the obligation implicit in his vows plans not only for the present, but for the *future* of his beloved as well. To guard against the final emergency which may

cut off his vital income, a fundamental protection for every family is life insurance.

Whether he be "richer" or "poorer", a Prudential policy may be obtained which will be designed to his own needs and circumstances and will provide security for his family which he can guarantee in no surer way.

*Buy War Savings Stamps from your Prudential Agent*



## **THE PRUDENTIAL**

INSURANCE COMPANY OF AMERICA

*A mutual life insurance company*

HOME OFFICE: NEWARK, NEW JERSEY



THE FUTURE BELONGS TO THOSE WHO PREPARE FOR IT



## ONLY FM RADIO BRINGS YOU THESE ARTISTS IN GLORIOUS "NATURAL COLOR"

FM is the *only* radio that duplicates in your home the human voice or a musical instrument as it actually sounds in the studio!

Music broadcast over conventional radio is *not* the music the artist sings or plays. Engineers say that "overtones" are missing. It's as though the very high notes, and the very low notes, got lost on the way to your house—and only the middle notes reached there.

But on a General Electric FM radio, *all* tones and *all* overtones come through magnificently! Special transmission apparatus and your General Electric FM receiver do what radio has never been able to do before! You are listening to a *new kind of radio*.

General Electric radio equipment now goes to the armed forces. But after Victory, the General Electric FM radio-phonograph will be an even

finer instrument than it is today! General Electric, Schenectady, New York.

Tune in General Electric's "The World Today" and hear the news from the men who see it happen, every evening except Sunday at 6:45 E.W.T., CBS. On Sunday evening listen to the G-E "All G-E! Orchestra" at 10 E.W.T., NBC. Each week over 193,000 G-E employees buy more than a million dollars' worth of War Bonds.

RADIO • TELEVISION • ELECTRONICS

**GENERAL ELECTRIC**

### Every General Electric radio is an electronic instrument

The heart of every General Electric radio is the electronic tube. This tube is similar to electronic tubes used in G-E television equipment, and in G-E electronic apparatus that speeds war output in thousands of industrial plants across the continent.





## a Pilot's letter advises: *"Better fly Buick"*

**S**HE is a three-star mother, with one son an Army pilot, one a Navy flier, one an Army cadet meteorologist—and a wartime job of her own to handle.

When a letter came from the one who has been out in the Pacific for 15 months—much of the time in a big Liberator bomber—she passed it on to us, with quite needless apologies about "a mere mother's pride" in her son's good efforts.

She sent it on because her son wrote:

*"These engines I fly behind are built by Buick, so I have the utmost faith in them. You take care of them and they'll take care of you."*

And you can be mighty sure that made us feel good.

But listen to what the mother added and see if

you wouldn't feel both proud and a bit humble in the face of such obvious appreciation:

*"Thank God," she wrote, "that if our modern machines must be used as instruments of war, Buick does build them. It means much to us mothers of men that, as they defy death in the skies, you have done your best to see them through."*

Yes, we have done our best. And we are glad that best has been good enough to give fighting men faith in Buick-built war goods.

But who wouldn't try to *better* his best when to such faith you have added the sincere gratitude of mothers who send their sons to fight for us?

Certainly *we* shall—every hour of every day—from now till Victory!



Every Sunday Afternoon—GENERAL MOTORS SYMPHONY OF THE AIR—NBC Network



**BUICK DIVISION OF GENERAL MOTORS**







Copyright 1944, The Pullman Company

## "I shoulda kept my big mouth shut!"



He would have, if he'd read the Pocket Guide to Iran, which the War Department gave him when he started overseas. It says:

*"When in an Irani home, don't be too enthusiastic about admiring some object. Your host might . . . give it to you."*

But the corporal *did* enthuse. And now he's stuck for part of next month's pay besides, because the book goes on:

*"If an Irani makes you a gift, the proper thing to do is to give him one of equal value in return."*

That's the custom of the country. He learned it the hard way!

There's an American custom that many boys have learned the easy way since they went in service. It's the custom of *traveling in comfort*—which troops in training do at the rate of 30,000 every night.

To many of them, going Pullman is a new experience. And that is just what it will be to everyone when the war is over and new

Pullman cars bring new comforts and conveniences.

**Duplex-roomette cars**, for instance, on almost every train—such compact little gems of comfort and convenience that it will be like traveling in your own living room, by day; like sleeping in your own bedroom at night—as you speed safely and dependably toward your destination.

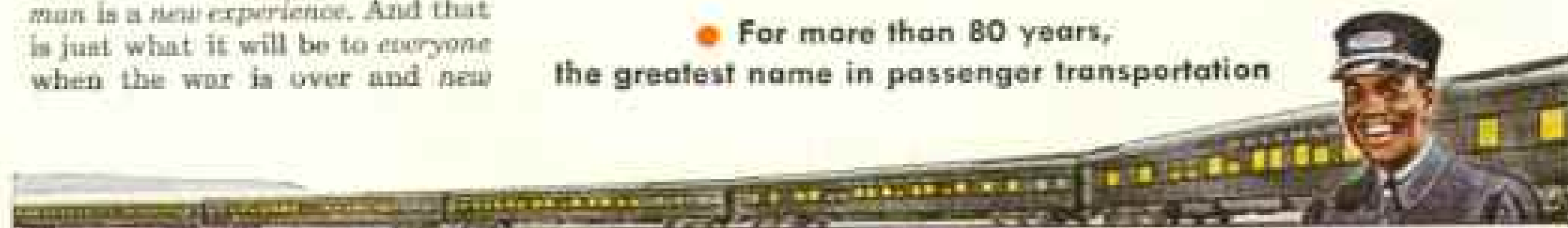
**Pullman plans** that duplex-roomette space will cost little—if any—more than lower berths cost now. And there'll be another new type car—the *coach sleeper*—providing Pullman comfort and convenience for less than the present rate for a berth in either standard or tourist sleeping cars.

That's what Pullman has in mind for the day when America can travel for pleasure again—in the comfort that's the custom of the country.

★ LET'S ALL BACK THE ATTACK WITH WAR BONDS ★

# PULLMAN

● For more than 80 years,  
the greatest name in passenger transportation





*Mr. Potter's  
private war*

MR. POTTER closed his eyes and listened to the music. . . . He was on the bridge of a destroyer in the North Atlantic. . . . Captain Potter gets the convoys through. Then he was Pilot Potter . . . riding the skies over Europe. The music softened . . . and Lieutenant Potter of the U. S. Marines was lying wounded in the jungle . . . pale and drawn. Then his wife called, "Henry!" she said, "Put the cat out and come to bed."



To Mr. Potter, music is relaxation from war work. . . . To the girl whose husband has gone to war, music is a companion. Music is many things to many people . . . but it is at its best when heard with all the subtleties that give it meaning. Tomorrow, all the richness, all the greatness of fine music, will come to you through the postwar Stromberg-Carlson. This is a promise worth remembering . . . for it is backed by fifty years of experience . . . by the skill that made Stromberg-Carlson the leader in FM . . . and by many new wartime developments! Keep the postwar Stromberg-Carlson in mind. . . . Your War Bonds will buy nothing finer!



IT IS IMPORTANT that we plan now to bring you fine Stromberg-Carlson radios when peace comes . . . important because these plans will mean good jobs for our men in the armed forces . . . and good jobs for the men and women whose work has won for Stromberg-Carlson the Army-Navy "E."

IN RADIOS, TELEPHONES, SOUND EQUIPMENT...  
THERE IS NOTHING FINER THAN A

**STROMBERG-CARLSON**

A HALF-CENTURY OF FINE CRAFTSMANSHIP

© 1944, STROMBERG-CARLSON COMPANY, ROCHESTER, N. Y.



BUY WAR BONDS AND STAMPS

## "Home again, home again, jiggety-jig!"

"Marketing was certainly simpler in the car . . . *oops, there goes a potato!* . . . but it's a lot easier to park a bike—and cheaper, too . . . *hold on, Johnny, we're coming to a corner!*"

An American sense of humor has helped Mrs. Frazer make the best of food, gas and rubber rationing. It's rather fun balancing groceries in front and a small boy in back. It's *not* so much fun balancing coupon points against prices. But there's still a certain satisfaction in making things come out even!

In the same cheerful, chin-up spirit, she has pitched into other wartime jobs. She's doing all her own cleaning since once-a-week Mary went to work at the plane plant. She's saving fats, flattening cans, baling paper. She grows vegetables instead of flowers in the backyard.

There are no medals for being a good wartime housewife. But Mrs. Frazer, and the millions like her who keep their families healthy and homes attractive, are making a magnificent contribution to morale and to Victory.

The "family" we feed with nature's most nearly perfect food—milk and milk products—includes millions of soldiers and civilians. We have many of the problems that face Mrs. Frazer—on a larger scale. We're trying to do our job with equal good sense and good will.

*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.*



**NATIONAL DAIRY  
PRODUCTS CORPORATION**

AND AFFILIATED COMPANIES



In all her world of music, *Rose Stevens* had never heard anything like this

TO a born New Yorker, who had sung for the elect of four continents — the little city of Mt. Carmel, Ill., might seem as far away as the distant planets.

But here it was... as real as the beautiful cabinet on which her elbow rested. For this was Mt. Carmel's glorious new gift to music — and Rose Stevens was enjoying it as she had never before enjoyed recorded music of any kind. "Such wonderful, wonderful music!"... exclaimed Miss Stevens. "I can't wait until I have a Meissner of my own — *exactly* like this one!"

Rose Stevens, star of opera, film<sup>®</sup> and radio, had just heard the only Meissner electronic radio-phonograph in existence — the final laboratory model perfected just before the war. Its luxurious postwar counterparts, however, will bring new pleasure to all the lovers of artistic perfection who have long been irritated by the "missing elements" in much of today's recorded music. Then you will glory in all the Meissner advantages described at the right.


**AUTOMATIC RECORD CHANGER** — plays *both* sides of a record in sequence, *one* side only, or *repeats* a record just played... *avoids* record breakage. Provides 2 hours or more of music without your touching a record.

**FREQUENCY MODULATION** — plus advanced electronic features for fidelity and tonal range greatly surpassing such qualities in home radio-phonographs now in use.


**SUPER SHORTWAVE... DISTINGUISHED CABINETS... NEW IDEAS** in a host of other advancements already being engineered into Meissner electronic equipment for our armed forces around the world.

**\*Her latest: Paramount's "Going My Way"** — in which she plays the feminine lead opposite Bing Crosby.

For tomorrow —  
A NEW WORLD OF MUSIC AT YOUR FINGER TIPS



**MEISSNER**  
MANUFACTURING COMPANY - MT. CARMEL, ILL.  
ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE







## *We can't all wear wings*

WE know how you feel, young fellow—that stout heart of yours is breaking because you can't be up there in those army bombers.

You couldn't help it that the medics turned you down. You wanted to *fight* for your country.

Well, what else do you think you're doing now? You're fighting—even though your uniform is a railroad trackman's overalls.

Every time men of your courage and character apply for work that will help shorten the war, we of The Milwaukee Road learn anew

what makes this nation invincible.

Out on the endless plains of the Dakotas, or in the rugged mountains of Montana or Washington, the sound of heavy war trains rolling over your stretch of track is like the roar of a bomber to your ears.

You don't wear wings. But we thought the country you're serving ought to know about you.

And we can tell you that over 5,000 men and women of The Milwaukee Road in the armed services consider you their kind of man.

★ ★ ★

*"They should not have taken a railroad man for the Army unless he, himself, clamored for military service. He is in as fine a military place as he can ever occupy when he is helping run the railroads."* Colonel J. Monroe Johnson, Interstate Commerce Commission.

**THE MILWAUKEE ROAD**  
11,000-MILE SUPPLY LINE FOR WAR AND HOME FRONTS



**THREE REASONS WHY**  
*The Martin Mariner*  
**IS POISON TO U-BOATS!**

**T**HE Navy is frequently silent on sub-sinkings. But when you read of convoy after convoy getting through, you know Martin Mariners are at work. From Iceland to Rio these big 20-ton flying boats help guard the sea lanes, ready at a moment's notice to unleash a storm of gunfire and depth charges on lurking killers of the deep. They're deadly poison to U-boats!

**WHY MARINERS ARE TOPS AGAINST SUBS**

Take a look at the picture above and note the big sturdy hull. That means seaworthiness, the ability

to take off or land in rough weather, maintaining the constant, never-ceasing hunt for U-boats. Then look at the broad tail with its twin fins. That gives stability, a steady platform, assured accuracy in bombing. Finally, there's the spread of those long, gull-wings. Such wingspread enables Mariners to "coast" through the air, with engines throttled down for minimum fuel consumption, permitting them to stay aloft hours longer. In addition, these tough PBM's pack sufficient firepower to slug it out with a U-

boat's guns when making low-level attacks. The Mariner was designed as a scourge for subs!

**YOUR OWN COMMAND**

When you pilot a Martin Mariner, you're leader of an eleven-man crew. If you've got what it takes to fly, you belong in the Navy Air Force. It's a real opportunity to learn the trade of the future . . . aviation. Even now Martin has completed plans for giant 150-ton "flying hotels," the transportation of tomorrow. Such ships, weaving an aerial network over the world, will require crews of expert fliers. You can be one of them, if you start now to win your Navy Wings of Gold!

THE GLENN L. MARTIN COMPANY  
 BALTIMORE-3, MARYLAND  
 The Glenn L. Martin, Nebraska  
 Company—Omaha

**Martin**  
**AIRCRAFT**

Builder of Dependability Since 1917

OFFICIAL NAVY PHOTOS SHOW MARTIN MARINERS SINKING NAZI SUB



**BOMBS AWAY!** Strings of depth charges cascade from Mariner's bays. Extra-big bomb capacity enables Mariner to drop lethal patterns of explosives, blanketing target area.



**DIRECT HITS!** Seesawed by depth charges, sub is forced to surface, crippled. Twin tail fins, assuring stability, permit accurate bombing like this, make Mariners the scourge of subs.



**HELPLESS!** Unable to submerge or flee, U-boat lies helpless. Mariner, designed to stay aloft for very long periods, circles watchfully until destroyer arrives to polish off the sub.



One of a series of incidents in the lives of immortal composers, painted for the Magnavox collection by Walter Richardson

## Out of the storm — a Ghost Opera

**T**WICE the small vessel which was carrying Richard Wagner to London, nearly foundered as she beat her way through Baltic storms.

Standing on the heaving, wind-swept deck, the great composer listened, entranced, as the helmsman told a weird tale recalled by the violent weather.

It was the story of a Dutch sea captain battling contrary winds to round the Cape of Good Hope — defying even Satan to prevent him, though it took till judgment day. According to the legend Satan accepted the challenge and the Dutchman's ghost ship still sails the sea through eternity.

That story, told in that setting, brought a sudden inspiration to Wagner. Then and there he began to create his opera, *The Flying Dutchman*. For what mattered storm or personal danger when his mind was on music? In fact, what mattered anything throughout the life of this "little Vesuvius of a man"

except his music and the satisfaction of his own ego! The years have proved Richard Wagner a rare genius. His *Tannhäuser*, *Lohengrin* and many other operas are as deathless as the legendary Dutchman, who sails on through the ages.

To appreciate to the full Wagner's mastery of music, hear his *Ring*, played with all its intended brilliance 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 many famous masters of our time—among them Kreisler, Rachmaninoff, Ormandy, Beecham and Horowitz.

Hear good music—recorded or by standard or F. M. broadcast—through a Magnavox radio-phonograph. Then you realize that an instrument of lesser quality deprives you of the true tone timbre to which you are entitled. The Magnavox Company, Fort Wayne 4, Ind.

Buy War Bonds For Fighting Power Today — Buying Power Tomorrow

**M**agnavox • *The choice of great artists*  
RADIO PHONOGRAPH

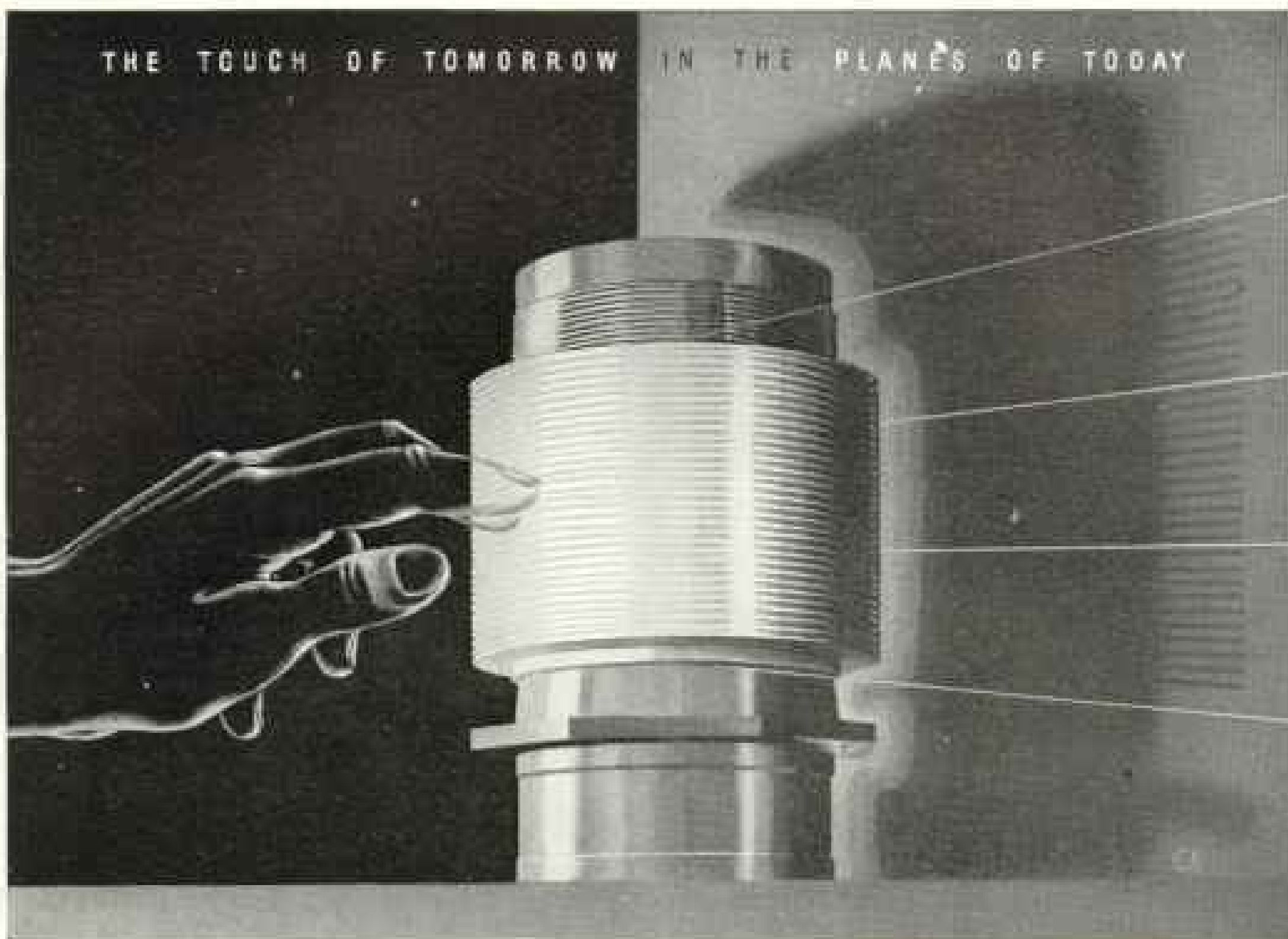


Magnavox radio-phonographs are bringing relaxation and courage to our fighting men on many new battleships and aircraft carriers. See your Magnavox dealer for a wide selection of records to send to your soldier or sailor.



For outstanding service in war production

THE TOUCH OF TOMORROW IN THE PLANES OF TODAY



## Off Comes the Lid of Aircooled Engine Power

Another outstanding engineering development has come out of Fairchild's Ranger laboratories—a new and unique type of aircraft engine cylinder barrel. With it, an aircooled engine can produce appreciably greater horsepower.

What does this mean in terms of air strength for the United Nations? It means that our planes can now have one or a combination of several new advantages: they can carry greater bomb loads; or heavier armor; or more ammunition; they can lift more gasoline and so increase their range; their maneuverability can be stepped up.

The full story of how it works is technical, involved, and shrouded with secrecy. But briefly and in non-technical language, this much can be told:

Those "fins" you see surrounding the cylinder barrel in the picture are made of aluminum, a

metal with pronounced ability to draw off engine heat. The core of the cylinder is steel. By all previous methods of manufacture an aluminum alloy "fin" was attached to the core as a separate part. Thus its cooling efficiency was only partly utilized. Now, with Fairchild's "Al-Fin" process, it is possible to *chemically bond* the two metals with the result that engine heat is drawn off much faster than by the conventional aluminum or steel "fin."

The announcement can now be made that all 12-cylinder Ranger engines produced during the past year have incorporated this revolutionary development.

As another example of the "touch of tomorrow," this latest product of Fairchild engineering takes its place among the notable aviation achievements of the day.

BUY U. S. WAR BONDS AND STAMPS

 **FAIRCHILD**

ENGINE AND AIRPLANE CORPORATION  
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Ranger Aircraft Engine Division, Farmingdale, L.I. • Fairchild Aircraft Division, Hagerstown, Md. • Burlington, N.C. • Duxford Division, New York, N.Y.



## The new watch that took a tip from the Sun!

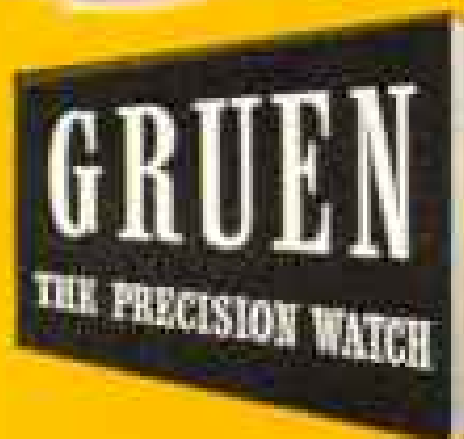
It's THE GRUEN PAN AMERICAN and it's travelling the skyways with famed Pan American Clipper pilots. Instead of sign posts, these men fly by seconds — their course is charted to the exact moment when their ship is over a point invisible far below. Their timepieces must show where they are as precisely as the meridian crosses the sun. The Gruen Pan American was chosen as the Official Watch of Pan American World Airways because it does tell time with absolute accuracy. It's numbered for the 24 hours of the air-world day — in fact, in every respect, it's the thin, smart watch of the future. Naturally government requirements get first call on our production of Gruen Pan American watches . . . and civilians may not find them at their jewelers today.



Nevertheless Gruen jewelers are regularly receiving other Gruen watches in such quantities as war conditions permit. In addition to manufacturing vital precision instruments for war and watches for the armed forces, Gruen is continuing to produce fine watches for civilian use . . . built to the same high standards that have made Gruen the choice of discriminating Americans since 1874. The Gruen Watch Company, Time Hill, Cincinnati, Ohio. In Canada: Toronto, Ontario.



BUY A GRUEN WATCH . . .  
BUT BUY A WAR BOND FIRST!  
AMERICA'S CHOICE SINCE 1874



GRUEN . . . MAKERS OF THE PRECISION WATCH  
AND PRECISION INSTRUMENTS FOR WAR

Report No. 4 on  
**HONESTY ENGINEERING**  
a new idea in  
**Personnel Relations**



**T**HAT'S typical of how employers reply to inquiries about Honesty Engineering. It helps keep needed employees on your payroll by helping reduce the number who "go wrong" and misappropriate money, materials or merchandise. In one large wholesale organization, for example, this new Personnel-Protection Plan cut by 83% the average number of employees discharged for dishonesty.

Based on long experience, the U. S. F. & G. Personnel-Protection Plan not only insures you against financial loss through employee dishonesty but: (1)

discloses undesirable personnel and prevents waste in training; (2) applies tested methods that help keep good employees from going wrong; (3) helps employers eliminate leaks, pitfalls and careless acts that often lead to employee dishonesty.

Whether you have 10 employees or 10,000, your U. S. F. & G. agent will be glad to show you how the Personnel-Protection Plan helps you keep employees by keeping them honest. Consult him today.

Branch Offices in 43 Cities—Agents Everywhere

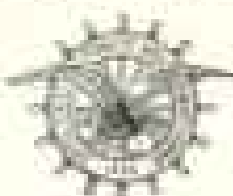
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## **MORE THAN A TRAIN . . . A SYMBOL**

● Burlington's Pioneer Zephyr, first diesel-powered, streamline train in America . . . symbol of a dramatic era in railroad transportation . . . and of the even more dramatic progress to come.

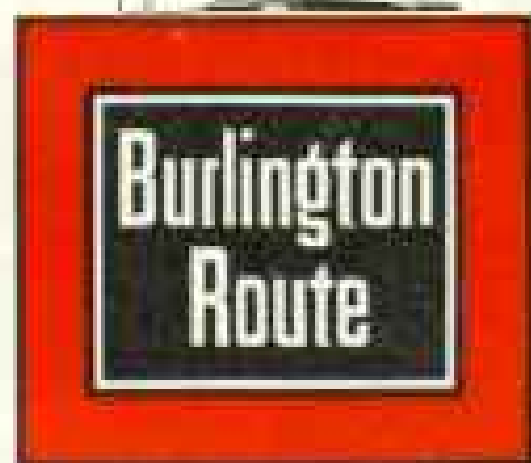
Christened on April 18, 1934 . . . exhibited in 222 cities in 27 states . . . tested through 30,000 experimental miles, the Pioneer Zephyr entered regular service with national acclamation, on November 11, 1934 . . . thus establishing the first streamline service in America.

Today, the Burlington has fourteen gleaming stainless steel Zephyrs operating on its system lines.

More than 100 trains, fashioned to the streamline pattern, have gone into service for railroads throughout the country.

With ten years of outstanding service to its credit—a period during which it has covered in excess of 1,676,000 miles—the Pioneer Zephyr is still on active duty, serving wartime America to the tune of 456 miles each day.

In the coming peacetime years, we look forward to a program of further improvement and refinement of the "streamline train" era, inaugurated by the Pioneer Zephyr ten years ago.



**AN ESSENTIAL LINK IN TRANSCONTINENTAL TRANSPORTATION**

# Jewels of Today

ARGUS EYES FOR VICTORY

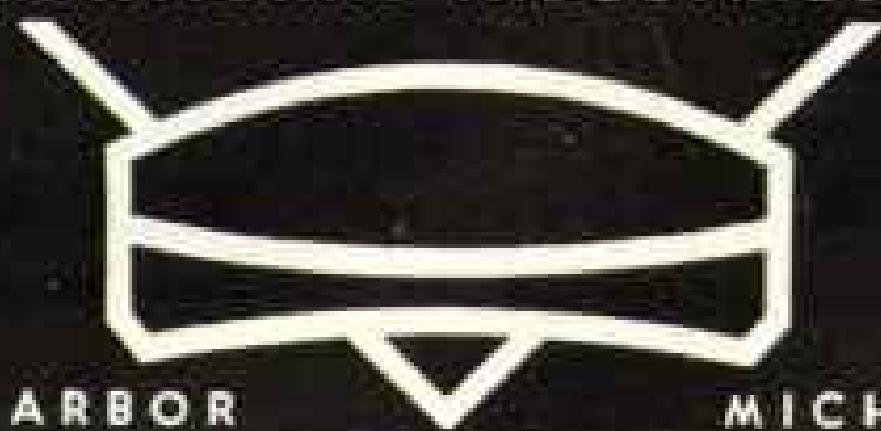


AWARDED TO PLANE J  
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*Finish the Fight with War Bonds*

## Toward Tomorrow

Here is the plane that gave Americans a *new highway* . . . far up in the heavens . . . the Boeing Stratoliner, introduced in 1940 as the world's first high-altitude transport.

Perhaps in peacetime you had the thrill of journeying in one of these huge luxury liners along TWA'S transcontinental route . . . above weather, high in the sub-stratosphere, where flight is swifter, smoother, and surface storms are left far below.

Today Stratoliners are wearing khaki in the Army's Air Transport

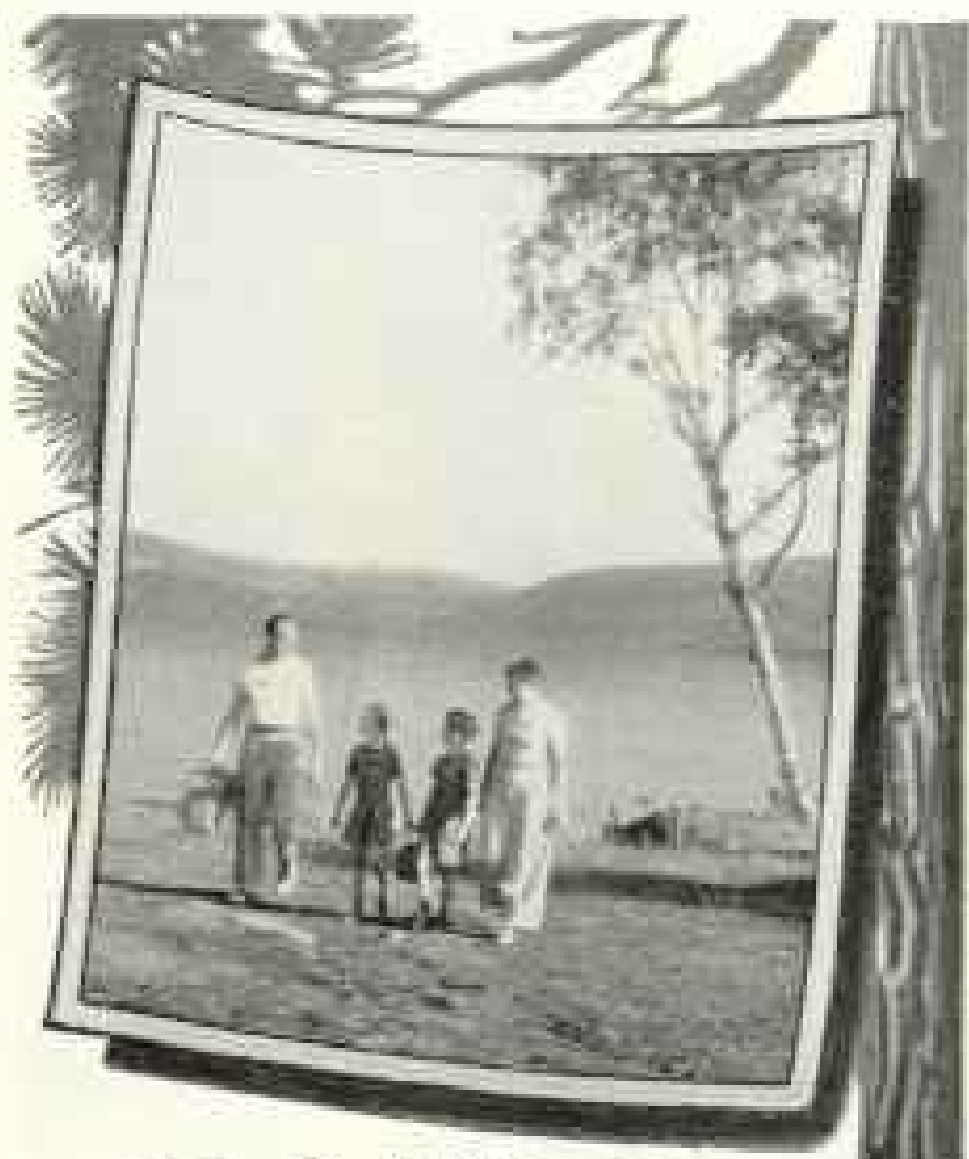
Command, flown by TWA to the far reaches of the earth . . . to Africa and to Iceland . . . to Arabia and Australia . . . over the towering Himalayas, rooftop of the world, from India into China.

Madame Chiang Kai-Shek made her flight to America in a Stratoliner. Ambassadors, technicians, fighting men have hopped the oceans in them by the thousands.

Stratoliners are constantly carrying ammunition, mail, life-giving plasma to battle fronts everywhere . . . bringing back sick and wounded.

With its pressurized cabins and its advanced aerodynamic design, the Stratoliner, a Boeing development of yesterday, is truly a forecast of the *planes of tomorrow* . . . another example of the engineering and manufacturing skill that produced such ships as the Boeing Flying Fortresses and the trans-ocean Clippers.

*This skill in many lines . . . structural, metallurgical, heating, hydraulics, acoustics . . . will some day be devoted again to peacetime products. And you may know of any such product: if it's "Built by Boeing" it's bound to be good.*



# MAINE

## THE VACATIONLAND THAT'S LOVED BY MILLIONS

Just a few hours from all the East lies America's favorite vacationland—the land that's second home and first love to millions.

Here every member of the family will find his or her particular vacation pleasure—mountains, lakes, the woods or the sea. Every outdoor sport is theirs for the doing. They can play hard, enjoy round-the-clock life at a smart resort, rest in a quaint village inn or a lakeside cabin or roam, conveniently, all the scenic glories of the State.

They'll eat incomparable "Down East" foods—slumber soundly through our cool mid-summer nights. They'll warm to the genial hospitality of their hosts.

We want you to come to Maine this summer. You'll have a "million dollar" vacation, whatever you can spend.



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*For Men Who  
Really Know Pipes*



SILVER CROWN  
MODELS... CHOICE  
NATURAL GRAINS

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No man can appraise the intangible assets of a truly fine pipe—or evaluate the dreams and reminiscences, and the contentment derived from its smoking . . . But many men know such a pipe and ask for it by name—Royalton.

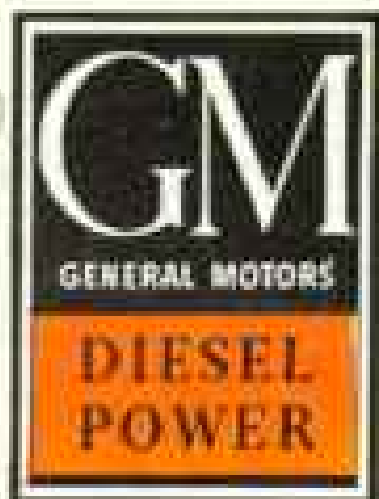
# PATHFINDERS OF THE DIESEL ERA

*The original Burlington Zephyr which inaugurated a new era in American transportation history in 1934. After more than 1,650,000 miles it still is assigned to its daily round trip of 465 miles between Lincoln and McCook, Nebraska.*



*Latest of the illustrious descendants of the original Zephyr—one of the sixteen 3,400-horsepower General Motors Freight Locomotives being put into wartime service by the Burlington Lines.*

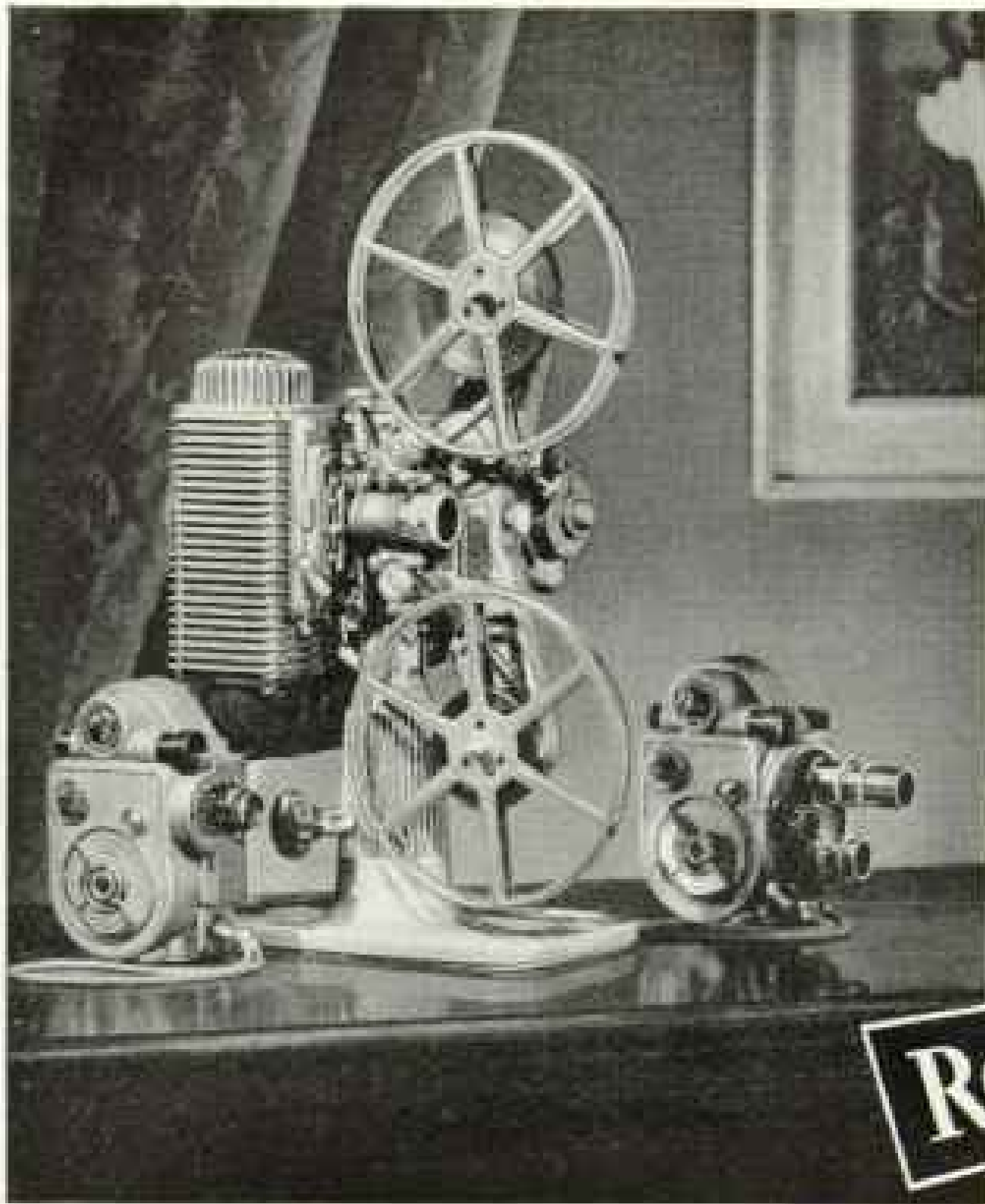
**I**T is just ten years since the famous Burlington Zephyr introduced new ideas in railroad travel. It was the world's first Diesel-powered streamlined train. Its power plant was General Motors Diesel. Today hundreds of General Motors Diesel Locomotives are hauling passengers and freight on 75 American railroads. They operate many millions of miles annually with astounding dependability and economy. Day by day additional GM Locomotives are entering that honored field of more than one million miles of operation. Every day brings new records of performance. And this performance, highlighted by its invaluable contribution to the astonishing war record of the railroads, is providing a glimpse of the greater day of railroading which lies ahead.



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ENGINES . . 150 to 2000 H.P. . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

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## To Mothers—a bouquet with a reminder tied to it

Lots of people have asked . . .

"Is the war affecting the health of America's young children?"

Here's one answer:

*Fatalities from childhood diseases are at an all-time low . . . Infant mortality is at an all-time low.*

For this achievement, the mothers of our youngest generation deserve a great big bouquet. They have realized that the most valuable war-time service they could render is to safeguard the health and welfare of their little children.

Along with this compliment, we'd like to add these few reminders . . .

**Some of the dreaded childhood diseases** can be prevented. Early in infancy—usually between 6 and 9 months—your doctor will advise protection against *diphtheria* and *smallpox*, and probably whooping cough. All young children should have medical checkups *at regular intervals*.

**Regular, undisturbed sleep** is very important. Children *grow* in their sleep. Most children between the ages of 2 and 6 need additional rest—usually an afternoon nap.

There should be regular play hours, some of it out of doors, and with other children. Provide well-balanced meals at regular hours.

Make the home safe for little children by keeping such things as sharp instruments and matches out of their reach, and by protecting them against falls, suffocation, and other hazards. Even when mother must be away, it is very important for the child that the daily routine and safety program be maintained.

**FREE BOOKLETS!** Metropolitan offers two valuable booklets for mothers. No. 54N, "*Your Baby*," deals with the child's first year. No. 54NA, "*Out of Babyhood Into Childhood*," covers the pre-school years. Send for either or both.

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## Even Oysters have Thorns

ONE OF THE MANY strange and colorful creatures who inhabit the corals of tropic seas is the Thorny Oyster (*Spondylus pictorum*).

Like most mollusks, the Thorny Oyster starts early in life to build a hard shell-fortress which he keeps enlarging as he grows. This protects his soft, defenseless body from many misfortunes.

But he is surrounded by dangers from which the hardness of his shell, alone, could not defend him.

Large fish with teeth that can easily crush a mollusk shell are always swimming among the corals in search of food. And, unlike the Deep Sea Scallop, the Thorny Oyster cannot skip about to elude these potential enemies. He is usually attached to a coral by one of his valves.

So nature has provided a special defense for his fortress in order to make it doubly secure. In contrast to the ordinary oyster shell, his shell bristles with long spines which curve outward in a menacing fashion. With these formidable weapons, the Thorny Oyster keeps danger at a safe distance.

Now although you may never have thought of it this way, the average man relies upon his

income, or business, much as an ordinary oyster relies upon his shell. It serves as a fortress to protect him and his family from many misfortunes.

But however carefully a man may build this fortress, enlarging it with his needs, he cannot rely on his income alone, to make himself financially secure.

That is, if a fire should destroy part of his home, a windstorm cause heavy damage, or an accident land him in the hospital for a time, his income might fail to cover the heavy expenses which would follow.

And so man has developed a special defense, an extra protection, to guard his income from exceptional financial strain. This defense is insurance.

If you have not checked on your fire, life, accident, and other insurance policies lately, the Travelers man in your community will be glad to advise you as to whether you are carrying proper protection for your present needs.

**MORAL:** Insure in The Travelers. All forms of insurance and surety bonds. The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, Hartford, Connecticut.

# Living up to Leadership!

**S**heaffer writing instruments are the finest we know how to make. They always have been—always will be! Everyone at Sheaffer is imbued with that singleness of purpose—to make Sheaffer pens and pencils accurate reflections of designing and manufacturing "know-how" which has been patiently, persistently acquired through many years of craftsmanship. Today no effort is spared to see that Sheaffer products live up to the leadership which public acceptance has accorded.

Today Sheaffer's writing instrument production is limited to further the war effort. Pens and pencils are being produced only in quantities authorized by the War Production Board. A substantial percentage of these are available for civilian use. W. A. Sheaffer Pen Company, Fort Madison, Iowa; Toronto, Ontario, Canada.

At right: "TRIUMPH" pen, with clip, \$12.50; pencil, \$5.—"TRIUMPH TUCKAWAY" model, without clip, for men or women, carries safely in all positions in purse or pocket—pen, \$12.50; pencil, \$4.

\*All *Lifeline* pens, identified by the White Dot, are unconditionally guaranteed for the life of the first user except against loss and willful damage—when serviced, if complete pen is returned, subject only to insurance, postage, handling charge—35c.

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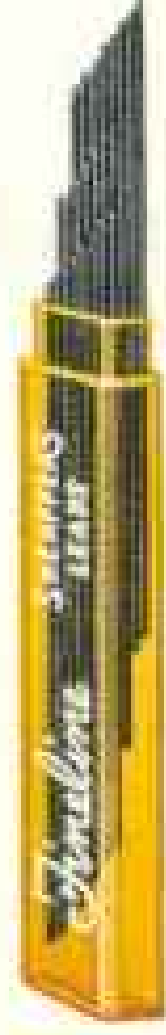
THE BOTTLE WITH THE TOP WELL



Top Well keeps fingers clean because it is not necessary to dip pen into bottom well. Only SKRIP has the Top Well. All other writing fluid containers are bottom well bottles.

**ASK FOR SHEAFFER'S WHEN YOU ASK FOR LEADS**

Most of the better stores have complete Sheaffer lead departments containing all sizes, colors and grades—strong, smooth-writing, grit-free—the original, genuine Fineline leads developed for Sheaffer by the J. M. Dixon Castable Company. Economy package, 25c; regular package, 15c.



# SHEAFFER'S

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## **They'll mean home to your soldier or sailor**

Next to being with you—what else can bring the home scenes and faces close to him like *full-color snapshots*?

With the revolutionary Kodacolor Film you can take these beautiful color snapshots—in good sunlight—with an ordinary Kodak or Brownie. From the negatives the Kodak Company makes Kodacolor Prints—full-color snapshot prints on paper . . . easy to send in a letter, carry around in a bill-fold.

Kodacolor Film isn't too plentiful just now—so save it for important occasions. Use it for the color snapshots that will mean so much to your soldier or sailor . . . Eastman Kodak Company, Rochester, N. Y.

Reproductions of Kodacolor snapshots, reduced in size.

## **THE MARCH OF COLOR**

IN 1928 Kodak brought out a film for making home movies in full color.

IN 1935 Kodak introduced full-color Kodachrome Film—making color movies available to every home.

IN 1936 Kodachrome "still pictures," shot with a Kodak Bantam or 35-mm. camera, became the joy of tens of thousands.

IN 1938 Kodachrome sheet film led to full-color photographs as magazine and newspaper illustrations.

IN 1941 Kodak introduced Minicolor Prints from miniature Kodachrome Film transparencies—the first direct full-color photographic prints.

IN 1942—Kodacolor Film fulfilled the dream of generations—color snapshots, full-color prints made from color negatives in an ordinary roll-film camera.

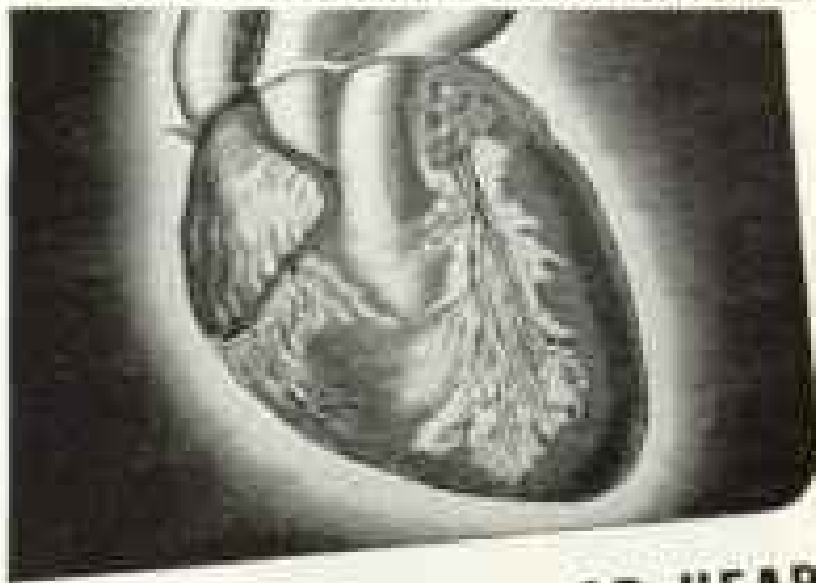
*Know your wife is glad to get the color snapshots of Belle, and the ones Dad took of you both together when you were home on furlough. They were revised as Dad carries a set in his briefcase and shows them to all the neighbors. He is so proud and a set*

# Kodak Research

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# War Maps

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National Geographic Society \_\_\_\_\_ 1944  
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A color reproduction (14 1/2" x 20") of this scene from Paramount's "Union Pacific" may be had free by writing Union Pacific Railroad, Room 1117, Omaha 2, Neb.

## The driving of the golden spike

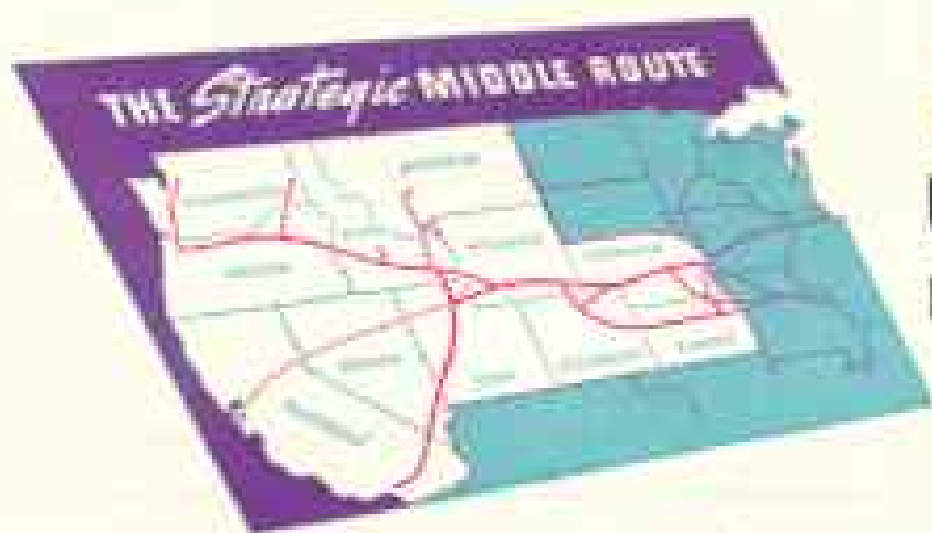
● PROMONTORY POINT, Utah, was the scene of a history-making event on May 10, 1869—the realization of a great American's dream. It was Abraham Lincoln who visualized the vital need for uniting by rail, the East with the Pacific Coast, and who authorized the building of a transcontinental railroad.

The Union Pacific struggled through lean and troubled years but, like other pioneers, it had faith in America's future. Edward H. Harriman had unbounded faith in America. His guiding genius—and the faith of the leaders "from the ranks" who followed him—gave strength and vigor to the railroad.

America always has offered unlimited opportunity and ample reward as an incentive for hard work and individual enterprise. That's why it's such a great country. It's our job to keep it that way.

\* \* \* \*

This year marks the 75th Anniversary—the Diamond Jubilee—of the driving of the Golden Spike, the completion of "The Strategic Middle Route." Union Pacific commemorates that historic occasion by continuing to exert every effort in the transportation of materials and troops to hasten the hour of victory and peace.




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1944

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