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THE NATIONAL GEOGRAPHIC MAGAZINE



# TRAINS OF TODAY—AND TOMORROW

BY J. R. HILDEBRAND

AUTHOR OF "MAN'S PROGRESS IN CONQUERING THE AIR," "ENGLAND'S SEVEN TRIPLE ISLE OF WIGHT," "MARCO POLO, WORLD'S GREATEST OVERLAND EXPLORER," "BUDAPEST, TWIN CITY OF THE DANUBE," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

"HOW fast?" I asked the conductor of the Twentieth Century Limited.

"Slowing down now to 70 for a curve. We've been doing 80."

Passengers had been conscious of neither curves nor speed. Just then a town snapped by—a muffled roar of trapped sound, a swift blur of lights, like a movie reel gone "haywire."

A tall young man came along the aisle chatting affably with an elderly train maid.

"That's Mr. Blank," the conductor explained, naming a millionaire sportsman. "Emma's been on this train since it started. In a way she helped raise him, and dozens of other sons of New York and Chicago families, when they were boys traveling back and forth with their parents."

Railroads have their historic liners; the Twentieth Century is the *Mauretania* of the New York Central. They lay colored carpets from gate to platform when the Century leaves Grand Central Terminal. Passengers know each other and greet the train crew as they would the officers and stewards of their favorite steamship.

## SPEED—AND DOUGHNUTS

"Speed's the thing now, speed, safety, and comfort," rambled on the veteran conductor. "I remember when they put the first electric lights on the old Empire State Express. And they cut down the New York-Chicago time to 24 hours. There was a great to-do about that; crowds were out at every station to see her whiz by. Now we make it easily in 16½ hours."

"That secretary, now, does he really do much?"

"Last run he typed a contract for a $200,000 deal. Two weeks ago he helped a lawyer and his client make a will. Then he telegraphed ahead for a notary to board the train at Elkhart. The papers were all ready for a safe-deposit box when we reached Chicago."

The Pennsylvania's Broadway Limited is a similar train, making the same time as the Twentieth Century. With rates and running time on competing roads often the same, rivalry now is for added touches of passenger comfort.

"I landed two regular passengers from our competitors," chuckled one passenger agent, "because they liked the doughnuts we give them mornings with their small cups of coffee."

## "TRAINS OF TOMORROW"

Over a Chicago travel agent's desk hangs a sign, "Trains of Tomorrow." I asked the alert young clerk to name a few.

She looked puzzled, but, self-possessed, waived the question of destination and reeled off a list: the Sunset Limited, the Hiawatha, the Abraham Lincoln, the Argonaut, the Green Diamond, the Columbine. And, taking breath, the Ak-Sar-Ben, the Super Chief, the Mark Twain Zephyr, the Mountain Bluebird.

The names were redolent; one waited for a Samarkand Limited, a Bali Special, or a Marco Polo Express.

The Mark Twain won my first ride.

Photograph by J. Baylor Roberts

AN AIR-CONDITIONED, STREAMLINED, HIGH-SPEED MODEL, IN MAROON AND ORANGE, LEAVES CHICAGO

Engine wheels are semi-shrouded, the taproom (part of second coach) is windowless and softly lighted, the observation car is beaver-tailed, on the Hiawatha. Its regular 7-hour run between Minneapolis and Chicago calls for a top speed of 106 miles an hour at one place; it has attained 115 miles on short stretches when it was delayed.

There it stood in the station, its stainless steel gleaming like a platinum wedding ring, the humorist's pen signature scrawled on its beetled, glass-incased observation tail.

The cars were "Tom Sawyer," "Huckleberry Finn," and "Injun Joe." "Cars" is not the proper word. They are three "units," for this train is all of one piece—"completely articulated" they call it. The "control room" is in the front end of the forward unit, back of that are a mail compartment and chair seats for 92 passengers.

The whole train weighs not much more than a standard Pullman car. A train made up of a steam engine and two coaches would have 36 or 40 wheels; this one had 16 on four roller-bearing trucks.

Diaphragm vestibules make passing from one unit to the other scarcely perceptible to the passenger were it not for the different decorations of the smoking compartment, the main passenger cabin, and the observation lounge.

Victorian red plush and cupids carved in woodwork have disappeared from most railroads. Decorators and lighting specialists bid for contracts to do the interiors, even those of day coaches. An architect's fee of $28,000 is part of the cost of one club car built this year.

Gray-green carpets, pastel upholstery, rose curtains, aluminum chair frames marked the "rooms" of this Zephyr. Storage space for baggage supplanted overhead racks, radios transmitted the oratory of political campaigns and symphony concert music, a hostess helped make passengers comfortable and amused their children, insulation deadened outside noise.

### HANDLING "FRESH AIR"

Constantly a trainman kept a watchful eye on the thermometer and regulated air conditioning.

"The railroads handle more fresh air than any other industry except the movies," an expert said. "High-speed trains would scarcely be practicable without air conditioning. If windows were open, suction would deluge passengers with dust and

BABY'S RATTLE MAKES THE ONLY RACKET ON THIS TRAIN

The Challenger has soundproof, reclining-seat coaches. Aboard are graduate nurses who prepare formulas for infant feeding, amuse the children, care for the sick, and help make passengers comfortable (page 546).

dirt; if they were closed, bad air would suffocate them."

In effect, these clublike compartments are built within a titan sealed tube of stainless steel nearly 200 feet long, rounded at the ends and jointed at two places. A Diesel power unit within the tube rockets it along the rails at 100 miles an hour or more on wheel trucks that have been rubber-insulated to lessen sound and vibration.

The inventive genius and the prolonged experiment that go into making such a carrier are bewildering.

Consider whistles and windows. The safety-glass panes of the latter are set in dumdum putty to prevent cracking. They are hermetically sealed to help keep temperature and humidity at proper levels, and between two panes is an inert gas that eliminates steam or frosting, which would hamper the passengers' view.

Inside the train the sound of the whistle is like the distant moan of a tugboat's signal heard from the top of a New York skyscraper, but it is warranted to be audible five miles; it carries ten miles or so if the wind is right.

I scanned a list of equipment for this short train: coil springs and V-belts, weather stripping, felt, copper screens, cork flooring, and composition table tops; exhaust fans, light fixtures, signal valves, paper cups, air filters, storage batteries, and other items.

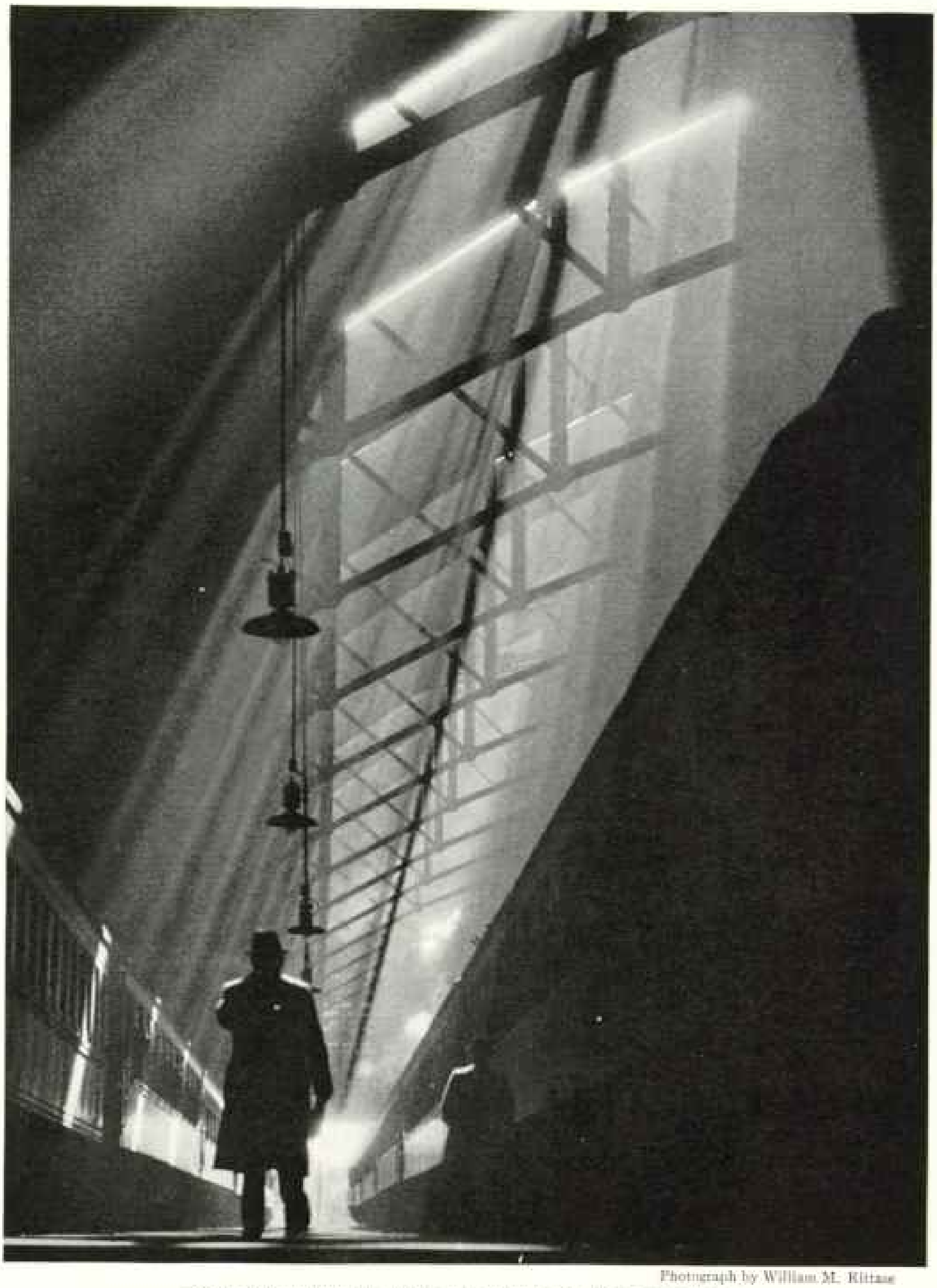
A TRAIN BUILDER'S SHOPPING LIST

"Probably you had to shop around a bit for these?"

A road official produced a requisition sheet listing 107 firms, which gives some idea of the railroads as customers and of the research required to meet their needs.

They let me ride in the control room where the motorman, an erstwhile locomotive engineer, drives the 660-horsepower Diesel engine.

"Motormen, drivers, operators, whatever you call them, all are graduates of the steam-engine school," an official explained. "Starting, stopping, running a Diesel or an electric engine is not hard to learn, but it is knowing every quirk and curve of every mile of track that counts—every switch, every grade, every crossing.



Photograph by William M. Rittase

REMBRANDT WOULD HAVE REJOICED IN SUCH LIGHTING

The vaulted shed of the historic La Salle Street Station, in Chicago, has the aspect of a cathedral. Among famous trains that leave here are the Twentieth Century Limited (see page 555), the Golden State Limited, the Rocky Mountain Limited, and the Wolverine.

"The engineman, by any name, always will be the pilot of any craft on rails."

It was much like sitting beside the driver of a sleek automobile, up there in the control room, busy windshield wipers oscillating on the half-dome of safety glass about us, gleaming instrument board at hand level, the motorman relaxed and casual, but eyes fixed on signals and track ahead.

The running was smooth as an automobile gliding over a superbly surfaced road, but the speed would have incited the most indulgent traffic policeman to instant action. Up to 75, then 80, past 90, on to 93 climbed the speedometer.

"Oh, yes, we could make well over a hundred; often do, but no need now," explained the motorman. One hand or one foot always was on the "dead-man control." Had he let go that, the power would automatically have been cut off and the emergency brakes applied.

### "SLOW DOWN," TO 90 MILES AN HOUR!

For safety's sake all railroads have "slow orders" for certain stretches. An engineer showed me one, dated May 29, 1935, which read, "Articulated trains must not *exceed* 90 miles an hour on eastward track between milepost 195 and milepost 198."

"This streamlining, is that decoration or does it help speed?"

"Below 50 miles, no. Above that, where we run most of the time, considerably. They had scale models of this train tried out in a laboratory. Tests showed that at 95 miles an hour streamlining reduced the 'drag,' or wind resistance to motion, by 47 per cent."

The only flaw in the short, pioneer Zephyrs is their capacity. Passengers grow dispirited when all space is sold out, sometimes for days in advance.

In venerable Philadelphia I saw them building the ultramodern 10-unit trains that will run from Chicago to Denver, and the 6-unit speedsters for the daily "flights" to St. Paul and Minneapolis. There, too, under construction was the Santa Fe's new 9-car Super Chief.

A Zephyr train starts out in life as a coil of stainless steel, an alloy of ordinary steel, nickel, and chromium.

The two ends of each coil are snipped off for a pulling machine, to assure its tensile strength, and for the "bend test," which may reveal various technical defects.

Piles of acceptable coils, and flat sheets, too, are card-indexed and guarded like bullion in a bank, even though they may be stacked in the open, since the elements do not corrode them.

### BOLTS OF STEEL RIBBON

I pointed to one coil of the gleaming metal, wrapped like silvery ribbon 10 inches wide in a bolt two feet thick.

"How much is that worth?"

The attendant consulted his file and quoted "$355."

Like the stone money of the island of Yap, this wealth is not very vulnerable to theft, since the coil weighed 710 pounds.

When car making starts, a mechanic requisitions coils of desired width, slips one end into the forming rolls, which shape it, and as it moves along the rolls he arc-welds the other end to a fresh coil.

A radiac stone saw clips the formed pieces to the exact fraction-inch length of specifications.

Contour machines work on other parts; curved sheathing is beaten out by hand. All these parts are numbered and thus assembled in the jig for side frames, and these sides are then swung over by cranes to be welded to center sill, floor, and roof.

Hundreds of parts are "shot-welded," and the name is appropriate, for by this time the massive metal tube looks as if it had been dented by enough bullets to fight the Battle of the Marne.

Stainless steel is held by its proponents to be of special value in train building because of its high strength in proportion to weight, and no extra thickness is needed to allow for corrosion. The roofing of a stainless-steel train is only two one-hundredths of an inch thick. Its use reduces the weight of train equipment per passenger by more than half.

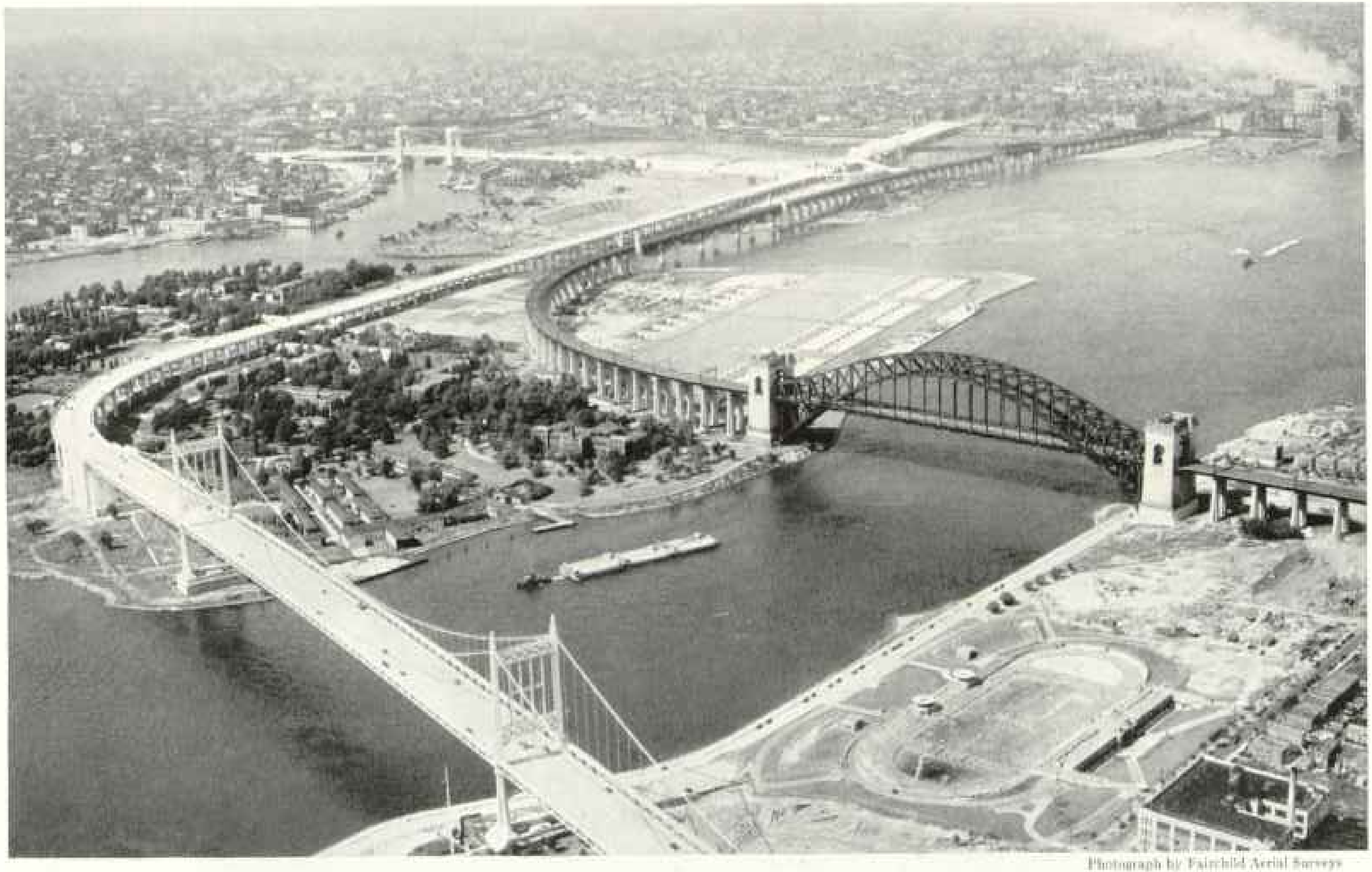
Cor-Ten and aluminum are being used for the same reason—lightening the load. It takes about a ton of train equipment to move a ton of freight, which ton of freight the railroads haul for a cent a mile. It requires from two to seven tons of train to move one passenger, and the railroads now are hauling him for 2 cents, and less, a mile.

For twenty years or more stainless steel has been used for kitchen utensils. But its structural use was limited because ordinary welding processes destroyed the very qualities which made it desirable. Not until an inventor adapted the shot-welding process could it be employed for train building.

Photograph by J. Baylor Roberts

MOST OF MANHATTAN'S FREIGHT MUST FLOAT TO TERMINALS

Some of the float bridges, such as these, have a capacity of 22 cars. The railroads' New York marine department numbers some 1,900 vessels—craft ranging from tugs and ferries to grain boats, refrigerator barges, and hoisting lighters. Now wireless telephones facilitate the operation of these harbor vessels (page 573).



Photograph by Fairchild Aerial Surveys

BY RAIL, SHIP, AND BRIDGE MAN CONQUERS THE WATER-CLEFT GEOGRAPHY OF NEW YORK CITY

Hell Gate Bridge (right) carries through trains between Washington and Boston. The new Triborough Bridge, opened in July, 1936, bears the heavy automobile traffic from Queens, Long Island (foreground), across Ward's Island and over a truss section into the Bronx (upper right), or over the vertical lift bridge from Randall's Island (upper center) across the Harlem River into Manhattan (upper left). Beneath the Hell Gate span of both bridges (foreground) is the main water channel for coastal steamers between New York and Boston.

Photograph by Ewing Galloway

A LACY STEEL BRIDGE SPANS TUNNEL TRACKS

Far beneath congested streets and under this vast concourse glide trains entering New York's Pennsylvania Station (page 583). The highest point of the four miles of station tracks is nine feet below sea level. It required 27,000 tons of steel for the 8-acre building.

Shot welding, in essence, consists of clamping piece to piece and then shooting an electric charge, exactly timed, through the pieces. To the layman it looks like nailing strips of steel by lightning bolts, only there remain no "nails," or rivets.

Attached to the welding machine that clicks along like the put-put of a motorboat is a recording device that registers on a ticker tape the effectiveness of each weld. If a weld registers offside on this tape, and thus is imperfect, the device automatically rings a bell and a foreman comes running to spot the trouble.

Except for a break beneath, where the center sill runs lengthwise, a stainless steel car literally *is* a mammoth tube. Each member—the floor, the floor beams, the side walls, the "skirts," the carlines, or "rafters"—is designed to withstand its part of strain, pull, and even collision impact.

When the train is moving, the diaphragm vestibules, the doors and the windows, are flush with the corrugated surface, thus avoiding any niches which would catch the air and defeat streamline benefits.

### CROWDS WATCH THE TRAINS GO BY

As I rode the Zephyr, the unexpected sight was the crowds.

Out West they again are coming down to way stations and crossroads to see the trains go by. They come by the thousands, in roadsters and afoot, some in Model T's; I counted five horse and buggy teams.

They gather for the silvery streak of the stainless-steel Zephyrs, for the polished angleworm dash of the "Cities" fleet, which plies from Chicago out to Portland, to Denver, to San Francisco and to Los Angeles; for the red-and-yellow splotch of the Hiawatha against Wisconsin's green meadows; for the sturdy, square-jawed "400," steaming standard locomotive defiance to Diesel and electrification speed, and the Indian-head contours of Hollywood's pet Chiefs.

"It's been ten years since I saw crowds waving to trains that didn't have the President aboard," said an eastern passenger.

At Omaha I abandoned the Burlington's Zephyr for the Union Pacific's Challenger.

"A challenge to what?" I inquired.

"A challenge to people who ride our own bus lines," replied an official of that historic railroad.

The Challenger—its name was suggested by a veteran employee—is a train of standard-size and weight day coaches, drawn

Photograph by J. Baylor Roberts

A DIESEL ENGINE WINDOW FRAMES CHICAGO'S MAMMOTH MERCHANDISE MART

Theoretically, the engineer need not look out, because an electric circuit shows green, yellow, or red lights on the panel to the left in the picture. An automatic safety control blows a whistle should he exceed the allowable speed, then cuts off the power and sets the brakes should he fail to heed the whistle warning. The device also indicates too close proximity to a train ahead or a switch set wrong. The unique 5-acre Merchandise Mart is built over tracks of the Chicago and North Western Railway. The railroad retains ownership of the area on which its tracks operate. It sold "air lots," representing possession of the space above ground occupied by the entire building, and numerous miniature ground lots necessary to sink caissons. The air was actually subdivided into lots and the diagram of this aerial real estate is filed in the office of the Recorder of Deeds of Cook County, Illinois.

by a steam locomotive, also carrying tourist sleepers. You ride it for the minimum rates, although it makes the same time between Chicago and the Coast as the crack Los Angeles Limited.

The Union Pacific had no prejudices against its own bus travel, but it believed it could carry passengers for long distances more speedily, more economically, and more comfortably on its trains. So it sent out scouts to interview hundreds of bus passengers; even the president observed them.

### WHAT THE PASSENGERS WANTED

"We found we had to do far more than meet the price of the bus ticket," an official explained. "Some said train meals cost too much. Others hesitated to go from coaches to dining cars where they might meet friends traveling Pullman. Silly, perhaps, but that was human nature as we found it.

"Certain small charges irked passengers. We would spend half a million dollars to put a train in service, then collect pennies for towels, drinking cups, pillows.

"Passengers were stranded with baggage in day coaches, with no one to help them get it off the car, and many thrifty folk balked at paying redcaps in the stations.

"Coach passengers were cramped after sitting in straight-back seats. Lights burned brightly all night long, and brakemen would call out stations throughout the night.

"Women were afraid of meeting undesirable persons in coaches. They could not get proper food, or get it cheaply, for their babies. And women were 62 per cent of our patrons.

"Every time train crews changed, each passenger was disturbed by a new conductor to punch his ticket or to demand a coupon the last ticket taker had given him."

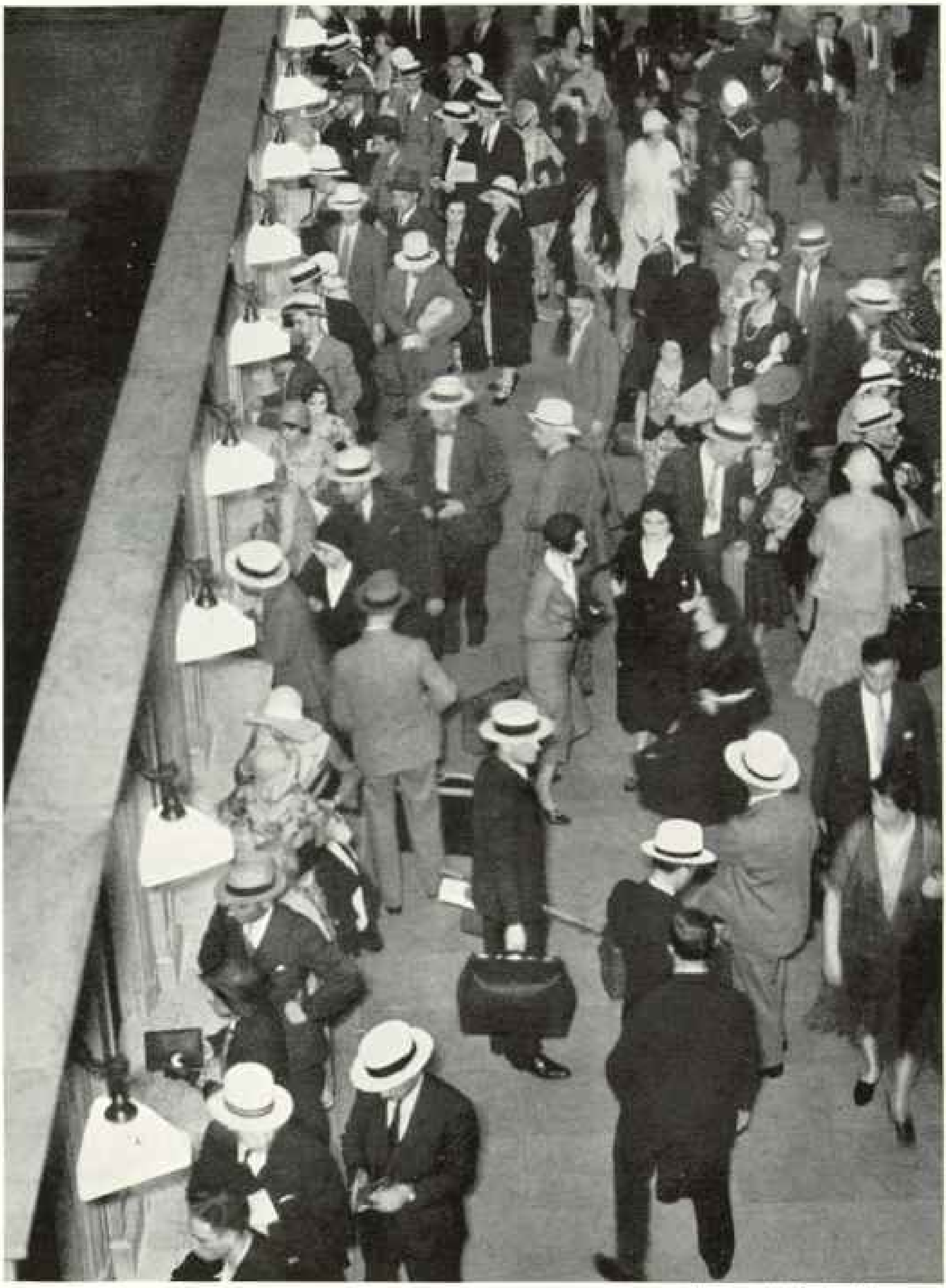

IT'S GREEK, ALSO ITALIAN, FRENCH, AND SIGN LANGUAGE TO THE LAYMAN

At this Duane Street Terminal of the Erie Railroad, in New York City, some 500 dealers attend the daily fruit auctions. There is a babel of tongues, but the bidding is largely by signals, a tilt of cigar, despite the sign, a finger to left eyebrow. When buying is brisk, the bidders jump from their seats like schoolboys playing "handies" to attract the auctioneer's attention.

Photographs by J. Baylor Roberts

BENEATH SKYSCRAPERS AND BUSY STREETS BURROW GRAND CENTRAL TRACKS

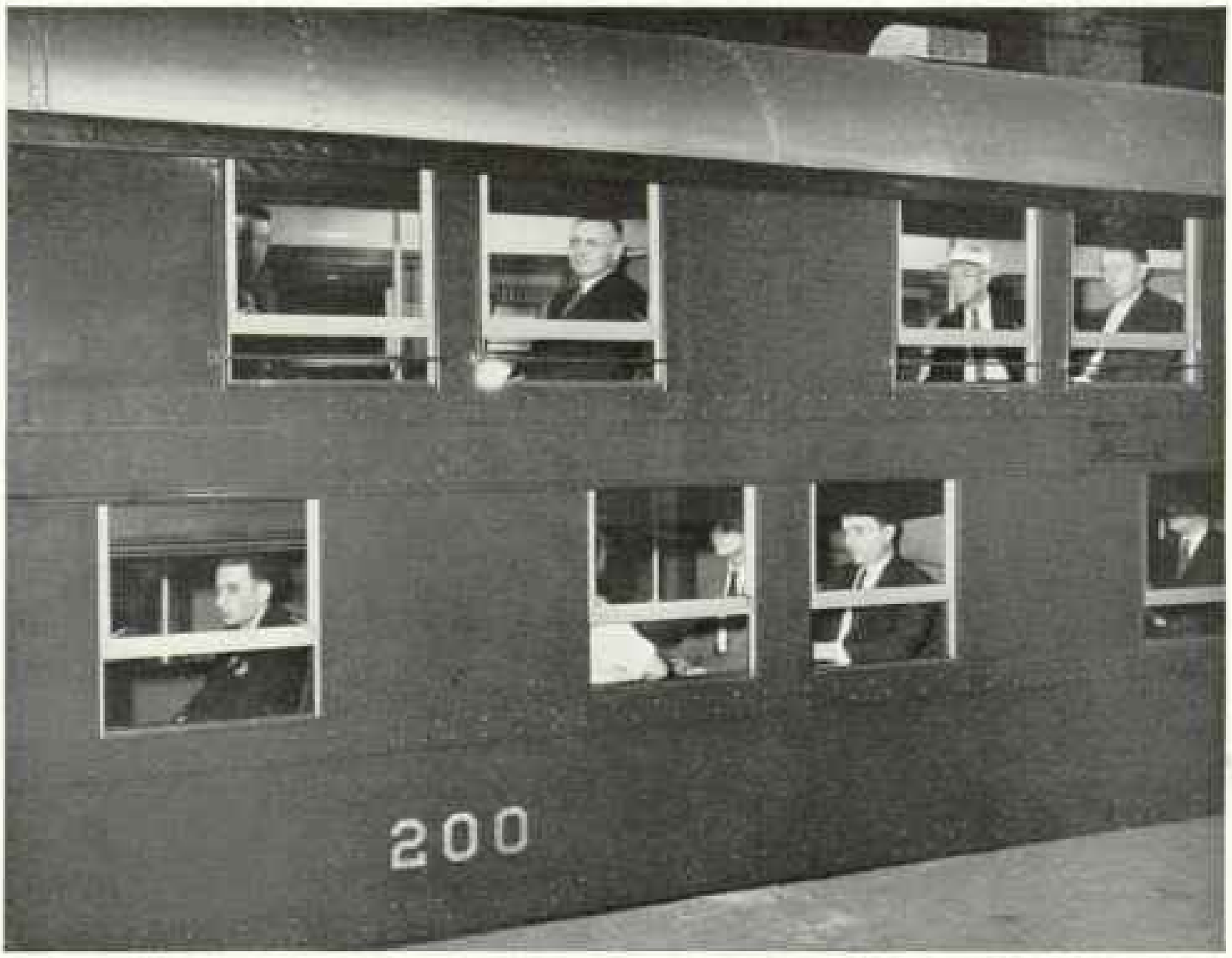
In rush hours 60 trains an hour pass over these rails to and from the platform tracks beyond the lights. The columns are some of thousands which support skyscrapers and streets above the tracks (see page 580).



Photograph by Ewing Galloway

IT TOOK 79 TICKET SELLERS TO HANDLE THE LABOR DAY CROWDS

To sister's wedding, or ailing mother's bedside, home after a hard day's work, vacation in a National Park, or quest of a job—there is constant drama in the ticket window line. Enough commuters to populate the city of Troy, New York, come and go daily during the 9 o'clock and 5 o'clock rush hours at Grand Central Terminal. The majority head direct for subways or pour through underground passages to adjacent skyscrapers (page 582).




Photograph by Ewing Galloway

A DOUBLE-DECKER FOR LONG ISLAND COMMUTERS

Clearance limitations make it impossible to place seats on two floors, as in motorbusses. Here the lower tiers are reached by a step down from the center aisle; the uppers are just as commodious. Because the car's walls are aluminum and it seats 120 passengers, as compared with 76 in the standard coach, a new "low" in weight per passenger is attained in coaches of its length.

All these and many other complaints were codified, considered, and the Challenger was born.

### PAINT AND ROAST PORK

The train's name was painted in bright colors on the exteriors of the coaches; the interiors were decorated in subdued designs. Upholstery of adjustable, individual seats varies. Two diners were refurnished, in coffee-shop style; menus offer 25-cent breakfasts and 35-cent dinners. The latter, the day I was aboard, afforded:

Roast Loin of Pork, Apple Sauce
New Potatoes in Cream
Asparagus on Toast
Hot Dinner Rolls
Coffee Tea Milk

Cooking and service were comparable to those on the usual dining car. About half the patrons give tips, the waiter told me, but he serves twice as many as on the usual runs.

When meal service is concluded, the two diners are used as club cars, for reading, writing, smoking, beverage service, or card games. As I retired, a group of college boys and girls had turned on the radio for an impromptu dance.

Normal lighting of the coaches is indirect. At 10 o'clock these lights go off, and there remain only dim blue lights and amber floor lights, enough to avoid stumbling in the aisles. But there are individual lights for late readers. Porters pass out pillows.

Tickets are collected once for all. Stations are not called; if any passenger must get off during the night he is awakened individually. Baggage is carried to the platform by a car porter and given to a redcap who must not take a tip. The road pays him.

And he won't take it. I tried it out.

Two cars, or more, behind the mail and baggage are reserved for women. Aboard


Photograph from Pictures, Inc.

"ALL ABOARD—AND YOUR FIRST SWIM TONIGHT!"

A councilor announces the glad news to boys on their way to a large New England camp, lined up under squad insignia, at Grand Central Terminal. More than 10,000 boys and girls left on special camp trains the first week in July. On one day it required 257 sleepers, parlor cars, and coaches to transport groups to 130 camps.

are stewardesses who must be trained nurses, preferably also college graduates. They give first aid, assist the aged, infirm, and young, care for children traveling alone, look after others when their parents dine or wish to rest (page 537).

There were fourteen children on half-fare tickets, and seven under five years, who were carried free, the day I was aboard.

"Yes, I have seen death on a train," a stewardess recalled. "And a baby born? Almost. But we wired ahead for an ambulance in the first town where there was a good hospital. Later the mother wrote me gratefully and enclosed a picture of the child."

She drew the snapshot from her bag.

### A MUSEUM ON WHEELS

Back from Denver to Chicago I rode the City of Denver, then in operation just one week, pioneering in luxury as the Challenger was in comfort (page 575).

Thereon one may lounge in a frontier shack, authentic reproduction of a western tavern of the post-Civil War period. From its timber rafters hang faithful prototypes of kerosene lamps; walls and ceilings are white pine boards, of rough finish and uneven width, face nailed. Men hang their hats on iron spikes.

From the Union Pacific's historic museum have been assembled rifles, horns, portraits of famous pioneers, showboat and melodrama programs, old railroad schedules, one counseling those who have cattle for shipment to have them down at the station by 10 o'clock the following Tuesday morning, and faded newspaper clippings of the General Grant period.

One may sleep in the newest type of Pullman section, which has aluminum sliding panels that operate on the principle of a rolltop desk, to give greater privacy than berth curtains. Dressing platforms and windows are provided for upper berths.

This sister of the Portland, Los Angeles, and San Francisco "City" trains is a standard-size streamliner and has twelve aluminum cars. Its two 1,200-horsepower, 16-cylinder Diesel engines enable it to make the run in 16 hours, cutting 9½ hours from previous fastest schedules.

The adaptation of the Diesel engine for train motive power, by lightening their weight and lessening vibration, is a wonder tale of American inventive genius.

The story goes that after the units of 1,200 horsepower were completed, the famous engineer who supervises this development called in his associates and said, in effect, "You boys had better be figuring on even more horsepower. These railroads are insatiable. Give 'em 1,200 and in a few months they will be wanting 2,400."

That afternoon came a telephone call from the Santa Fe.

"Can you build us Diesel units that will give 3,600 horsepower to run our new Super Chief on a 39-hour schedule between Chicago and Los Angeles? How soon can you deliver the job?"

The order was accepted; the units are nearly completed.

### RAILROADS AND RESEARCH

The railroads have been charged with being asleep at the research switch. Larger railroads have research and testing staffs of their own. In addition, all join in a research program carried on jointly through the Association of American Railroads. The railroads have paid more than two million dollars to study air braking alone. Recently $125,000 was appropriated for testing new types of draft gears.

To provide ready reference for their laboratory engineers, the railroads have compiled a "Brief Digest of Research and Experimentation," which merely lists and concisely describes each project. The résumé is printed in two book-size volumes of 730 pages, and indexes 488 items of research in laboratory, shop, and on rail.

One extensive project includes 70 subjects pertaining to locomotives, 15 to signals, 65 to freight cars, 38 to passenger cars, and 84 to other lines of inquiry.

All new equipment must gear in with that already in use. A new car, a new brake, or a new coupling device must permit the car to be operated on practically all existing track. If it doesn't, national transportation will be slowed up as badly as it was in the bygone days of various gauges for tracks.

Railroads purchase more different kinds of products than any other industry. They challenge experts of factory, farm, and mine to meet their special requirements.

On railroad payrolls are listed paint chemists, radio engineers, animal-husbandry experts, illumination specialists, artists, chefs, surgeons, printers, produce buyers, architects, writers, seamstresses, butchers, geologists.

### BUYING FREIGHT CARS AND LEAD PENCILS

For one example, the Pennsylvania Railroad, in 1936, is buying more than 100,000 different kinds and sizes of material. Specification sheets fill a small library.

That road is spending $25,000,000 this year for 10,000 new freight cars and $3,610 for lead pencils. The freight-car order will give a year's work to 2,000 men direct and to about 6,000 more in the basic industries involved.

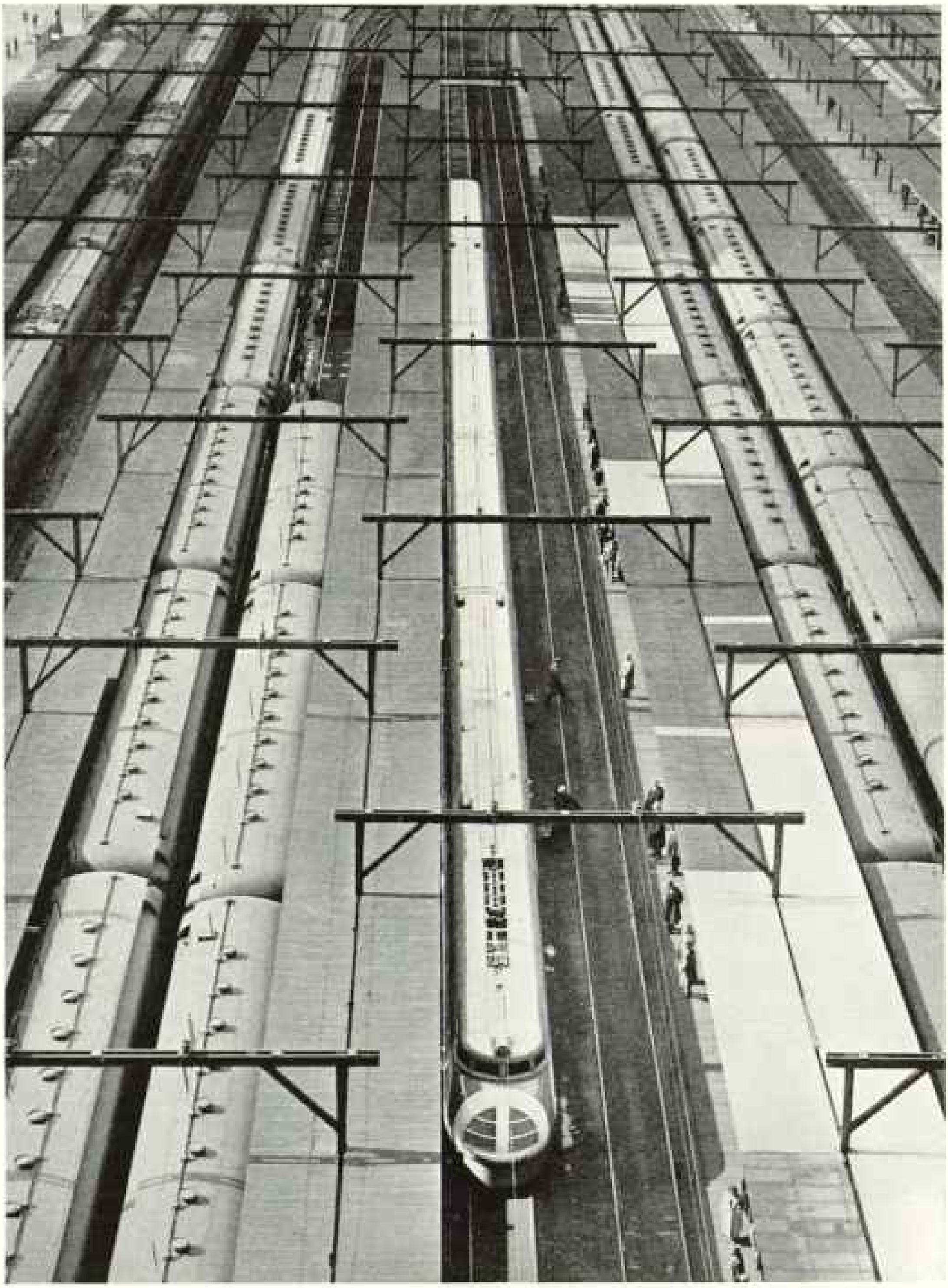
Nearly half a million dollars will be expended for printed forms, a million and a half dollars for silver, dishes, and utensils for dining cars, $7,248 for paper towels. When the road suggests that you save your timetable for reference, it is trying to keep within its $132,960 allotment for that item.

Having ridden behind steam locomotives and Diesel engines, the rail explorer also must experience the 656-mile electrified ride over four mountain ranges on the Milwaukee's Olympian, or speed between Washington, D. C., and New York on the Pennsylvania's Congressional.

Just 100 years ago the news of his father's death did not reach John Quincy Adams in Washington, D. C., for five days. Special arrangements were made to speed the statesman home; they whisked him as far as New York in 45 hours.

"He made six changes of conveyance en route," the historian relates. "His own carriage took him to Baltimore, a steamboat from Baltimore to Frenchtown to the head of Chesapeake Bay, a stagecoach to New Castle, Delaware, a boat from that place to Philadelphia; a stage from thence to New Brunswick, at which place he took a steamboat to New York City."

Today Mr. Adams could buy a ticket for $4.55 and leave any hour between dawn and midnight to ride the 226½ miles to New York in less than four hours!



A MODERN WESTERN FLYER VISITS HISTORIC BROAD STREET STATION

The Union Pacific's Diesel-engine, streamlined City of Portland was viewed by thousands at Philadelphia and at other terminals on its exhibition tour. The umbrella platform shelters were built when the vast arched shed burned down. Now this venerable station, with its elevated approach, often called the "Chinese Wall," is to be removed as part of the improvements already begun with the erection of the Pennsylvania's monumental main passenger station at Thirtieth Street.

Photograph by Robert Dudley Smith

PASSENGERS ADMIRE WILD FLOWERS ON AN "OFF THE BEATEN TRACK" EXCURSION

This special took more than 500 people on a 270-mile tour out of Philadelphia into the mountains of eastern Pennsylvania and down the Susquehanna into Maryland. "Hiker Trains," "Bicycle Excursions," "Mystery Trips," and "Fisherman's Specials" are a few types of week-end runs.

Photograph by J. Baylor Roberts

THE POWER DIRECTOR IS A KEY MAN OF ELECTRIFIED LINES

In the control room at the Thirtieth Street Pennsylvania Station in Philadelphia miniature boards show the layout of trolley circuits on each track. White, green, and red lights located at the ends of each trolley section and on either side of a power switch tell what circuits are in service.

Photograph by J. Baylor Roberts

HERE TRAINS, STREETCARS, BUSSES, AND SUBWAYS CONVERGE

Four kinds of transportation enter Newark's new Pennsylvania Station on four levels. City transit lines take to a subway, while the intercity trains from downtown New York, via the Hudson tubes, will emerge on elevated tracks still under construction on the left. Busses and taxicabs arrive on surface level. Through trains pass under the long shed on a fourth level. Escalators convey travelers to the covered passageway across the roof.


Photograph by J. Baylor Roberts

TRAIN AHOY! AND A "WEST SIDE COWBOY" AHEAD

On sectors of Tenth Avenue riders go ahead of freight trains, waving red flags. Since 1849 a city ordinance has compelled this safety measure, but the "forty-niners" soon will disappear. Already skyscraper warehouses stand like top-heavy skeletons where lower stories have been cut away around the supports to make way for new tracks (see page 563).

To enable any citizen to do this, the railroads built in Washington a terminal costing $16,308,277.01 (the one cent on the official figure attests the statistical exactitude of railroads); the Pennsylvania has bored tunnels under Baltimore costing $7,500,000; has spent $25,000,000 for a new station and tracks to facilitate his ride over and around parts of Philadelphia; has dug deep beneath the Hudson River and East River a 7-mile tube and erected a world-famous station in New York, which entire improvement cost $125,000,000.

Of course, these are only a few major items; the complete accounting to make possible this one 226-mile run at high speed, safety, and comfort would have to include costs of trains, locomotives, rights of way, roadbed, and maintenance.

Then the Pennsylvania spent $100,000,000 for the electrification of its line between Washington and New York.

Even had the knowledge been available in John Quincy Adams's time, the entire national debt of 1826 would not have been enough to defray the cost of electrification.

The Pennsylvania likes to talk of "fleets of trains" which give frequent, dependable service. But one must ride on some train, so let us consider the Congressional.

Legislation has been framed on that train, friends meet friends in its dining car and lounge. They have to talk faster now, because the time has been cut to 3 hours and 35 minutes; soon it will be 3½ hours.

The power already is there, in its mammoth electric engines. Increasing speed

FREIGHT TRACKS PIERCE BUT NEVER JAR THE BELL TELEPHONE LABORATORIES

Piles sunk in soft mud support the building in New York City, but the tracks rest on concrete piers that go down to bedrock, 30 or 40 feet deeper. Columns supporting the tracks also rest on pads of lead and asbestos. The elevated structure forms the ceiling of one floor of the building, but is not connected directly to the walls. A flange on the track structure is dipped into a trough containing heavy oil. This provides a weather-tight closure without any solid contact between tracks and building.

Photograph from W. W. Bates

NO LONGER CAN YOU ALWAYS COUNT THE CLICKS OF RAIL JOINTS AND TELL TRAIN SPEED

Forty-two flatcars start from Schenectady with a 1,560-foot continuous rail to be placed on the Delaware and Hudson lines. After unloading, it will be welded to similar lengths to make mile-long sections of track. Elimination of joints smooths rides for passengers, reduces maintenance of tracks and trains; and does away with bonding for signal circuits.

waits on the work of further banking its tracks, like the automobile speedway at Indianapolis. One rail may be six inches higher than the other along the arcs of its broad curves; this rise must begin a mile or so back of the curve.

Its electric locomotive, one of 58 of the new GG-1 type, equals the weight of 164 Ford V8 Sedans, and if it should stand on its hind end its bulbous nose would rise higher than a 7-story building.

It rides on 12 driving wheels and 8 more wheels on the other trucks, 20 in all; and a 152-pound track (152 pounds to the yard), heaviest yet made, is being laid to withstand that load and speed.

Science again outstrips mythology in the person of a modest engineering Jove who, from a Philadelphia control room, regulates the flow of electricity along this electrified route (page 550).

From seven power stations flow 132,000 volts to transmission lines. Every ten miles there is a station that steps down that voltage to 12,000 for the trolleys that make contact with the pantographs of the engines. A transformer in the engines cuts down the voltage to 1,400 and the engineer regulates that power by a master controller operated by only 32 volts.

Riding comfortably through the Baltimore tunnels, the engineer recalled how engine crews used to provide themselves with buckets of water and sponges to protect their lungs from the fumes of smoke and gases of steam-engine days.

The aforementioned crack trains illustrate, but by no means complete, the picture of new-type passenger travel.

### "RUBBER HEELS" ON THE ROYAL BLUE

On the Baltimore and Ohio's Royal Blue, twin of the Alton's Abraham Lincoln, one may sit at a lunch counter for a hasty snack (page 580), eat in a luxurious diner, read in a modernistic lounge car, or watch the landscape go by from a glass-inclosed observation car with no rear platform to obstruct the view.

The veteran president of the B. and O.

HERE IS ONE WAY THE RAILROADS SAVE MONEY

This skilled "burner" with an acetylene torch attacks a pile of discarded equipment in the Pennsylvania's reclamation yards at Conway, near Pittsburgh (page 576). Some parts will be repaired and used again, others will be assorted and sold as scrap.

Photographs by J. Baylor Roberts

"STOP. START. SPEED UP. PUT ON YOUR BRAKES"

There is no guesswork now when a railroad buys a locomotive. A dynamometer car attached to a train puts new engines through all their paces, and magnetically operated instruments record performance on such a table as this on a Norfolk and Western testing car. These instruments chart time, speed, coal fired, pull on grades, air-pump strokes, and many other operations (page 578).

Photograph by J. Baylor Roberts

A TEEMING CITY WITHIN A CITY

Skyscraper office buildings and hotels tower above, while stately Park Avenue and crosstown streets traverse the "platform" that spreads 25 blocks north of Grand Central Terminal. This platform rests on piers and columns between the tracks below, where some 600 trains arrive and depart daily (see page 580). In this 48-acre area over the tracks 140,000 people live or work. Around the station, left to right, are the Yale Club, the New York Central Building, a corner of the Waldorf-Astoria Hotel, the Graybar Building, and Hotel Commodore. All these, and others, are connected by underground passages with the station.

dryly remarked that "All this talk was going around about riding on rubber, so we cushioned the Royal Blue with 106 pieces of rubber."

Asked about building new locomotives, he replied with a metaphor of the maple sugar belt, "No, this year we are just sugaring off some of the old ones.

"As you go out," he concluded, "don't forget to look at the sign by the door. It means you, too. Then read this card."

The sign said "Suggestions always are in order."

The card was a typed memorandum which told with Coolidgelike brevity the story of the esprit de corps that road has built up among its employees and its president, who once was a locomotive engineer. It was headed "Summary of Suggestions Received and Discussed at Cooperative Committee Meetings, Jan. 1925 to date." It tabulated: "Number meetings held, 1,113. Suggestions rec'd and discussed, 8,432. Suggestions adopted 5,718. Dropped, considered impractical, 1,909."

The remainder still are pending.

### CHINA, RECIPES, AND WHAT TO WEAR

An important B. and O. official is its Engineer of Service—a woman who originally was a bridge builder. Her only "office" is aboard trains; her duty is to keep riding, on her own and other lines, and make suggestions.

Now the road has women passenger agents. They join women's clubs and handle women's conventions. They answer questions no mere man could solve: "What shall I wear now in Florida?"—"How can I arrange for proper feeding of my children on the way to Chicago?"

The Northern Pacific's North Coast Limited and the Great Northern's Empire Builder carry on the steam tradition on their long hauls. The Boston and Maine, with its Flying Yankee, and the New York, New Haven and Hartford, with its Comet, are demonstrating the Diesel-drawn, streamline principle in New England. The Rebel is doing the same in the South on the Gulf, Mobile and Northern.

Ultramodern in its streamlining, its movable furniture and costly fabrics, its "electric eye" operating the dining car door, and its floodlighted engine as it speeds through the night, is the New York Central's Mercury (see page 588).

When one rides the new, luxurious trains of a score of railroads, making the highest schedule speed yet attained, it is not hard to believe that some of them cost a million dollars or more.

Does it pay?

The answers are affirmative, but the reasons are different, in the East and in the West.

"Our average passenger haul is 391 miles, as compared with 61 miles on a large eastern road, or 37 miles on one of the Middle West roads," said an official of the Union Pacific. "We can afford to go after passengers, as does a steamship company."

"Our tracks from New York to Philadelphia are the busiest in the world," said an official of the Pennsylvania. "The whole New York-Washington route is highly congested. Speeding up trains, running more trains and longer trains, is the equivalent of building more tracks. It cost less to electrify than to buy expensive rights of way and increase trackage."

In all areas it must be considered that a railroad cannot expand or contract its passenger service proportionately to the patronage. Scheduled trains must run, the mail must go through, and whether they run full or half empty may be the difference between profit and loss on the operation.

Ten years ago one ate lobster in Baltimore or Washington with some trepidation; fresh berries and melons from Maryland and Georgia might be wilted by the time they reached Buffalo, Pittsburgh, and other inland cities.

Now a train loads lobsters from the boats at Boston's wharves into special tank cars and delivers them to Philadelphia, Baltimore, and Washington next morning (page 579). Refrigerated freight trains speed nightly from Baltimore and Washington with fruit, oysters, and vegetables over a 450-mile radius and more to the north and west.

At Altoona I saw them building a new type of car, with aerated tanks, to haul fresh fish from the Great Lakes to Philadelphia.

### FREIGHT, AND YOUR DINNER TABLE

This introduces the portentous question of freight, which is considerably more important to the railroads, also to the citizen, than passenger travel.

The new fast passenger trains are the most spectacular advances in railroading; the faster freights, and the improvement in handling freight shipments, are far more fundamental.

If all the railroad trackage in the United States were laid down in a vast continental griditon, like the streets of Philadelphia or the State highways of Indiana, each line would be only 14.29 miles from the other. Nobody could live more than 7.15 miles from a railroad.

That simple fact was all-important in the population spread of our country.

Never before in the history of the world, or anywhere else in the world today, has been developed such an extensive network of rail transportation.

Everywhere else, except in a western fraction of Europe, dense populations cluster along river courses—along the Yangtze, the Nile, the Ganges today, as they have done for thousands of years; or they settle near the sea, as they did on the peninsulas we now call Greece, Italy, Spain, Denmark, and the islands of Great Britain and Japan.

In the vast expanse of the United States are populated places many miles from navigable water. Railroads peopled and still sustain some areas which otherwise might be as thinly settled as the fringes of the Sahara or the Gobi.

Without railroads, how could there be cities where Denver, Indianapolis, Dallas, Atlanta, Oklahoma City, Dayton, and many other centers now stand?

Even that is not the whole story. London, for example, looks to ships that go

WHERE PRESIDENTS, KINGS, AND INAUGURAL CROWDS ARRIVE

Washington's Union Station, facing the United States Capitol, has a State Suite, which serves as a waiting room for the President and as reception hall for monarchs and other dignitaries. Into its concourse, nearly as large as those of the Grand Central and Pennsylvania Stations in New York City combined, could crowd the entire Standing Army of the United States. Adjoining it is the Capital's City Post Office and, beyond that, is the mammoth Government Printing Office, Uncle Sam's publishing house where 65,000 different Federal publications are carried in stock. All-time best seller is one on infant care.

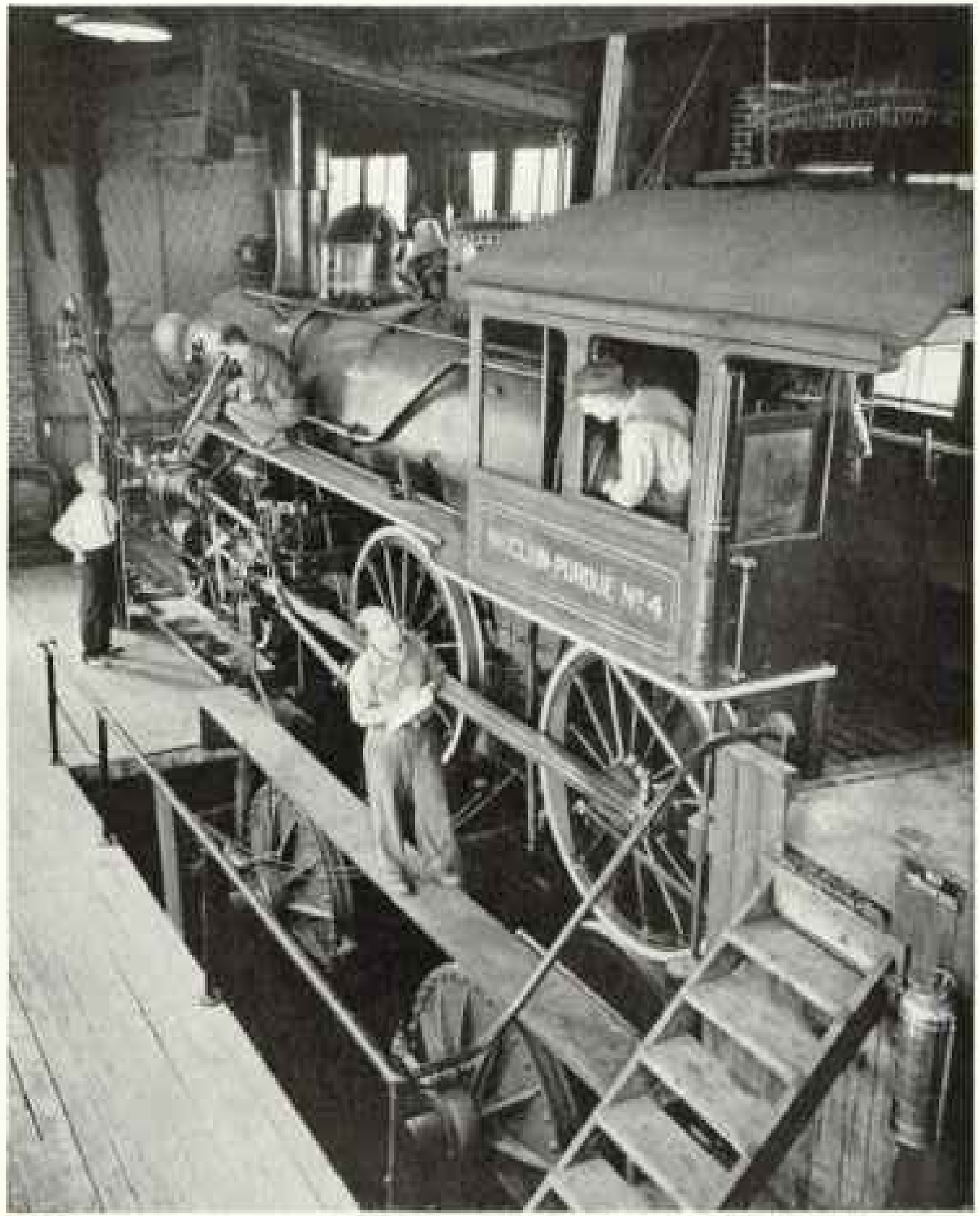
Photograph by Fairchild Aerial Surveys

FERRIES, CAR FLOATS, OCEAN LINERS, TUNNELS BENEATH THE RIVER BED, APPROACH A TRAFFIC HONEYCOMB

This cluttered portion of the Jersey City freight yards and Hoboken Terminal of the Lackawanna Railroad is opposite the Canal Street section of Manhattan. To the right is the Ferry Station. The Erie Railroad's projecting pier at the left is used by the Dollar Steamship Lines. To the extreme left are the Erie's Jersey City yards and beyond those tracks is the entrance plaza of the Holland Tunnel. The Erie is a major carrier of California citrus fruits (page 572).

AN "X RAY ON WHEELS" DETECTS "RAIL CANCER"

Rails develop internal fissures invisible to the inspector's eye. In past years these were frequent causes of derailment. Now railroads employ Sperry detector cars to check these defects. While the car runs, brushes contact the rails and record imperfections by electrical impulses. These impulses are amplified to operate the pen which here is marking the record tape, and also to spray white paint on the rail at the defective spot.



Photograph by J. Baylor Roberts

PULLING AN IMAGINARY LOAD THAT GOES NOWHERE

This test-plant locomotive at Purdue University is "running" on revolving wheels, visible below, and the "pull" is controlled by the large, low wheels beneath the platform where the man stands. Purdue was a pioneer in establishing a locomotive testing plant and here seniors and graduate students of railway engineering problems do laboratory work. Forty years ago the University first experimented with wind resistance and streamlining.

Photograph by Theodore Horydczak

CHOKE THIS BOTTLENECK AND CITIES NORTH OF WASHINGTON WOULD GO ON SHORT RATIONS OF FRUITS AND VEGETABLES

Potomac Yards, at Alexandria, Virginia, form the funnel of Atlantic seaboard rail freight traffic. There are 88 miles of tracks in this area—tracks for receiving, for classifying, and for distributing freight cars in the north-south movement of five railroads. Humps, retarders, and inspection pits (page 576) facilitate the distribution of the cars into remade trains. In the busy perishable season more than 4,000 cars are handled here every 24 hours (page 563).

Photograph by J. Baylor Roberts

THERE ARE 50 FEET OF "TRACK" IN THIS INFORMATION BUREAU

The head of the Chicago Union Station's question office also is an inventor. Files mounted on roller-bearing wheels run on miniature rails. Revolving tables, wastebaskets with tariff schedules on their sides, "flip-flop" files that can be used by clerks sitting opposite each other, are other of his devices for speeding up the right answers. Maps, charts, and blackboards operate by pulleys, and red, yellow, and white chalk further clarify intricate schedules. One file shows 5,000 train and sleeping-car fares from Chicago to points in every State and into Canada.

down to the sea to bring her millions food, raw materials and supplies, and to carry her products to world markets.

But New York, Los Angeles, Chicago, San Francisco, and other American ports depend largely upon railroads to haul from our own interior their daily bread and eggs, fruits, spinach, timber and coal, and to distribute inland the bulk of their manufactured goods.

Western Europe connects its deep sea indentations and interlocks its rivers with canals. In the United States the distances were too long, the mountains too high, to get far with building canals.

### THE RACE OF RAIL AND CANAL

The race of rail and canal began even. The Ohio River was the goal. On the same day of the same year, 108 years ago, work was started on the Chesapeake and Ohio Canal, from Georgetown, D. C. (now a part of Washington), and on the Baltimore and Ohio Railroad, in Baltimore.

On July 4, 1828, just 52 years after he had affixed his bold signature to the Declaration of Independence, Charles Carroll, of Carrollton, Maryland, then only survivor of the Signers, laid the first stone of the new railroad.

"Just a crazy dream," said most people.

Certainly no one dreamed that railroads were to become to the United States what ships are to the British Empire, coolies to China, caravans to the Near East: the essential, but swifter and cheaper transport, to feed, clothe, and supply the people.

### A YARD 13 MILES LONG

The New York Central System handles more freight than all the railways of Great Britain and France.

If you would see how an American city is fed and supplied, visit that road's West Side Freight Yard in New York.

The "yard" is 13 miles long, extending from Spuyten Duyvil to lower Manhattan. If all its tracks and sidings were laid in a single line, you could ride on it from New York to Trenton, New Jersey.


Photograph by J. Baylor Roberts

FROM ELEVATED PLATFORMS CARLOADS OF PERISHABLES ARE RE-ICED ON THEIR SWIFT WAY TO CITY TABLES

On one summer day it required 1,200 tons of ice for fruits and vegetables in Potomac Yards, near Alexandria, Virginia. Oranges and grapes from Florida, cantaloupes from the Carolinas, apples from Virginia, peaches and watermelons from Georgia—all pass here. Florida also supplies the bulk of lettuce, celery, bean, beet, and pea shipments. Upon the summit of Arlington Ridge, overlooking the Potomac, is the George Washington Masonic National Memorial, visible from many parts of Washington, D. C. (page 561).

For fifteen blocks north of 60th Street children romp and adults stroll in 32 acres of park rising from the banks of the Hudson over its tracks.

More recent improvements at West Side Yard involved the removal of 640 buildings and the purchase of some 350 separate parcels of land. The city relocated two schools, and the railroad had to build a new church on another site for one congregation.

South of 30th Street the tracks go "elevated." They take to viaducts and then spread out to enter the second floor of St. John's Park Terminal, new freight warehouse that covers three large city blocks. There are 21,000 tons of steel in that structure.

Trailer trucks cling like leeches in long rows to the undercover platforms of the street level, resting on hind wheels and a support until a tractor hooks under their forward end and hauls them away.

More than 150 trucks can load and unload there at a time, and by the tractor method each becomes a miniature warehouse, thus avoiding the tying up of motive power until the vehicle is ready to move.

On an average, not overbusy day, through this one station passed 72 tons of butter, 16 tons of cheese, 45 tons of eggs, 20 tons of canned goods, and 22 tons of poultry. Hundreds of miscellaneous items, from brooms to newsprint paper, aggregated 592 tons.

### FREIGHT SIDING AROMAS A LESSON IN GEOGRAPHY

The West Side tracks weave in and out of huge warehouses, factories, a biscuit bakery, a refrigerating plant, and a stockyard structure. Sidings span busy streets from one unit to another of several plants. Along this 13-mile yard department store warehouses, manufacturers, automobile assembly plants—all have literal "back door delivery" from car to floor or shelf.

Photograph by William M. Rittase

STEAM UP, TENDERS FILLED, READY TO GO!

Locomotives, serviced at the West Philadelphia enginehouse of the Pennsylvania Railroad, will proceed to Paoli, 19 miles west on the main line, present terminus of the electrified zone.

Other sidings run out to docks and piers. I saw them launching speedboats direct from rail to water, and handling cargoes consigned to Rotterdam, Valparaiso, Singapore, and Canton.

Riding the front platform of a Diesel switching engine, I caught stray whiffs of Florida oranges, Hawaiian pineapples, Brazilian coffee, and vinegar from Wisconsin—two tank cars of vinegar, sire of how many orders of pickled pigs' feet or platters of salad?

Two carloads of ripe tomatoes, and three of head lettuce, track to track, awaited culinary assembly.

Pungent odors of onions there were, too, of a tarred rope shipment, of scented soap, and of fresh fish. Shut your eyes there and your nostrils report the geography of the railroads' amazing distribution of food and goods.

The most odorous, but among the most immaculate, series of sidings are those assigned to poultry cars. They come in by the dozens daily—a hundred and more around Thanksgiving—these cars with their barnyard cackle cargoes, the fowls in trays like filing cabinets behind screen sides. In the center is cabin space for an attendant, the "poultry porter," who serves them food and water in troughs that run alongside the tiers of trays.

"What becomes of the eggs laid en route?"

It was the wrong question. There was intimation that the shippers wink at the attendants' "rake-off" on selling them here and there along the way, perhaps as a tip for a stuffy, uncomfortable job.

Frenzied bidding goes on around these poultry sidings of a morning. Before a single hen or turkey is removed, it must be inspected by a Government agent to see that its crop is not overfull and that it otherwise is in prime condition for a roast or fry.

Photograph by J. Baylor Roberts

SWING HIGH, SWING LOW, BUT DON'T JAR THE CONTENTS:

In the busy Enola Yards, near Harrisburg, Pennsylvania (page 575), are seven tracks over which moves a bridge that carries traveling cranes for transfer of containers. On one busy day this apparatus swung 673 of these huge metal boxes from car to car. The containers effect a major economy in handling shipments of less than carload lots.

Segregated also is another freight yard "spotless town"—that for handling milk. Bulk milk for dairies, chain restaurants, and ice cream makers now may be shipped, like petroleum, in tankers. One type has a 2,100-gallon truck tank, its hind wheels locked to a flat-bottom car, its front resting on supports in transit. When the car arrives, this trailer is swung sidewise on a swivel, a tractor is attached under the front end, and it is hauled away.

Other types have siphons which drain the fluid from their stainless containers.

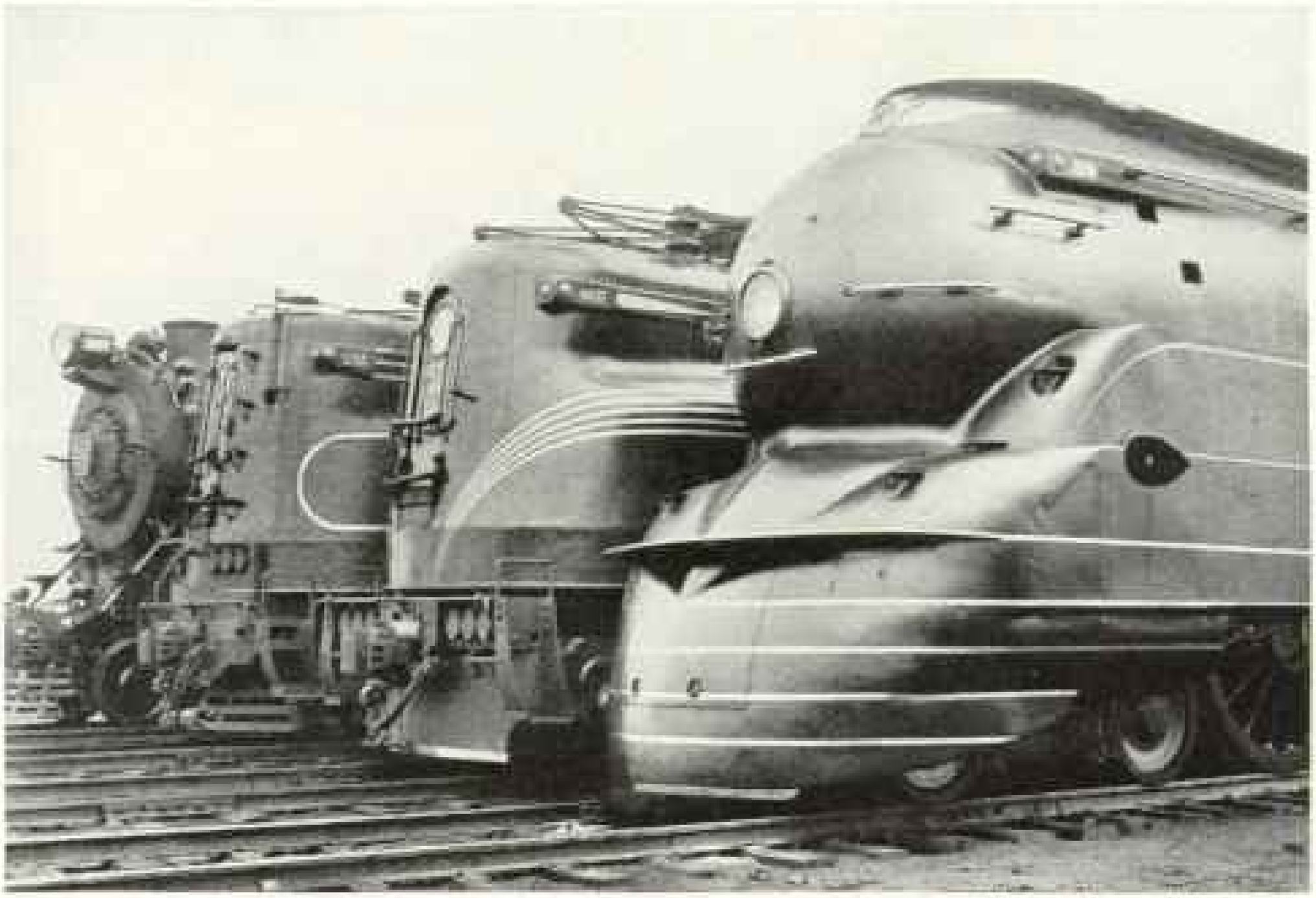
Tracks are cleared, as for a passenger express, when the Merchandiser trains, Twentieth Centuries of the New York Central's 300 scheduled freighters, come or go on their overnight runs between New York and Buffalo. To make the 460 miles in 10½ hours they have to speed 65 miles an hour on some stretches.

Freight cars on such runs now are mounted on passenger-car trucks. Their engines scoop water on the fly from track pans.

Among railroad men you will hear much more about the Merchandisers, the Banana Specials, the Frisco Flash, the Potato Special, or the Blue Streak than you will about the famous passenger trains.

The Speed Witch of the Pennsylvania and New Haven roads plies between Baltimore and Boston in 16 hours. The B. and O. runs its banana train from Baltimore to Cleveland in 14½ hours. The Illinois Central schedules its Panama Dispatch, laden with tropical imports at New Orleans, to Chicago in 41 hours. The Katy Rocket lands Texas grapefruit and persimmons (now a commercial crop) in St. Louis in 34 hours.

Speeding up perishables is only part of



Photograph from Wide World

"THEY HAVEN'T DONE RIGHT BY OUR COWCATCHER"

This is the complaint of a veteran railroad man who laments the evolution of the standard steam locomotive (left) through the successive stages of streamlined electric, heavy-duty streamlined electric to the rounded prow of the new steam locomotive, on the right. At maximum speed streamlining saves nearly 300 horsepower on these Pennsylvania engines.

the advantage. The merchant profits by carrying smaller stocks, saves on storage, and can give quicker and more flexible service.

Recently a customer entered a Boston store at 4 o'clock to buy a rug. The only one in stock that fitted the color scheme of his room was damaged.

"If you like that rug, I will have a perfect one delivered to your home tomorrow morning," promised the salesman.

"If there's another to be had, tell me where and I'll drive out to get it."

"You will scarcely wish to do that, sir. I will wire our New York warehouse, they will put it on the night freight, and I'll have it out to you by 11 o'clock tomorrow morning."

And he did!

### PICKUP AND DELIVERY

A vast extension of faster freight service has been accomplished by collection and delivery. If a peach grower of Georgia, or a hardware manufacturer of New England, a butter and egg shipper of Wisconsin, or a sheep raiser in Utah wishes to ship even a small consignment, he has only to call a freight station. A truck will collect his parcel, another truck will deliver it to consignee.

Carload-lot shippers are known to every freight agent and their business is stable. But in the less than carload lots, the occasional individual consignments, railroads have found a new field for freight expansion. Railroad contracts with trucking companies for performing this service now form no mean item of the latter's business.

To help handle these small shipments the container car was devised (page 565). Five or six huge steel boxes that look like magnified office safes are mounted on flat cars. If an entire consignment is for one shipper, a crane swings it from car to truck, the recipient unpacks the goods and returns the container.

Cattle from the plains, timber from the forests, coal from the mines, fruit from the orchards, fish from the sea, vegetables from gardens everywhere—how does it all get here, one wonders, as he scans the

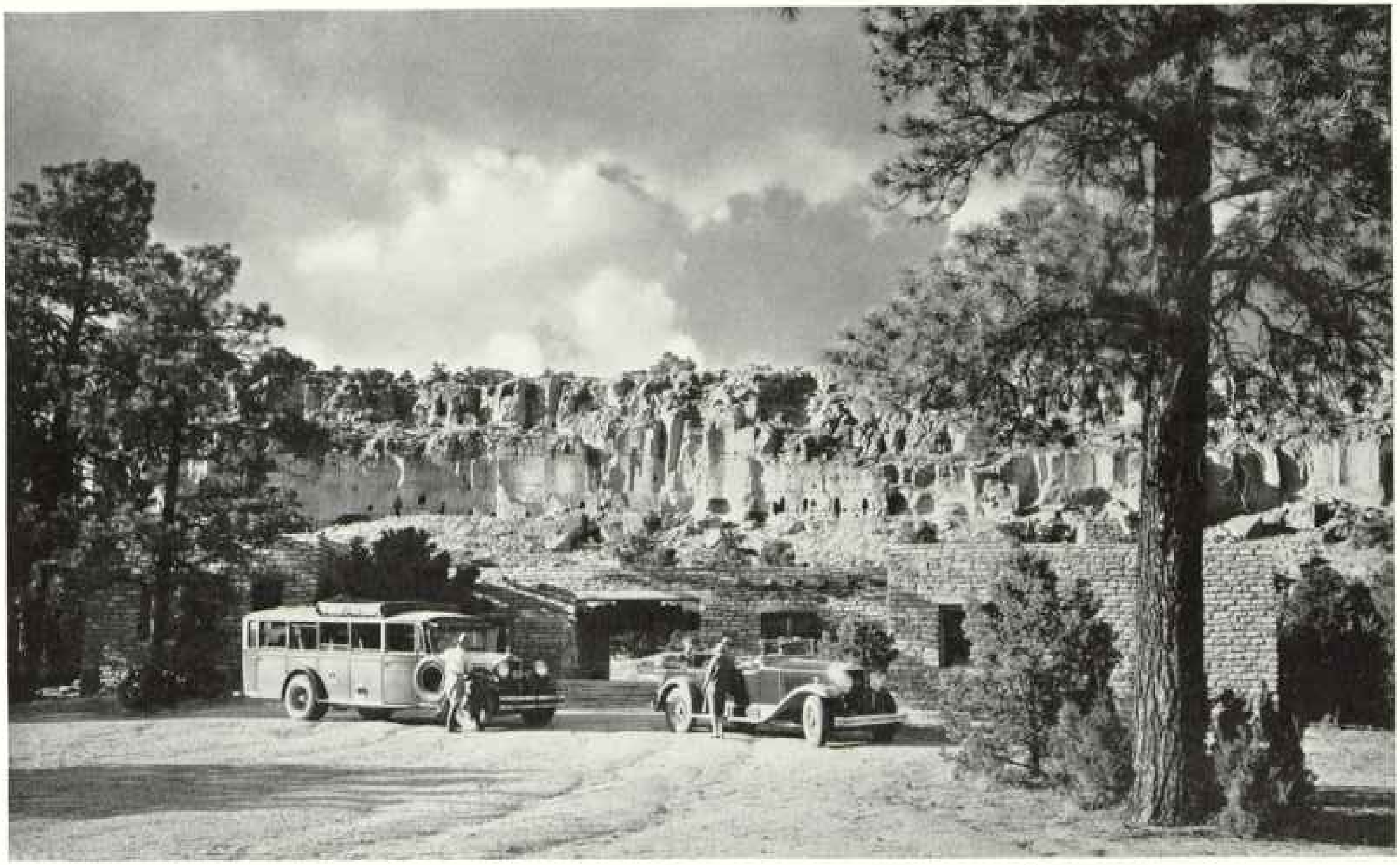

Photograph by J. Baylor Roberts

"CAN I CARRY MY CANARY WITH ME ON A DAY COACH?"

It takes 24 people to answer 3,600 questions a day at the information booths and telephone inquiry room of Chicago's Union Station (page 562). Beneath the serene concourse and waiting rooms are electric, carpenter, and machine shops, an art studio, and kitchens that make 200 gallons of ice cream a day, bake 600 to 700 pies each morning, and wash 20,000 dishes every 24 hours. Mostly unseen by passenger eyes some 100,000 mail pouches are handled daily in this station.

"OLD MAN RIVER" IS CONQUERED AGAIN

A Southern Pacific passenger train is first to cross the new cantilever bridge over the Mississippi River near New Orleans. The entire structure is 4.4 miles long and rises 135 feet above high water. Its central pier from top to bottom of its foundation far below the water is equivalent to the height of a 32-story building.



A HOTEL WAS BUILT AND COLLEGE WOMEN TRAINED AS COURIERS FOR THE SANTA FE'S INDIAN DETOURS

Coaches and limousines await passengers who would stop over from one to 30 days to explore the Spanish and Indian country of northern New Mexico. Here, hollowed from soft rock of Puye Cliff, some 35 miles northwest of Santa Fe, are the prehistoric dwellings once occupied by the remote ancestors of the Santa Clara Indians, whose present-day pueblo is only a few miles distant. The resthouse in the foreground is built of stones from the enormous 1,000-room pueblo ruins above.

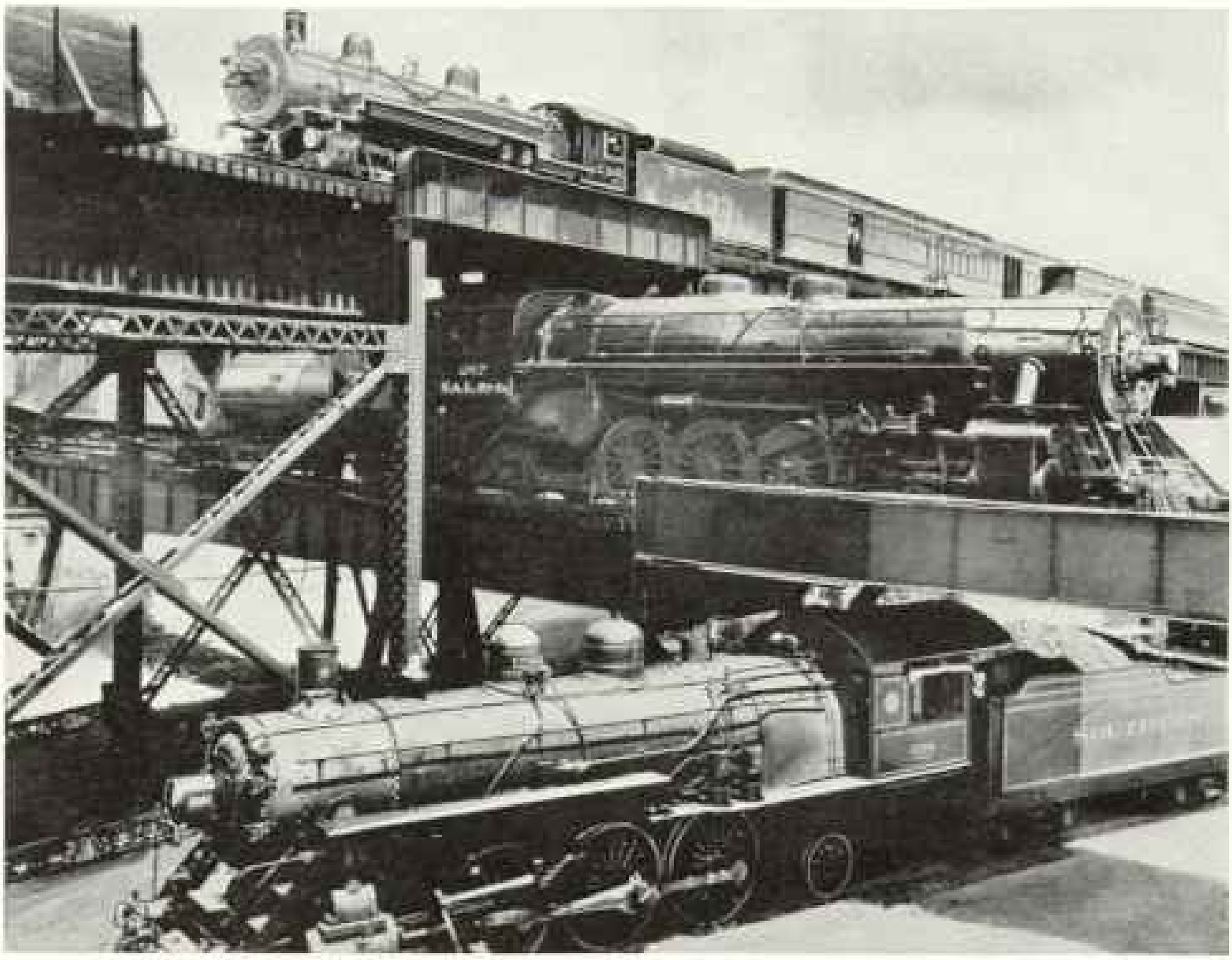
MYRIAD COAL CARS, LIKE GIANT BEETLES, LINE UP ON NORFOLK PIERS

At the right is a new lake-type pier, recently completed at a cost of $1,600,000. This steel robot can transfer 2,000 tons an hour from car to ship, laying down its black cargo so gently that no lumps are broken. The storage yards for the Norfolk and Western's tidewater terminal have a capacity of 5,000 cars.



LONG, LOFTY BRIDGES LEAP ALL GRADE CROSSINGS IN CINCINNATI

Across the Ohio River, in the foreground, and from all other directions converge the viaducts which bear the passenger and freight traffic of seven railroads. In the right center is the half-dome of the monumental Union Terminal, which ranks among the world's finest modern buildings. Artists and students travel far to see its magnificent murals. Beyond either end of the roofed passenger platforms are towers which route through trains over the fanlike spread of station tracks. In front of the Station Plaza is a city park laid out as part of the terminal beautification project.



Photograph by A. L. Dement

LITERALLY AN AIRLINE FOR THE SEABOARD, ALSO FOR THE CHESAPEAKE AND OHIO

The Southern Railway's ground track here was in use before the Civil War. One of the Seaboard Air Line's mammoth engines travels its main line on the second trestle. The C. and O. train at the top is passing over one of the longest railroad trestles in the world, extending more than 2¼ miles. The triple crossing at Richmond, Virginia, enables these lines to enter Main Street Station.

infinite conglomeration of shipments in the West Side Yard.

### THE CHANNEL AND TRIBUTARIES OF RAIL TRAFFIC

The man-made channel for the flow of traffic on the New York Central System has its trunk across the Empire State from Buffalo to Albany.

Its tributaries reach out to Chicago, penetrate Michigan to the north, and touch St. Louis on the south.

Its huge delta has mouths at New York, Boston, Montreal. And the goods that emerge in that delta may originate on the Pacific coast, in the Gulf of Mexico, or in Canada.

Providing the facilities and arranging clockwork schedules to haul hundreds of tons of perishables from the Pacific coast fresh for eastern tables is an epic of railroad teamwork.

The carloads of oranges, pineapples, melons, lettuce, arriving daily in New York on various lines, represent the most amazing food transport in the history of the world. Across the continent they speed for 3,000 miles, guaranteed to arrive the ninth morning from California.

The products are garnered over an area equal to that of New York State, New Jersey, Maine, Vermont, and Rhode Island combined. Pickup trains run as far as 375 miles to collect carload lots for concentration points: Sacramento, Roseville, Bakersfield, San Bernardino, and others.

At last report railroads had invested $182,574,319 in 66,944 refrigerator cars for this business; some $15,000,000 in piers and auction markets in New York City alone; $26,500,000 in icing and re-icing facilities.

The refrigerator car has done more to extend the range of food distribution than

any agent except the "tin can." It means more in the daily life of the individual than all the air-conditioned passenger cars.

Now precooling in plants has given way to precooling within the cars. This is accomplished by placing ice and salt in tanks on the cars and forcing air circulation by portable fans. After precooling the fans are removed, the ice and salt renewed, and they are replaced as needed along the 3,000-mile run (page 563).

### THE RAILROADS TAKE TO SEA

Because Manhattan is an island, the twelve railroads serving New York City must take to the sea with most of their freight (page 540).

Even the New York Central, which has the only direct rail freight connection with lower Manhattan, maintains a fleet of harbor craft for handling import and export goods, and for coastwise traffic.

All in all, the railroads' fleets number 150 tugs, more than 1,000 lighters and barges, 323 car floats, and various other vessels, representing an investment of $50,000,000 and employing 3,400 men.

Aboard the tug flagship of the Pennsylvania Railroad's harbor fleet I heard the Commodore, or marine superintendent, giving orders to shore stations and to various vessels of his 258 craft by wireless telephone.

A railroad committee worked with the Bell Telephone Company experts for many months to develop this communication system for the railway's floating units.

Carload lots ride the 3-rail floats, some of them carrying 22 cars, and a tug between propels two of the floats at a time. The car floats move on schedule, just as the trains do. At terminals a towerman, operating an array of levers, levels the tracks and a jackknife apron clamps land rail to float rail.

In a single recent month 76,099 freight cars were floated between rail terminals across the waters that surround Manhattan and Long Island. As many as 2,075 cars have been floated from Greenville to Bay Ridge in 24 hours.

Moreover, in the same month more than 83,000 freight cars were floated to pier stations to unload for delivery or transfer in New York City.

At the pier stations floats anchor, and cars aboard are loaded or unloaded as they would be at any freight station. One of these piers has 12 acres of floor space and 200 cars can be anchored at one time.

Over the rails came to New York last year 5,556 carloads of apples, 3,882 of cabbages, 3,416 of peaches, 7,531 of oranges, and 15,258 of "hardware," the trainmen's parlance for potatoes. It took 350 cars to bring in the artichokes the city consumed. If you prefer your statistics in tons, multiply such items as 335 carloads of snap beans by 12, but double the multiple for heavier vegetables and fruits.

Then there is the lighterage service. That is the pickup and delivery of the harbor. However, the run is between ship and pier, rather than from farm or factory to station.

While the car floats run on schedule, the lighters engaged in collection and delivery do not. They must be directed by a single supervisor, a sort of marine train dispatcher, and that is where the radiotelephone helps.

In the lighterage service are huge derrick barges that can swing upwards of 65 tons of machinery or structural steel from their decks to steamer holds, swift little power lighters for express service, and mammoth, tug-drawn barges for grain, timber, coal.

There are 140 refrigerator barges, to protect livestock, fresh meats and other perishables from spoiling in hot weather, also provided with stoves in winter to keep them from freezing.

### MAKING OUT 18,000 BILLS A DAY

"The bookkeeping for all this freight must be an auditor's nightmare," I suggested.

Each road, of course, handles its own accounts. I was taken through the New York Zone Billing Bureau of the Pennsylvania Railroad.

Nearly 200 employees there are engaged in sending out some 18,000 bills a day and handling remittances that aggregate $6,000,000 a month.

There are 217 freight stations in this one zone, which extends from Bridesburg, Pennsylvania, up to Montauk Point, Long Island.

Waybills are speeded by passenger trains and by motorized messenger service. One whole floor is given over to records of all transactions in this area for three years.

If you loaded freight cars to capacity with all the freight the entire Pennsylvania System hauls on an average day, the en-

PIONEER ALL-PULLMAN TRAIN NEARS GOLDEN ANNIVERSARY

Several times the Atlantic Coast Line's historic Florida Special had to run six sections; frequently it has three or four. It begins its fiftieth season of continuous operation in January, 1937. Hawaiian musicians play in each recreation car, where a hostess arranges dances, bridge parties, and games for children. In the background towers Miami's City Hall, with the city's unique skyscraper jail on the upper floors.

gine of this imaginary train would be pulling into New York while the caboose would still be in Wilmington, Delaware.

### A CONEY ISLAND OF FREIGHT CARS

To see how a vast volume of freight is handled in transit, the Chicago and North Western Railway's Proviso Yard, 13 miles west of Chicago, affords a good vantage point.

Here I stood at the crest of the "hump" and watched them shuffle thousands of cars about like an invisible hand playing a game with giant dominoes. In came the trains—80-car, 100-car, 120-car trains—along 30 tracks of a receiving yard.

As they arrived, conductors shot their waybills and "wheel reports" into pneumatic tubes to the freight office, two or more miles distant from the trains; for this yard is 5 miles long and spreads over 1,250 acres. There they were transcribed on teletype machines to all the switch towers, the lighthouses of the yards.

Then a train would creep to the hump, beyond which 59 tracks fan out, downgrade, forming the classification yard. As each car crossed the hump, it was cut loose, and the towerman, with teletype sheet in hand, switched it to its assigned track.

Down the tracks roll the cars, without benefit of brakemen, the towermen operating switches and retarders, clamping devices on the tracks which control their speed. Each car passes over seven retarders before it reaches the bottom of the grade and hooks on to its new train.

As soon as a classification track is filled,

WHAT'S WRONG WITH THIS PICTURE?

"They are writing, reading, chatting, ordering refreshments—doing everything except looking out all the windows we put there with not even a back platform to obstruct the view," humorously complained the conductor on the City of Denver (page 547).

a "trimmer" engine pulls the newborn train to one of the yard's 21 forwarding tracks. There engine and caboose are attached and away it goes.

By night the entire yard is illuminated by floodlights like a Luna Park, for the freight must go through 24 hours a day.

You could stand 26,000 cars, rolling stock enough for a goodly sized railroad, in this yard, and there is adequate track to run a train from Chicago to Cincinnati. Sixty switching engines are working there every day, and you can shuffle trains around with the aid of 740 switches.

For less than carload lots there is a freight transfer warehouse under one roof of 21 acres. Through its quarter-mile length run 24 tracks, each with a platform on either side for quicker loading. Along these platforms scurry tractors with their trailer "trains" piled high with parcels. Here 720 freight cars may stand while 42 gasoline tractors and 4,600 trailer trucks unload and reload their cargoes.

Lay the platforms straightaway and you would have a 6-mile boardwalk, ample for a sizable sea resort's wheel chairs and strollers.

The freight agent at this warehouse has the job of loading and unloading 873 cars on an average day, handling 13,980 separate shipments, and supervising 719 employees. In it is a busy cooperage for repairing or rewrapping packages in transit.

### BOTTLENECK OF PENNSY'S TRAFFIC

If one retains a youthful urge to see the trains go by, the Enola Yards near Harrisburg, Pennsylvania, neck of the traffic bottle for the Pennsylvania's enormous west-east freight movement, would fulfill his uttermost craving (page 565).

Cars there are shunted about too fast to be halted for inspection. A tense inspector sits in a swivel chair in a pit beneath the track as they approach a hump. Floodlights play on the underparts of the cars. In his hand he clasps a bulb and when he spies a defect he squeezes the bulb and white lime is sprayed over the wheels of the truck that needs repair.

Should there be a major defect in a car carrying perishable freight, a huge crane lifts that car, cargo and all, from the classification track to a repair track, and there every effort is made to have it ready to rejoin its fellow freight by the time the train is made up to leave the yard.

On one busy, but not peak day, July 11, 1936, 9,433 cars were "humped" in 24 hours. In addition, 1,141 cars were relayed through in trains that did not have to be broken up and reclassified.

Enola is "alone" spelled backwards, but the name belies the fact. On that same July 11, what with cutters and brakemen, markers and car riders, inspectors and all, it took 534 men to handle that 24-hour operation of 10,574 cars.

### SHOWER BATHS FOR HOGS

Some tracks are equipped with sprinklers, shower baths for hogs on hot days.

The lowly porker, it seems, is the temperamental and pampered passenger of the freights. He grows nervous and loses weight in transit if he gets overheated, chilled, or jolted too much.

Engineers consider him their special bane if he wanders across tracks. A cowcatcher will toss aside a cow or an automobile, but a pig is apt to be ground under the wheels and a hambone has derailed cars.

There are feeding stalls and rest pavilions for cattle at Enola. Federal law requires that all livestock be taken off trains every 28 hours for feeding, watering, and a 5-hour rest.

Faster freights now make only one stop necessary from the packing centers to eastern cities; formerly the animals had to be "yarded" two or three times.

### A BONFIRE OF BOXCARS

Across the Susquehanna River from Enola is an isolated yard where nightly last summer blazed a bonfire of 30 or more abandoned wooden boxcars. At first frightened citizens miles away turned in fire alarms when they saw the red glow.

After the reclamation crew salvaged wheels and bars, trucks and bolts, and scores of other parts, permission was given neighbors to help themselves to the wood. Daily they came, usually a hundred or so of these "wood pickers," loading antiquated automobiles, wheelbarrows, decrepit wagons. In adjacent woods and fields rose many a shack built of boxcar parts, and woodpiles of winter fuel.

Complementary to its 1936 program of building 10,000 new steel freight cars, the Pennsylvania is burning up, or breaking down, 32,000 old cars.

When this is done the System will have 22,000 fewer cars, but it will be able to handle more freight.

This economy results from adapting new cars to special uses, from faster schedules and longer trains, from quicker classification and less delay in yards, and from use of some 4,500 of the steel containers in merchandise service.

But the real graveyard of the freight cars, where all the salvaged bones and sinews are shipped, and where worn-out locomotives meet merciful death, is at Conway, near Pittsburgh (page 555).

There is a touch of sadness about a steam engine, half dismantled, its entrails exposed to public gaze; or the sight of iron couplings in last embrace after their cars have been cremated, clasped like two hands excavated from the ruins of a railroad Pompeii.

Crews with acetylene torches, the "burners," they call them, attack the rusted steel cars when they enter Conway, either performing a major operation of repair or demolishing them altogether.

"That man there has helped cut down 20,000 old cars, and has had only one reportable accident among his workers," the superintendent said.

### A LIBRARY OF TRAIN PARTS

But the amazing spectacles are piles of parts: 2,240 wheels, like a cubist's nightmare; a stack of 2,000 axles; a small mountain of 10,000 brake beams.

A magnetic crane reaches its gaunt arm over a mound of metal parts the burners have amputated. Its flat disk picks up six tons in its invisible clutch, swings them over to car or conveyer belt, and drops them when the towerman cuts off the current.

Quick-eyed sorters—it takes three months

to train these cataloguers of a thousand devices—separate usable pieces from the scrap.

Scrap itself is assorted, because it brings more that way, into 34 classifications, such as heavy melting steel, No. 1 cast iron, car steel, malleable scrap, cast iron mixed.

Track bolts are brought into Conway by the carload. Usable ones are plucked from a picking table, gauges applied, then they are thrown into an annealing furnace, put through a threading machine, heat-treated, oil-bathed, and nuts applied. A new bolt and nut cost 12½ cents, the reclaimed pair costs 5.7 cents.

Railroad economies during the depression, effected while actually improving service and keeping labor employed, range from such items as the $145,000 they are saving each day of the year by treating ties, to the 0.8 cents saved by reclaiming a track bolt.

Peering through the goggles each visitor must wear, we saw them speeding new steel boxcars down the assembly line just as they do in automobile plants.

Wheels are forced on axles under pressures of 75 to 100 tons. Trucks, with wheels, axles, brakes, and other parts attached, roll in. Sills, supports, cantilevers, floors, sides, ends—all are in place for gantry cranes to swing them to the car. A center sill alone may weigh eight tons.

Riveters swarm over the floor, ride movable platforms along the sides, and crouch beneath on a sort of "kiddy car." Men swing long tongs to toss red-hot bolts to the riveters at 13 positions the embryo car must pass. There are more than 3,000 rivets in a boxcar.

Carpenters have planks at hand for inside floors and walls. Out comes the com-

FROM THE AIR A MAMMOTH STRIP COAL MINE LOOKS LIKE FURROWS OF A PLOWED FIELD

The Northern Pacific digs here at Colstrip, Montana, the fuel for its giant locomotives (page 585). Enormous stripping shovels can gouge a hole big enough for a house cellar, lift 15 tons of earth to the height of a 10-story building, and deposit the load a city block away. The miniature mountains are made when earth is removed to expose the coal. Then the coal is taken out and earth from the last cutting is dumped back into the hole. A 30-mile spur was built to haul the coal to the main line.

Photograph courtesy Edward G. Budd Manufacturing Co.

NOT A PORCUPINE COUCHANT, BUT A ZEPHYR RAMPANT

At 80 miles an hour a Burlington streamliner explodes a snowbank near Lee, Illinois, on its dash from Minneapolis to Chicago. The train arrived on time.

pleted car in little more than one hour.

Huge sprinklers deluge it with heavier showers than any rainfall to test for leakage. Then paint is sprayed on, 14 pounds of red paint to a car. It is ready for the rails.

### "NOW TRY TO WRECK THESE!"

All over the country railroads and private builders are experimenting with new types of freight cars—end-door cars, ventilated boxcars, gondola cars, stock cars, refrigerator cars, tank cars, and with various materials—Cor-Ten, duralumin, aluminum, and other alloys—in their quest for the magic combination of greatest strength and lightest weight.

"Try these," say the designers. "Run them, smash them, bang them together, wreck them."

To test new brakes tracks are cleared on mountain roads with steep grades and sharp curves. Dynamometer cars are attached with instruments to measure impact, pull, speed, stresses, and scores of other factors, and every few cars there is a "cabin," or "hack" (caboose), with a spacious observation tower (page 555).

They race the cars at top speeds, dash them around curves, apply emergency brakes, and sometimes they do wreck them!

The spectacle is as thrilling as the stunt flights of airplanes, or the automobile races that make motoring safer; only, the railroad tests usually are in isolated places with no gallery of cheering crowds.

From such tests came new air brakes which can handle 150-car freight trains smoothly.

To see quantity building of new cars and locomotives having their faces lifted, one may visit Altoona, Pennsylvania, near the famous Horseshoe Curve.

That city of some 82,000 people, with its 45-degree streets climbing the base of the Alleghenies like an Alpine village, is the most extraordinary all-railroad community in the world.

We counted 43 people boarding a train for Pittsburgh one Sunday afternoon. The agent sold just one ticket—mine. All the others were traveling on passes, including the women, for the Pennsylvania shrewdly gives every employee's wife exactly the same sort of pass her husband holds.


Photograph by Luis Marden

"BROILED LIVES" NOW FOR INLAND CITIES

From Massachusetts Bay north to Nova Scotia lobsters come to Boston by boat, there to be loaded on fast freights for places that never knew them fresh ten years ago (page 557).

In stability the community is like an English manufacturing city. Some family names have been on the payrolls without a lapse since Civil War times.

"That man's father, and his grandfather before him, worked at that same job, in the same shop where you see him working now," the superintendent said.

The big day-in, day-out job at Altoona is repairing the rolling stock. More than 10,000 kinds of parts and material are kept on hand for freight-car repair alone. Soap, to blow bubbles that detect leaks; chalk, to mark dates and defects; rags for cleaning, are purchased by the ton.

One section is busy air-conditioning passenger cars.

The shops have an iron foundry, a hospital, a brass foundry, a fire engine house with two engines, carpenter shops, an artists' studio, a police department, a 4-story testing laboratory, even a photographic laboratory.

One tool shop makes the tools that repair the tools that repair the cars.

Engines coming here for repair, five, ten, fifteen a day, are stripped. Wheels, boxes, rods, crossheads and pistons, link motions, stoker parts, cocks and valves, retaining plugs, scores of other parts, each go to different repair gangs. Getting them all back again is just one mechanical miracle of this house of marvels.

The superintendent said he, too, would like to know how many parts are in a locomotive.

But the room became crowded with foremen, the debate grew acrimonious regarding whether wheels and axles were one part or three, or whether a nut should properly be counted with a bolt; sheets of paper were scrawled with figures. After an hour or so we concurred, "Let's skip it."

A steam locomotive is a massive machine, but it also is an instrument of delicate precision. Its taps must be cut so that there is not more than four one-thousandths of an inch variation between the bolts and the holes they fit.

A steel truck bolster for a freight car weighs 900 pounds. But its surface side-bearings must be gauged not more than one-sixteenth of an inch from the level of the center plate.

It is not surprising that most people have

WILL YOU HAVE A HAM SANDWICH OR A SIRLOIN STEAK?

A popular lunch counter is a Royal Blue feature. In its colonial dining cars the Baltimore and Ohio has reproductions of colonial china and it gives women patrons facsimiles of famous recipes from which some of its dishes are made. This one is copied verbatim from Martha Washington's Mount Vernon cookbook: "To Make a Custard—Take a quart of fweet creame & ftrayne therein 2 whites of eggs & 8 youlks well beaten put them in a diſh with a grated nutmegg a little falt & halfe a pound of sugar ſtir them well together & ſoe bake it you may allſoe put in some roſe water if you please" (page 554).

never visited a large freight yard. It is too dangerous. A railroad employee has to learn more safety rules—a 41-page book of them on one system—than he does when he applies for an automobile driver's license.

Guards can spot a visitor in the yard as readily as a sailor can recognize a landlubber. Stepping on a rail, sitting on a tie, or crossing a track nearer than ten feet from a standing train would mean a black mark on his safety record for a railroad man.

But it *is* surprising that among the millions of passengers who buy tickets in railroad stations so few have ever gone through one thoroughly.

### STATIONS RANK WITH PUBLIC BUILDINGS

In many cities, Chicago, Cincinnati, Buffalo, Cleveland, Newark, and others, passenger stations rank among the finest public buildings, and are informative museums of modern life.

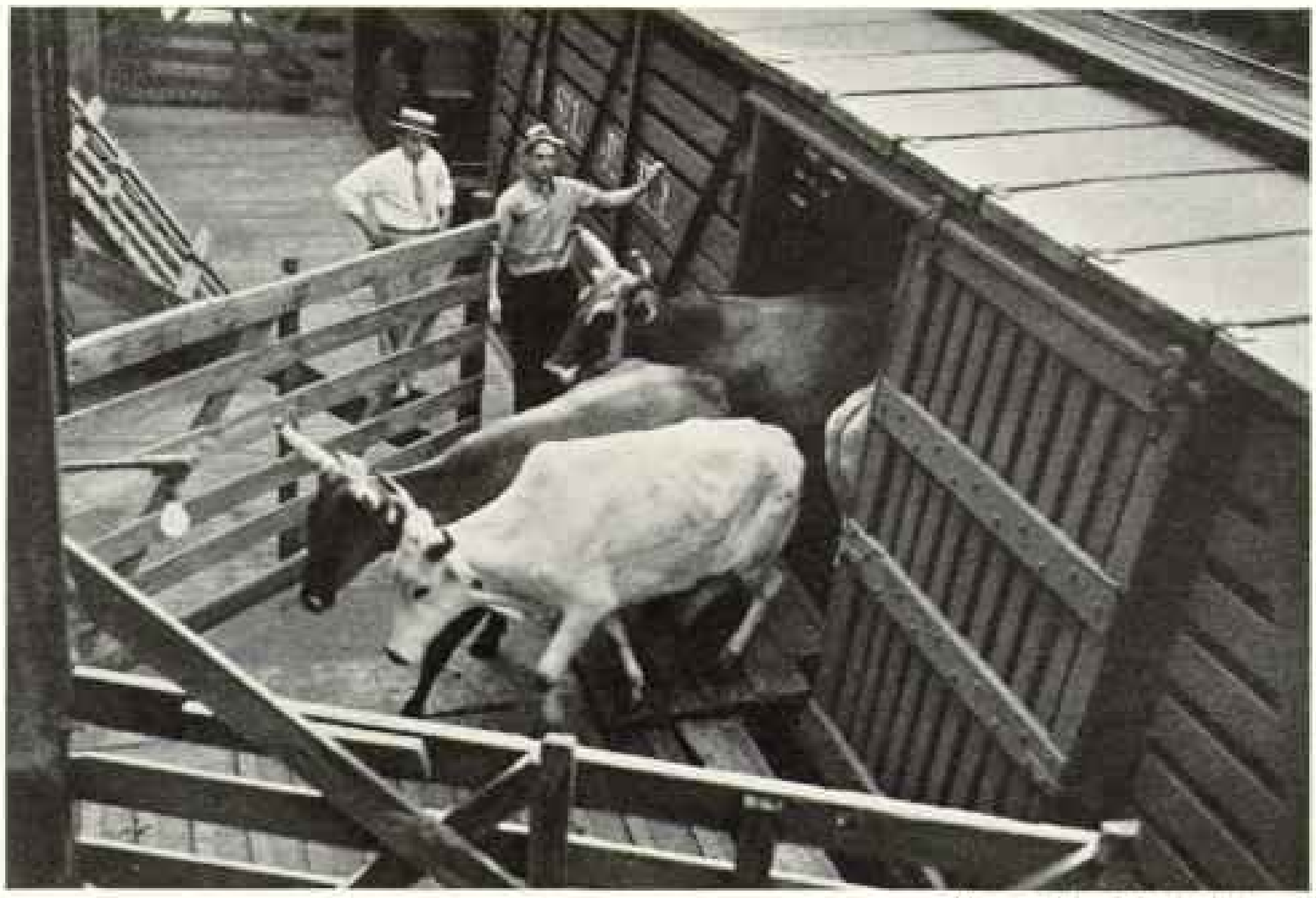
The Grand Central Terminal, in New York, is a seventh wonder of the engineering world, a 48-acre city within a city.

Tracks once barred cross-town traffic north of 42d Street, and steam engines puffed smoke into the heart of high-priced Manhattan real estate where stately Park Avenue and its busy intersections now are located.

To keep on using this valuable area, bounded by 42d and 50th Streets, Lexington and Madison Avenues, for a station and yard entailed a prohibitive cost.

So the New York Central leveled off the surface for these busy streets, erected its mammoth station and adjacent office building, then leased long-term air rights for other skyscrapers, including the new Waldorf-Astoria, loftiest hotel in the world (page 556).

It bored beneath the entire area for one level of 41 tracks, for a lower level of 39 tracks, and then farther down, deep into rock, for a giant power plant which moves



Photograph by J. Baylor Roberts

THEY MAY RETURN TO RAIL AS ROASTS, CHESSMEN, OR TENNIS RACQUETS

Beef cattle from Texas unload at the Chicago stockyards to be converted into many commodities besides meats: brushes, felt, and glue from hair and hides; bottle caps, violin strings, and surgical ligatures from glands and viscera; napkin rings, false teeth, gelatin, and buttons from bones. Some 160,000 cattle and calves are hauled by rail to Chicago in an average month.

its trains, heats and lights the buildings, and runs their elevators (page 544).

### A BAGHDAD ON STILTS

Thus every day, over the station tracks, there work in office buildings, or sleep in hotel rooms, as many people as live in Salt Lake City.

They are entirely oblivious of moving trains beneath because building supports are rooted below both track levels, around these supports are clearance spaces, and beneath them are vibration mats of alternate layers of lead, sheet iron, and asbestos.

Imagine the Yale Club built high enough to afford the aggregate floor space of the buildings in this area, and you would have a structure of 1,420 stories, about 3½ miles high. Or, if you would use the equivalent of this floor space for a highway, that would make a 20-foot boulevard from New York to Albany.

Beneath this 48-acre Baghdad on stilts come and go some 600 trains a day, over enough station track to reach from Washington, D. C., to Baltimore, carrying considerably more people daily than live in Springfield, Massachusetts.

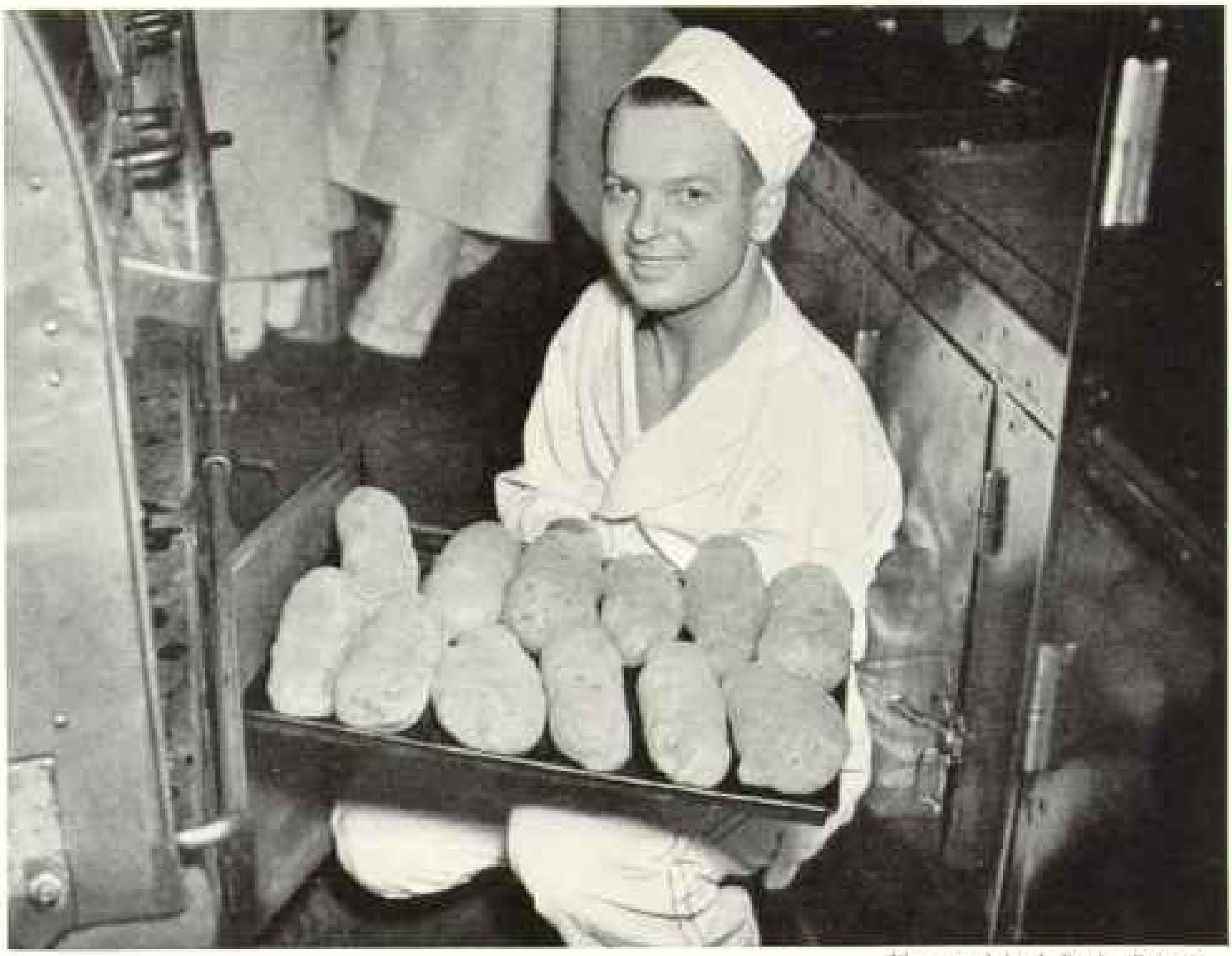
It takes more than 400 redcap porters to handle the baggage of this travel army, some 35 men at booths and telephones to answer their questions, a staff of 73 to sell them tickets (page 545).

By day 17 cleaners constantly work at emptying ash trays, spearing discarded chewing gum, and removing debris. About one o'clock in the morning late passengers will see a small army advance abreast, armed with mops, to attack floors and windows. Fifty-nine people work all night long to set the vast station in order.

### NICE OPENING FOR A CAVE DWELLER

A cave dweller could spend years in the terminal, with all the comforts of civilization, unless he yearned to swim.

He could telephone from 231 booths; eat at 17 restaurants, milk bars, and soda luncheonettes; buy clothes, shoes, fruit, books, cigars, hats, jewelry, typewriters, cutlery, toy trains at separate shops, and magazines or daily papers from 22 news-



Photograph by J. Baylor Roberts

A BAKED POTATO, TWO POUNDS, 15 CENTS

The North Coast Limited makes a specialty of these giant tubers from the State of Washington.

stands. He could have his clothes cleaned, pressed, or dyed, his hair cut, his prescriptions filled, the story of his troglodyte adventure printed, be treated in a hospital, take shower baths—all within the station.

Then he could have his choice of three hotels and a club, directly connected underground with the terminal, for sleeping accommodations, and more restaurants. He could even acquire an artificial sun tan.

Of course, if he ever wished to extend his undercover excursions into subterranean New York, he could pay a nickel at a subway turnstile, explore much of Manhattan, and touch at points in Long Island and New Jersey without emerging under open sky.

Nearly as many people as live in Washington, D. C., pass through Grand Central Station every weekday. Just now about 600 trains arrive and depart, with approximately 3,000 carloads of passengers, every 24 hours.

The nerve centers of this busy traffic movement are the towers. At one, farthest out, incoming trains are sorted from four tunnel tracks to six tracks bound for the upper level, and four for the lower.

A second tower routes trains from the six upper tracks to the 41 upper-level platform tracks; a third tower sends them from the four lower tracks to the 17 lower-level station tracks.

Two other towers handle movements on upper and lower-level loop tracks and between station tracks and loop tracks.

In each tower a dispatcher sits behind a long table intent upon his train sheets, directing operations of men who pull the levers for signals and switches. Before them a "live map" shows all tracks and flashing light bulbs indicate the train movement on each track.

The towermen need not look out the windows at all to the tracks below; they watch the trains come and go by the red, yellow, and green lights.

Interlocking devices click like amplified typewriters as men work the levers—devices designed to prevent pulling a switch when a light is against it.

TEA FOR TWO, AND A CHAT FOR FOUR

The 11-car City of Los Angeles makes five round trips a month between Chicago and Los Angeles in 39¾ hours. The Union Pacific is a pioneer in streamlining and this is one of its famous "Cities" fleet. The trains enter Chicago over the Chicago and North Western tracks.

"Could you cause a collision if you tried?"

The towerman considered. "I don't think so. I've been here 17 years and I haven't seen one. Of course, that's not long."

To take a train out of Grand Central Station to Mott Haven Junction, five miles north, an engineer must observe 33 separate signals. Also, the fireman must watch each signal and call out its color to the engineer.

When an incoming train passes the tower that controls the platform tracks, a teletype conveys that information to 14 places in the station—to information booths, to information boards, to stationmaster, to gatemen, baggagemen, redcaps, and others.

"No, I don't go home and play chess after a day on this job," remarked the train dispatcher.

### THE BIGGEST STATION IN THE WORLD

Although it celebrated its 25th anniversary in 1935, the Pennsylvania Station in New York still is the largest in the world.

Walk around it and you have tramped half a mile, with no more sight of train or track than you would encounter about the Vatican or the Louvre.

The station really is an 8-acre platform, with a mammoth superstructure, bridging the Manhattan mouths of two tunnels (page 542). Some trains run through these tunnels for seven miles, from New Jersey to Long Island, under the Hudson and East Rivers, pausing beneath the station, but never emerging into the daylight or night glow of New York City.

Northbound trains pass the most complex traffic corner in the world, for above the train tunnel, at Herald Square, in the order named, are the Sixth Avenue subway, the Hudson-Manhattan tubes, the street-level bus lines and the Sixth Avenue Elevated. Imagine an airplane overhead, and it would be perfectly feasible for six vehicles to pass that intersection at one time.

It takes a staff of 76 men to sell tickets

at Pennsylvania Station. In a recent normal month they sold 553,204 tickets for $1,595,280.60. The months of Easter, Christmas, and Labor Day raise that volume by a third or more.

Printed tickets ready for sale, 150,000,000 of them, are stored in a room where they are guarded like notes in the United States Treasury.

Some of these tinted, watermarked slips are worth a hundred dollars and more when stamped. The agent pulled out a tray of 50,000 for Long Beach, Long Island, each marked $1.46. Printing a new supply of tickets was just one detail of recent passenger-fare reductions.

Beside each seller's grilled window is a rack from which he flicks out tickets with familiar nonchalance. These racks are mounted on wheels and have folding fronts and locks.

Each seller has his own rack and key. When he goes off duty, he rolls his rack back of the line, locks it, and deposits the key in the cashier's safe. The tickets are charged out to him and he must return the unsold quota and the money for those he sold.

The station cashier's office is like a bank. You may have noticed that when you pay for meals on a dining car you always receive crisp, new bills in change. The cashier must have on hand these "fresh" bills for stewards. Some $3,000 in "ones" are enough five days of the week, but on Saturdays, Sundays, and holidays he must have a stock of $7,000 or $8,000 in ones alone.

### THE "ASK ME ANOTHER" BUREAU

Selling tickets, however, is only the final step in a series of events.

"When does the next train leave for Topeka, Kansas?" "What connections do I make for Chicago?" "What is the fare?"

Only a small fraction of such questions are asked in person at the conspicuous information booths. Normally 20 clerks are on duty at a time answering some 700 telephone calls an hour.

The peak of this year's inquiries exceeded 1,100 in one hour before Labor Day. Forty-four clerks work in shifts to dispense information.

For half an hour I watched the smooth operation of the soundproof telephone room and not once did I see a clerk consult a timetable. They are too cumbersome, and tell too little.

Instead, the information chief worked with card-index experts to compile all information about schedules of all railroad, airplane, and bus lines, and all fares on visible card files.

One file gives names of all important golf clubs on Long Island and the nearest railroad station to each club.

It takes poise, tact, resourcefulness, to answer some questions. As examples:

"Do I have a berth all to myself or do I have to share it?"

"What hotels in Washington have swimming pools?"

"My husband left last night on the B. and O. Where is he going?"

"How do I get to Buenos Aires?"

"Have you any hay fever fares to New Hampshire?"

"What time do I get a train to go to Mr. Abram Walker's funeral at Toms Ferry?"

"Should I dress and undress in my berth or in the men's room?"

### CALLING PENNSYLVANIA 6-2000

When you reserve a ticket by telephone you call one of the busiest telephone numbers in New York City. In addition to outside lines, 130 branch ticket offices in Manhattan, Brooklyn, and Newark are connected with the central reservation bureau by private wires.

In a spacious gallery from 15 to 20 clerks sit before a series of apertures like old-time village post-office boxes, except that these cases are mounted to move along a track from clerk to clerk.

In the boxes are piled the reservation cards, the kind the Pullman conductor always is fingering just before the train leaves; in each pigeonhole are marked-up cards for sixty days ahead.

Before each clerk is a series of ten red lights and ten green lights. The green lights denote a ticket office call; the red lights an outside call direct from a passenger.

A green light flashed.

"Lower ten, K7, 3 p.m. Chicago. Today. Ticket 7,492. Right."

In very different tone and tempo was the next response to a red light, an individual who must have explanation of price, type of accommodation, daylight time in summer, and a "thank you."

No switchboard operator intervenes in the 10,000 or sometimes many more calls that come in daily. An automatic selector,

A GIANT POWER PLANT OF THE RAILS

Little chance that this boy will grow to the 6 feet 5 inches diameter of the drive wheels on one of the Northern Pacific's new fleet of passenger locomotives. Each is streamlined and carries its 245 tons' weight on 28 roller-bearing wheels. Engine and tender extend 110 feet, more than half the length of the Mark Twain Zephyr train (page 537). A single part of this locomotive, the bed, weighs 38 tons.

Photograph from Wide World

DID YOU EVER SEE ONE RUN LIKE THAT FOR A QUARTER?

The Red Cap Derby was staged in Chicago last July as a part of Railroad Week. The baggage carriers raced for three city blocks with 50 pounds of luggage apiece.

worked out with the New York Telephone Company engineers, routes these calls from ten lines out of the selector room to ten "positions" at the "card tables" in the reservation bureau.

If one operator is busy, the "selector" shunts the call to another, lighting the red or green signal to denote its origin. In an average 24 hours 63 clerks are employed in shifts to make some 8,000 reservations for berths, chairs, compartments, or drawing rooms.

Perhaps the high light of "human interest" in the station is the lost and found storeroom. There were stored and ticketed, the day I saw it, some 240 different items, enough stock for an East Side second-hand store.

The articles included a basket of spectacles, skis, two cats, a bootblack's outfit, books in six languages, a pair of crutches, three sets of false teeth, a restive terrier, dozens of umbrellas, tennis racquets, more than twoscore women's coats, piles of gloves, a fresh sirloin steak (sad harbinger of domestic recrimination), and $20,000 worth of bonds about to be returned by special messenger.

In subterranean corridors, far below the station tracks, were piled hundreds of pigeon crates. As many as 3,200 crates of homers have been shipped in a month, as far as a thousand miles, to be released by baggagemasters for races back to home lofts.

### YOUR FELLOW PASSENGERS—HONEYBEES, LETTERS, ALLIGATORS

Other strange shipments come through the station for baggage or express cars—baby alligators, pedigreed chicks, honeybees, game, thousands of crates of "mail order eggs," and bullion cargoes accompanied by 25 or 30 armed men.

Saturday nights from 75 to 80 trucks race with their loads of Sunday papers to catch the baggage cars attached to the "paper trains." One newspaper's early Sunday edition goes to press at 9:10 p.m. and is loaded on a train leaving at 9:50. If the driver gets held up by a single traffic light the stationmaster must hold the train.

Some 150 carloads of mail are handled in and out of this station every day. If the sacks were piled and hauled along platforms passengers would not have space

Photograph by J. Baylor Roberts

BY ILLUMINATED MAP AND INTRICATE LEVERS 267 TRAINS ARE ROUTED DAILY

There are 170 working levers in this Lake Street Tower of the Chicago and North Western Railway Station at Chicago. Six main tracks branch out to 16 in the train shed, over which nearly 60,000 passengers arrive and depart every 24 hours. The light-colored levers control signals, the dark ones operate switches. Interlocking devices prevent clear signals being set on occupied tracks. In and out of this station daily runs the "millionaire club car," the "Deerpath," attached to a suburban train. Members charter the car, engage their own attendants, and vote on new admissions from a long waiting list. A golf special is operated Saturdays to North Shore points. All trains of the Chicago and North Western run on the left-hand tracks, as they do on English lines, because early double tracking was constructed by British and Dutch engineers.

to board trains. They are dropped through trap doors beside mail cars where conveyer belts carry them to huge separating tables.

There men assort the bags as they pour in and pitch them into chutes for other belts that run beneath the street to the City Post Office adjoining, or to belts that connect with outgoing trains.

Around special tracks, to which passengers are not admitted, where mail cars await loading, are spy galleries from which postal inspectors, unseen by the workers, may watch the operation.

Nearly 150,000 sacks of mail a day, about 1,500 trunks and other checked baggage, 2,200 pieces of hand baggage checked in parcel rooms and a thousand more pieces in parcel lockers, from 20,000 to 30,000 pieces of parcel post—these are some of the operations that must not obtrude upon passenger comfort.

You buy a ticket, you board a clean, cool train, you read a newspaper, you stroll into the dining car for luncheon. Few people are conscious of the complex task of getting a train ready for occupancy.

### THE "MAKE-READY" FOR A RUN

Out in Sunnyside Yard, at the Long Island end of the Pennsylvania's New York tunnels, 43 trains back in after runs in one span of 58 minutes.

There each engine is inspected; a quick check of 30 or 40 parts takes 25 minutes if nothing much is wrong. Squads pounce on the cars, shower-bath the outside, wash the windows, clean the interior, replenish water and ice, report any needed repairs.

More than a hundred engines and some 750 passenger cars are gone over each day, and it takes nearly a thousand men for the cars alone.

Water lines, air lines, steam lines, battery charging lines, all are laid in trenches

Photograph by J. Baylor Roberts

THE STREAMLINED MERCURY LEAVES CLEVELAND'S SKYSCRAPER TERMINAL

Towering more than 700 feet over the Public Square, Union Station dominates a city center that includes a hotel, office building, bank, Medical Arts Building, the Post Office, and a department store. Harvey Restaurants in the station, ranging from banquet hall to coffee shop, could serve luncheon to every resident in a city of 10,000 people. The tender of the ultramodern Mercury's huge engine carries enough coal, 16 tons, to heat a suburban home for the winter, and enough water, 15,000 gallons, to supply an average family for ten weeks.

along the 76 tracks. Ice for the coolers and for those cars which are not mechanically air-conditioned is stored at both ends of long platforms. Tractor trailers load at one end, fill the car containers, and load again at the other end to avoid an empty return trip.

On warm days last summer as many as 400 tons of ice were piled into passenger cars here in 24 hours.

### SUPPLYING RESTAURANTS ON WHEELS

In one building of the 72-acre yard is the supply warehouse for dining cars—a department store of grocery, butcher shop, cold-storage rooms, and long shelves of china, silver, and linen.

Meat cutters chop and weigh steaks; inspectors scan bushel lots of beans, carrots, oranges, berries, potatoes; white-clad men slice ham for sandwiches, others apply bread and wrap them in glazed paper; seamstresses mend tablecloths and napkins. Clerks pack each car steward's order into large hampers.

One employee is listed as a "tomato ripener." He has charge of the spacious, airtight room where crates of the vegetables are stored.

He speeds up or slows down the ripening of tons of tomatoes, according to the day's travel prospects, by judicious use of ethylene gas.

We had luncheon in the "dummy diner," built into an upper floor of the building, where chefs are trained, new recipes tried out, and waiters instructed. Except for an open side on the corridor, this diner is precisely like those on wheels in its dimensions, appointments, decorations, kitchen equipment and utensils, and tableware.

A steward is there to ask officials and visitors whether everything is all right, and bills are made out, though not paid, to carry through the final stage of a dinner on the train.

### "CAN YOU MAKE AN OMELET?"

In an office outside twelve chefs were waiting to apply for jobs.

"What do you do about them?" I asked.

"Tell them to go into the kitchen and make an omelet. Then we watch them to see whether they know what utensils to use. If they fumble on that, the interview is over. But if an applicant knows his way around a kitchen, we put him through a series of tests with other recipes, we examine his credentials and his health, and place him on the waiting list."

On an average day the entire Pennsylvania Railroad serves about 6,500 dinners. That would be a sizable crowd for the largest hotels, but the problem is complicated by the fact that the meal is served in 130 restaurants on wheels and that each restaurant must have its own steward, chefs, waiters, and supplies.

Most popular summer dish is the PRR Salad Bowl; around 35,000 are served in a month. The railroad's average daily shopping list includes 847 pounds of ham, 575 dozen eggs, 750 lamb chops, 1,695 one-pound loaves of bread.

There is a laundry here for a portion of the 24,000 pieces of linen that must be done every day. And aboard the cars are washed daily 140,000 dishes and 24,700 pieces of silver, knives, forks and spoons.

To this yard report daily some 500 Pullman porters, to help care for 6,200 persons who sleep as they ride. They must be supplied with 12,000 pillows and 18,000 sheets nightly.

Here the Pullman Company has one of its laundries, which averages 85,000 pieces of linen a day.

### "DOUBLE-HEADERS" AND "HIGH BALLS"

At Sunnyside awaits the "wreck train" for the order to "get the hook," meaning the mobile crane which can toss a 50-ton obstruction off a track.

Perhaps railroad slang was the origin of that expression, just as the most sober group of men in the world still talk of "high balls," a term carried over from the days when a ball hoisted on a high post meant a clear track.

Did the theater take over "deadhead" from the railroad pass bearer? Did a "double-header" mean two engines on a train before it referred to baseball games? A locomotive is a "hog," a conductor the "captain," an engineer the "hoghead," and an official of the road knows full well that, with no disrespect, he is referred to as a "tin hat."

Herein have been pictured some of the sights and scenes of railroading, an essential and a romantic industry. They are typical, but not yet universal. Smaller lines and branch lines of major railroads, especially the commuters' trains of many cities, still lack new equipment and air-conditioned coaches.*

In rail transportation, as in civilization, one may find almost all stages of development. On one short line the general factotum of the station loads baggage, sells tickets, and calls the train. Then he slams down his window, changes his station master's cap for that of a conductor, boards the train, and collects the tickets.

### AN END-TO-END TRAIN PICTURE

To visualize the volume of freight and passengers hauled by all the railroads of the United States is difficult. To say that the 1,964,000 freight cars would make a train reaching two-thirds around the world at the Equator is accurate, but no human eye could encompass such a spectacle.

Perhaps the plain figures are most impressive.

To the rolling stock of nearly two million freight cars add 48,300 locomotives and 43,800 passenger cars.

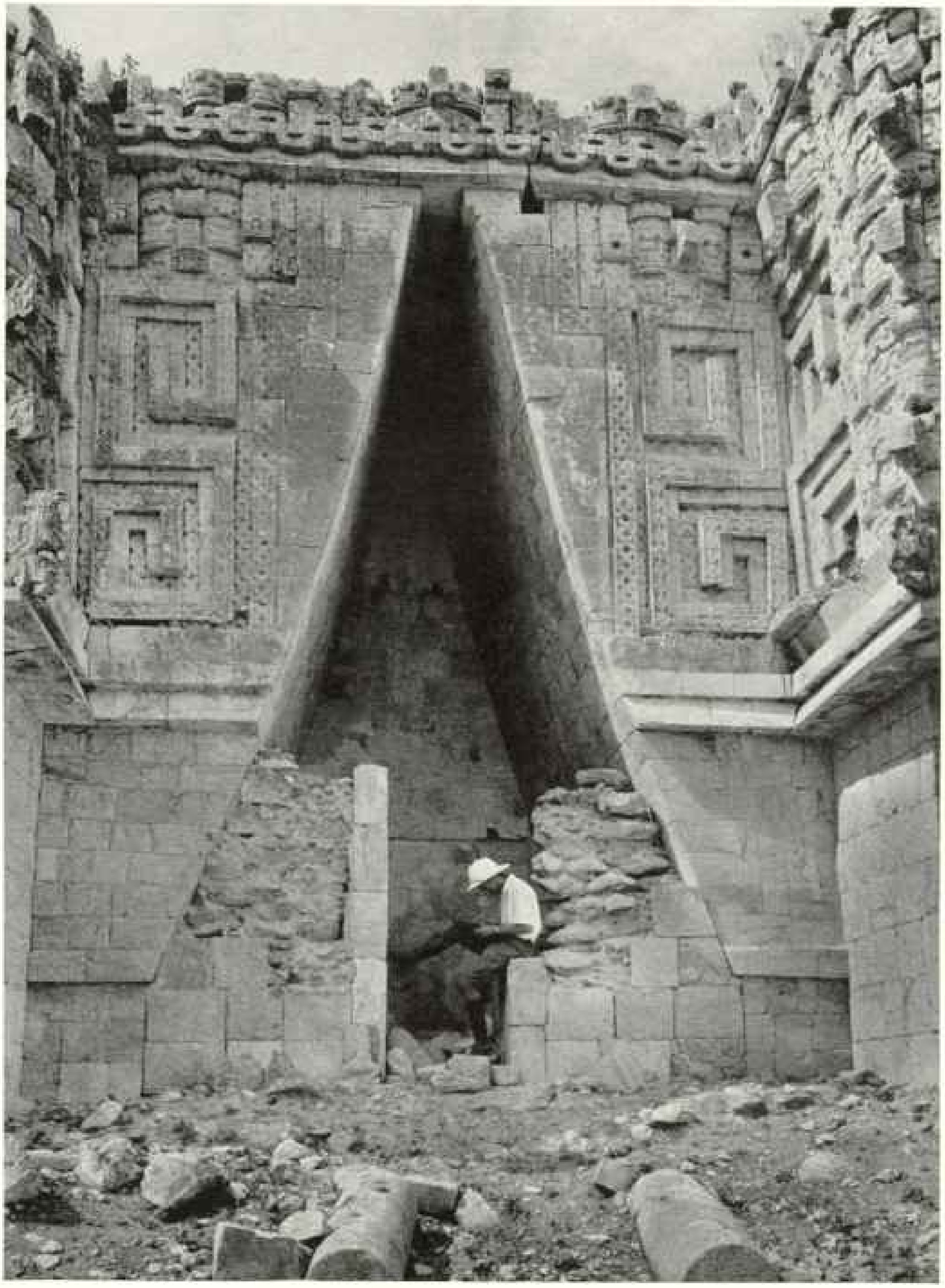
Imagine, if you can, 1,400,000,000 tons of freight hauled each year, at a cent a mile, in addition to hundreds of thousands more tons of mail, express, and baggage.

There are 450,000,000 passenger hauls—four 40-mile rides for every man, woman, and babe in arms in the United States, at an average of about two cents a mile.

To move that traffic over highways would require more trucks and busses than the 21,500,000 private passenger automobiles of the entire country.

Yes, there is plenty of business for the railroads!

* This article summarizes important improvements and experiments being made on the progressive railroads of the United States since THE NATIONAL GEOGRAPHIC MAGAZINE's last survey of the railroads in "America's Amazing Railway Traffic," by William Joseph Showalter, April, 1923.



AMERICAN INDIAN ARCHITECTURE REACHED ITS ZENITH IN THE HOUSE OF THE GOVERNOR AT UXMAL

This magnificent edifice surmounts the topmost of three terraces, some 50 feet above the general ground level, the lowest terrace covering about five acres. The building is about 300 feet long and 25 feet high. The upper half of the façade on all four sides presents an intricate sculptural design composed of some 20,000 individually cut stones. Originally the building was pierced by two arcades which permitted passage from front to back, but later these were converted into extra rooms by being walled up as shown here.

# YUCATÁN, HOME OF THE GIFTED MAYA

## Two Thousand Years of History Reach Back to Early American Temple Builders, Corn Cultivators, and Pioneers in Mathematics

By Sylvanus Griswold Morley

*Carnegie Institution of Washington*

*With Illustrations from Photographs by Luis Marden*

THE Peninsula of Yucatán projects northward between the Caribbean Sea and the Gulf of Mexico like the thumb of a giant hand. Located in its northern half are the States of Yucatán and Campeche and the Territory of Quintana Roo, in the Republic of Mexico.

It is almost as flat as the proverbial pancake, though, as one travels from north to south, a few low ranges, little more than foothills, are encountered, few exceeding 500 feet above the sea. The country is a flat, limestone plain of recent geologic formation, covered with a dense, rather low forest which increases in height from north to south as the soil grows deeper.

Yucatán has no surface water, no rivers or streams, and relatively few lakes, but everywhere are to be found large natural wells called *cenotes*, which made life possible in ancient times. In the formation of these, the surface coralline limestone, honeycombed by the action of water, has broken through, exposing the subterranean water level.

The cenotes and modern wells vary in depth directly with the increasing elevation of the land as one withdraws from salt water, from only a few feet at the coast to about 100 feet in the interior. The level of the subterranean water table, however, always remains the same.

There are only two seasons, the dry and the rainy. The former begins in December and lasts officially until May 3, Santa Cruz Day, when the faithful believe the rains should commence, though actually it may have been raining since the middle of April, or Nature, in a contrary mood, may have held off until the middle of June.

The thermometer does not fall below 39 degrees Fahrenheit, and does not rise above 107 degrees. But these two extremes do not tell the true story, since the average maximum is in the eighties and the average minimum in the sixties.

The nights, even after the hottest days, which are in April and May before the rains break, are cool, because of the trade winds which sweep across the peninsula from east to west practically throughout the year, bringing the freshness of the Caribbean Sea to cool the sun-parched land.

### ISOLATION MAKES YUCATÁN A "LABORATORY CASE"

Although Yucatán is a peninsula joined by a broad base to the continental land mass to the south, it is, practically speaking, an island (map, page 595). For every person who manages to fight his way into the peninsula through trackless jungles, across vast swamps and over stony ranges of low hills which together form an all but impassable land barrier, hundreds reach Yucatán by air or water.

This circumstance profoundly affected the civilization which flourished there in ancient as well as in modern times.

Because of its almost complete isolation, the peninsula was selected by the Carnegie Institution of Washington (D. C.), more than two decades ago, as a center for the intensive study of American aboriginal civilizations. Foreign influence having been reduced to a minimum, Yucatán is an excellent "laboratory case" for such a study.

This subtropical paradise is not difficult of access from the United States. Mérida, the capital, is only nine hours by air from Miami and less than six and a half from Mexico City. There are regular steamship sailings from New York and from New Orleans to Progreso, port of Yucatán. There is every facility for convenient touring about the peninsula, even the modern Mayaland lodge in the venerable ruins of Chichen Itzá.

Mérida, with about 110,000 people, must be one of the cleanest cities of its size in the world. All the streets are paved. Ninety

Photograph by Dr. Walter M. Stimpson

GRANDMOTHER GOES TO MARKET

The Maya, like other primitive peoples, have learned that the most efficient way to carry objects is on the head or back rather than in the hands. Thus masons transport blocks of stone weighing up to 200 pounds, and the Maya women balance baskets of food and clothes.

percent of the houses are of rough masonry coated with lime plaster. Flat concrete roofs rest either on wooden beams or, in the modern houses, on steel beams.

The houses are painted in every color imaginable, pastel shades of cream, pink, green, blue, and yellow prevailing (p. 638).

As in all Spanish cities, the dwellings present to the streets either entirely blank walls or heavily barred windows, but, once within the great front doors, even the humblest have their enchanting patios. In the more pretentious homes broad-arched cloisters with tiled floors surround the patios on all four sides, and in more modest ones on one or two sides.

The patio itself usually is a riot of brilliantly colored tropical flowers, many of which distill rare perfumes.

### "FIRST FAMILIES" WERE CAVE DWELLERS

Today, with its well-lighted, clean streets, its many parks, its movies, electric signs, autobusses and milling newsboys, bootblacks with their little portable boxes, and sweetmeat venders, Mérida is a city of the 20th century.

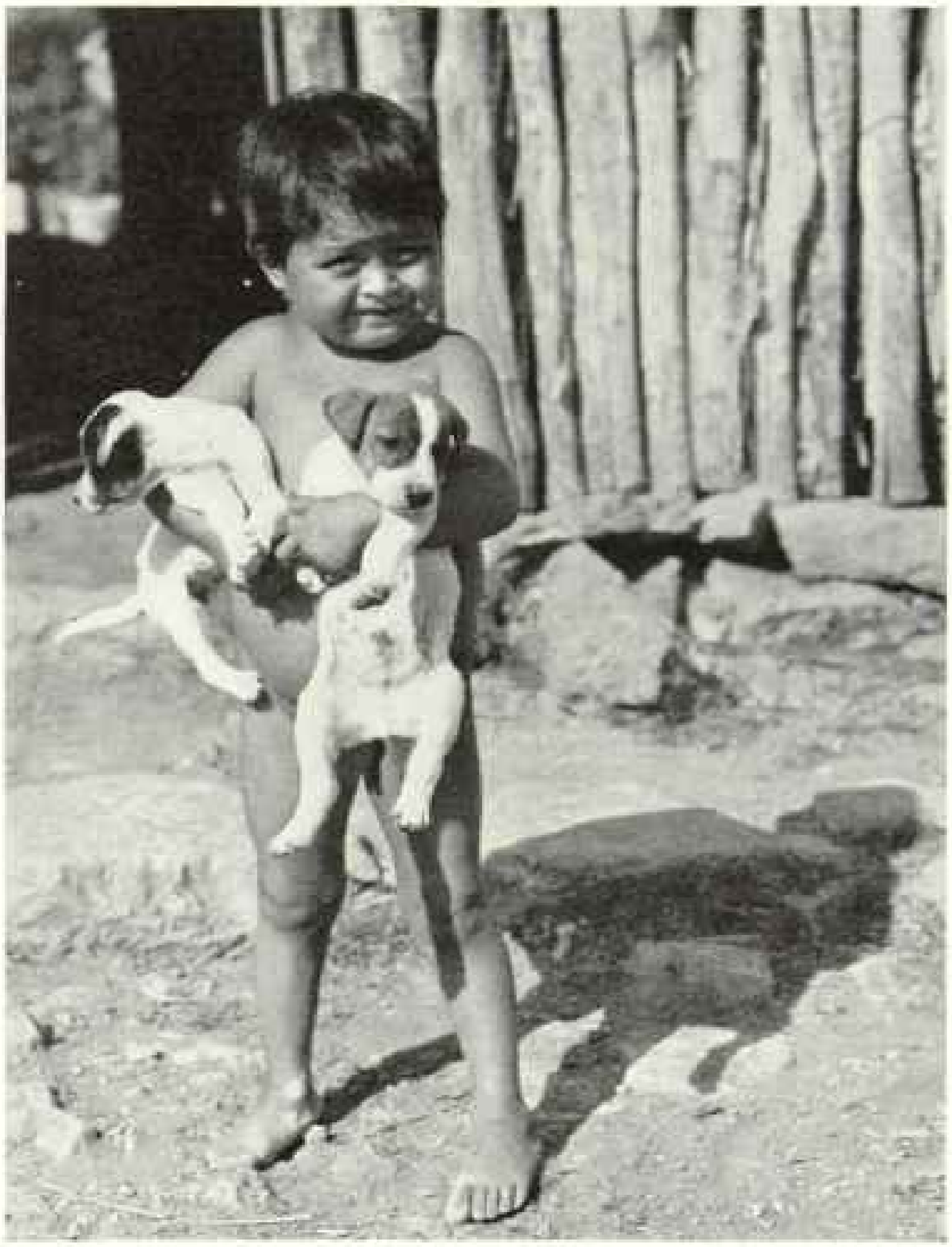
But with Maya Indians in their picturesque native costumes rubbing shoulders with Mexicans in the more familiar habiliments of the modern world, even with American visitors in plus fours strolling beneath the medieval dignity of the Cathedral towers, a thousand years of human history unfold before the eye (p. 635).

The story of man's earliest occupation of Europe has been recovered from the caves of France and Spain, so in Yucatán the archeologist naturally turns to the caves, of which there are many, for evidence concerning man's antiquity in this region.

It would seem that the dwellers in the caves were the same people as the builders of the great cities of stone, since excavations disclose that both appear to have used the same utensils, the same kinds of dishes,

bowls and water jars, the same kinds of corn grinders, arrow- and lance-heads, fiber cleaners, pottery burnishers, and the same kinds of jade ornaments, earplugs, nose-plugs, beads, and pendants.

However, about the builders of the cities of cut stone, the ancient Maya, the archeologist knows more than a little, and with the Maya the clouds of obscurity surrounding the ancient history of Yucatán begin to dissipate.



NO MORE CLOTHES THAN THE PUPPIES HE HOLDS

This little Maya man of Pisté, near Chichen Itzá, plays contentedly all day, taking fatherly care of his younger brothers and sisters. When he is about six, he will be sent to the forest to bring in loads of wood on his back for the kitchen fire. In humble households such as his there are no idlers.

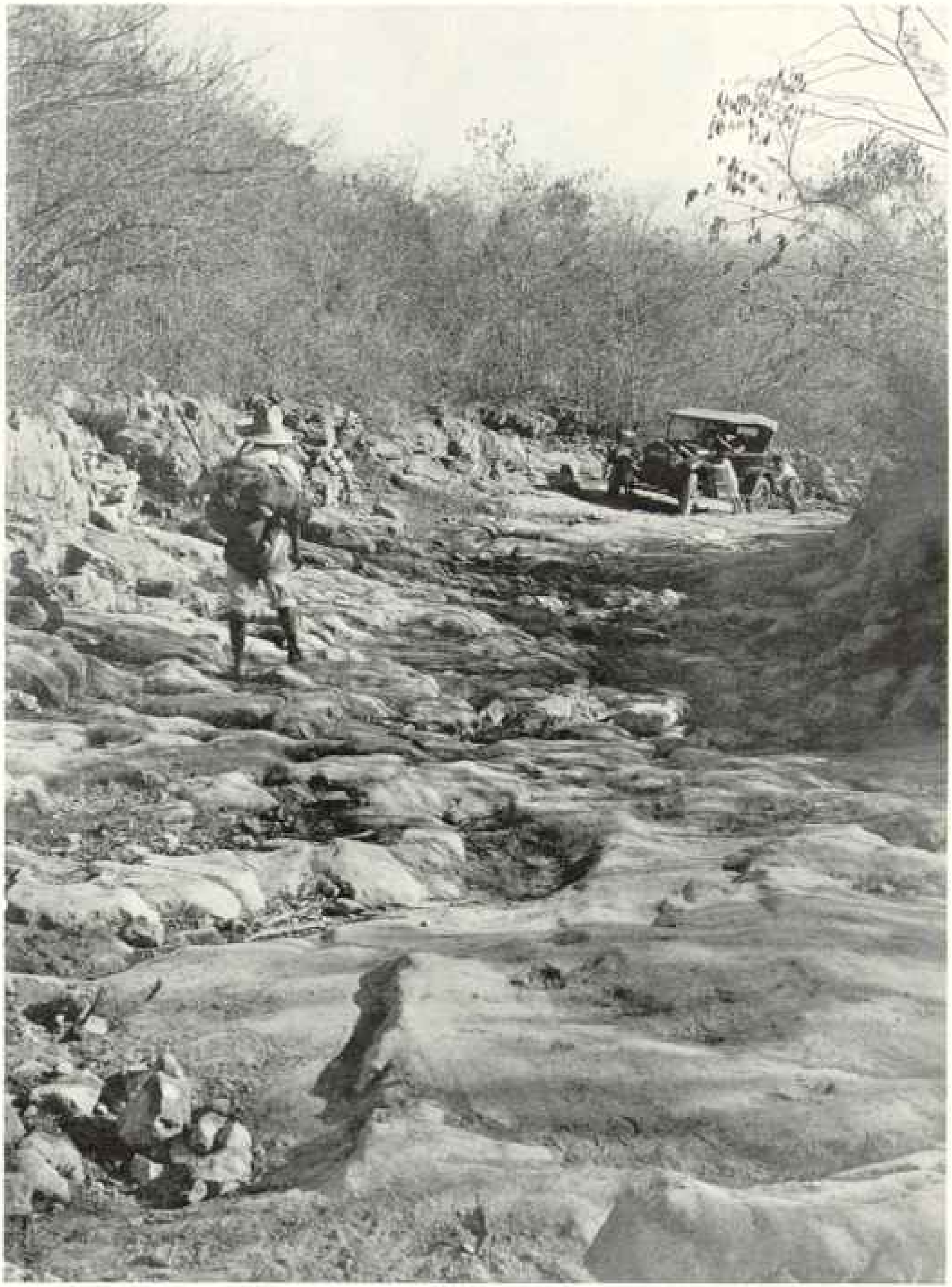
### GREEKS OF THE NEW WORLD

Sometime during the early years of the Christian Era there developed in what is now the northern part of the Republic of Guatemala—more exactly, in the Department of Petén, Guatemala, south of Yucatán—a civilization which archeologists have called the Maya.

This civilization, which was destined to become the most brilliant cultural expression of ancient America, was based upon agriculture, chiefly the raising of corn.

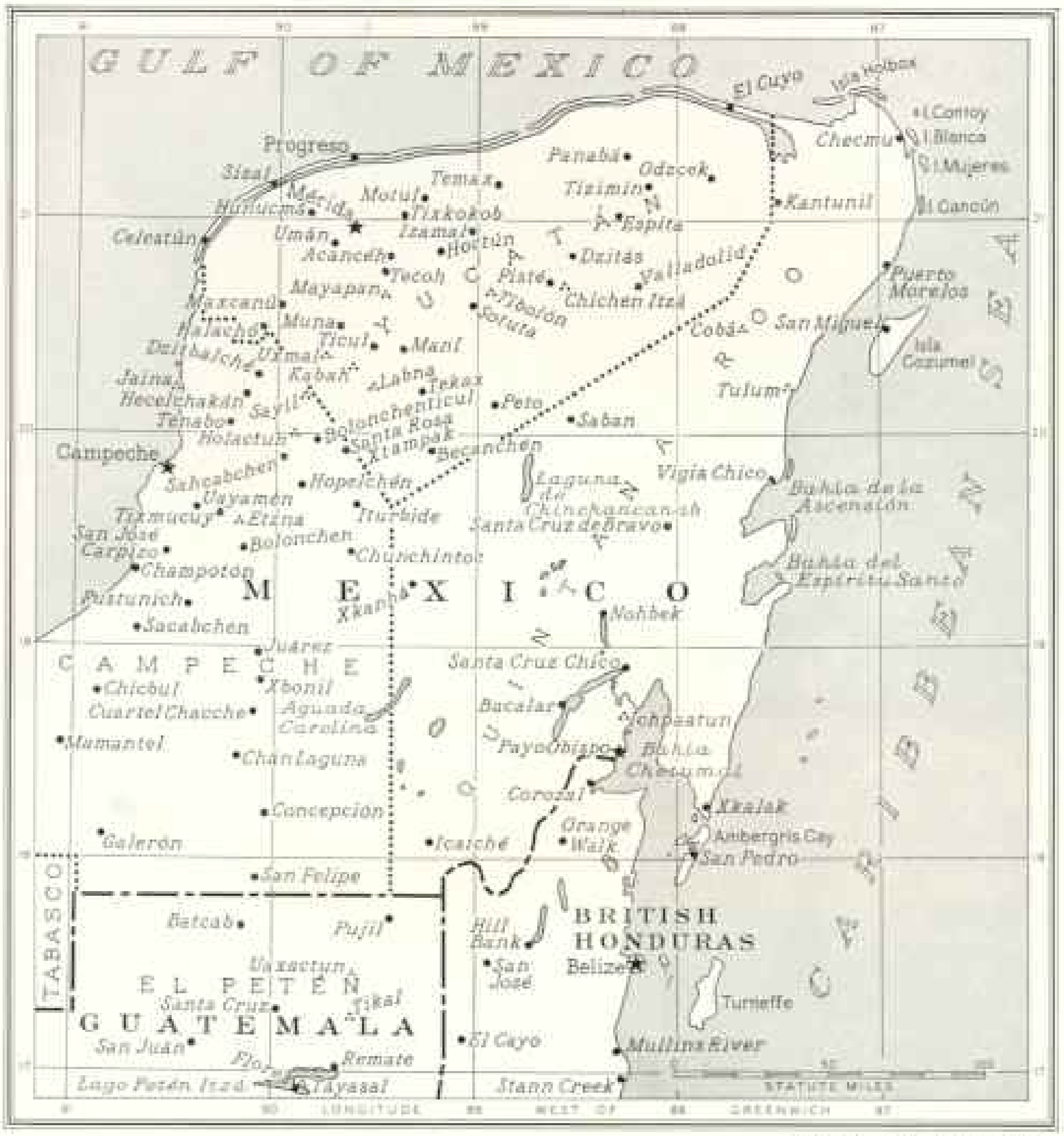
Because the early Maya were primarily farmers, they became interested in the phenomena of time, the passing of the seasons, the several stages of the farmer's year—when the forest should be felled, when the dried wood and leaves should be burned, when the corn should be planted, and when harvested. All these were of vital concern, so their priests at a very early date, probably by the beginning of the first millennium before Christ, turned their attention to the measurement of time and to the study of astronomy.

Although the Maya in their knowledge of the apparent movements of the heavenly bodies—the Sun, Moon, Venus, and probably other planets as well—far excelled both the ancient Egyptians and Babylonians, their greatest intellectual achievement was the invention of a chronology, exact to the day within a period of 374,400 years, which is as accurate as our own Gregorian



NOT A BOWLDER-STREWN STREAM BED, BUT A ROAD IN NORTH-CENTRAL YUCATÁN

Bedrock is only a few inches below the surface, and highway making without blasting is a hopeless task. Over stretches like this only an automobile with high axle clearance can travel. It took the author one hour and three quarters to cross this range, a distance of only two or three miles. Wise motorists get out and push where outcroppings of the native limestone make natural hazards.




Drawn by Newman Bumstead

THE YUCATÁN PENINSULA IN EFFECT IS AN ISLAND

Like a giant Mexican thumb, it points toward Florida across the Gulf of Mexico. Because it is difficult of access by land, this home of "the New World Greeks" is a natural laboratory for the study of the agriculture, architecture, and other amazing achievements of the Maya. Now airplanes from Miami and Havana, and steamers from New York and New Orleans bring increasing numbers of visitors to see the descendants of this cultured people, living among their ancestral ruins, with many customs unchanged for the last 2,000 years.

Calendar. For the first time in human history, their mathematical system to keep account of this chronology made use of a positional system of writing numbers involving the conception of the abstract mathematical quantity of zero, one of the outstanding achievements of all time.*

* I have explained the rudiments of the Maya Calendar in "The Foremost Intellectual Achievement of Ancient America," National Geographic Magazine, February, 1922.

While our own numerical system is decimal, increasing by tens from right to left of the decimal point, the ancient Maya system was vigesimal, increasing by twenties from bottom to top. But all the essential elements of our own modern arithmetic, including numeration by position and use of a symbol to represent zero, had been devised by the ancient Maya 2,000 years ago, and at least five centuries before the Hindus had developed the fundamentals

RURAL TRAINS ARE DRAWN BY WOOD-BURNING ENGINES

At each station men toss fuel into the tender from convenient piles stacked beside the track, while the passengers casually pass the time of day with relatives and friends. These locomotives are of ancient American vintage. Despite their age, they rarely break down and the passenger usually "gets through," well covered with wood cinders.

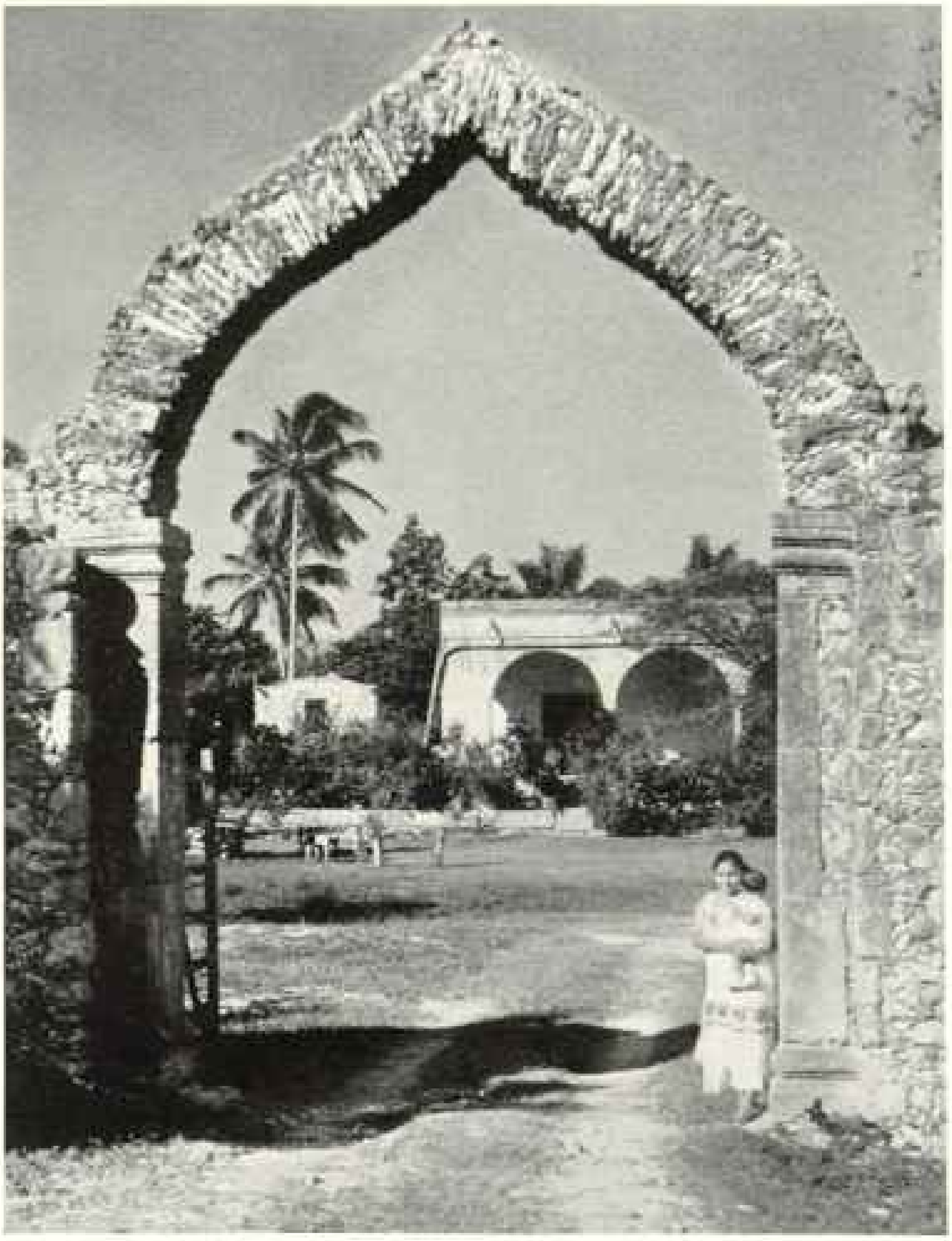
Photograph by Franklin L. Fisher

PEDRO, ENGLISH-SPEAKING GUIDE, STANDS BETWEEN "ATLANTEAN" COLUMNS

In the area known as Old Chichen Itzá, pillars of several buildings are carved to represent human figures with arms raised above their heads; hence the name applied to them. They are sometimes found in interiors, but more frequently in façades, as here.

of Arabic notation in India.

By their exceedingly accurate system of chronology as well as by their knowledge of the apparent movements of the heavenly bodies, the Maya priests were able to predict eclipses and the heliacal rising and setting of Venus. Moreover, what was of even greater importance to the Maya farmer, they had determined the length of the tropical year with as high a degree of accuracy as Pope Gregory XIII did a good thousand years later.



ARCHEOLOGISTS USE THIS HACIENDA AS HEADQUARTERS

The house was not built until about 1754, but there was a cattle ranch on the site here at Chichen Itzá a century and a half earlier, and the old stone gateway leads into what was formerly a corral. The arch with its pointed top reflects the Moorish influence seen so frequently in the present-day architecture of Yucatán.

### A CIVILIZATION FOUNDED ON CORN

The Maya civilization, being founded upon corn, the increasing production of this ancient Maya staff of life, due in no small part to the excellent service of their local weather bureau officials, the astronomer-priests, made possible the accumulation of food reserves.

The growing wealth meant more and more time off from the imperative routine of keeping body and soul together, so that an increasing number of people were able to turn their leisure time to other pursuits, such as architecture, art, sculpture, painting, ceramics, jade engraving, weaving, and featherworking, all of which crafts were highly esteemed by the ancient Maya.

Thus, during the fourth to eighth centuries of the Christian Era, there grew up numbers of cities, with public buildings made of stone, decorated with stucco, and brilliantly painted.

There were lofty pyramids, surmounted by towering temples, progenitors of our modern skyscrapers; great monasteries for the numerous priesthood; probably palaces for the ruling caste; astronomical observatories; ball courts, where a game something like our modern basketball was played; vapor baths, and other specialized masonry constructions.

These buildings were arranged around the sides of large squares or plazas, or on top

of artificially raised terraces sometimes of enormous extent. In the plazas and on the terraces stood beautifully sculptured monuments, ranging from 5 to 25 feet in height.

These were erected usually at ten-year intervals to commemorate the principal astronomic events of the past decade, to set forth the corresponding calendar corrections for the period, like our own leap-year corrections, as well as for other ceremonial and religious purposes.

### THE AMERICAN INDIAN'S ZENITH

This first florescence of the Maya culture I have called the Old Empire. It was the highest civilization, judged both by its intellectual and esthetic achievements, ever produced by the American Indian. The Old Empire was probably not so much a political entity as a cultural unit, like the ancient city-states of Greece, Athens, Sparta, and Corinth, or the city-states of Italy in the Renaissance, Venice, Genoa, and Florence.

The Maya probably did not constitute a political unit at all, strictly speaking, but rather a loosely associated group of powerful communities enjoying a common and exceedingly homogeneous culture.

The Old Empire stretched from what now is western Honduras to the highlands of central Chiapas, Mexico, always, however, keeping to the Atlantic side of the Continental Divide. Thence it extended northward across the heavily forested lowlands of northern Guatemala (the Department of Petén) and the adjacent parts of the States of Chiapas and Tabasco, Mexico, on the west and British Honduras on the east, and still farther northward into the Yucatán Peninsula (map, page 595).

However, it should be borne in mind that the northern half of the Yucatán Peninsula, which I have called the New Maya Empire, was only a provincial region in Old Empire times. It did not reach its cultural zenith until the 12th, 13th, and 14th centuries.

### THE COLLAPSE OF THE OLD MAYA EMPIRE

During the eighth century one by one the cities of the Old Empire ceased to build new temples and palaces; ceased to erect sculptured stone monuments with hieroglyphic inscriptions setting forth their respective dates in the Maya Era; ceased, in fact, to function as governmental and religious centers. The administrative leaders and the priesthood, who together had made the Maya what they were, withdrew to Yucatán. The common people soon fell away, and finally the former centers of teeming population were abandoned.

The forest returned, and again the jaguar, tapir, peccary, and deer stalked the courts where kings had ruled and priests performed their rites of human sacrifice (Plate XVII).

Earthquakes, foreign conquest, civil war, recurrent epidemics of yellow fever and malaria, climatic changes bringing an increased rainfall so abundant that the land was no longer tillable by the Maya system of agriculture, intellectual and esthetic exhaustion following a long period of forced productivity, social disorganization, political decay, and governmental disintegration—all these have been assigned at one time or another by different writers as causes for the collapse of the Old Empire.

While some of these factors undoubtedly played their part in Maya decline, especially social and governmental disorganization, I believe the chief agency which brought about the fall and abandonment of the Old Empire civilization was an age-old economic principle, the law of diminishing returns.

The primitive system of agriculture practiced by the Maya consisted in felling a patch of forest at the end of the dry season, in December or January, in burning it toward the end of the dry season, in March or April, and in planting it at the beginning of the rains, early in May. This procedure had two serious drawbacks (Plate XXIV).

First, long experience showed that the crop of corn harvested the second year from any given field was only about two-thirds as large as the first year's yield, while the third year's crop had shrunk still another third.

Corn experts from the United States Department of Agriculture who have studied the problem at first hand in Yucatán, where the modern Maya still practice the same system of raising corn, believe that the decreasing yield each succeeding year is due to the intense competition that the growing corn suffers from equally thriving weeds, which, by the third year, have become so thick as to choke out the corn.

In practice today the Maya find it easier to clear a new patch of the forest and make a new cornfield than to fight the exuberant

© National Geographic Society Finlay Photograph by Luis Marden

GOOD HUNTING STILL IN THE "LAND OF THE TURKEY AND THE DEER"

Thus the Maya of old called their domain in the Yucatán Peninsula, Mexico. The smiling hunter, holding a gorgeous ocellated turkey and wearing the customary apronlike cloth over his breeches, is a descendant of the mighty builders of Chichen Itzá, holy city of the Maya. Its patron deity was Kukulcan, the Feathered Serpent (Plates X, XI, XVI). Ruins of magnificent pyramids, palaces, and temples abandoned about 500 years ago have been excavated and restored by the Carnegie Institution of Washington, D. C., and the Mexican Government. The author describes the Institution's work there, which he has directed since its beginning in 1924.



Finlay Photograph by Luis Marden

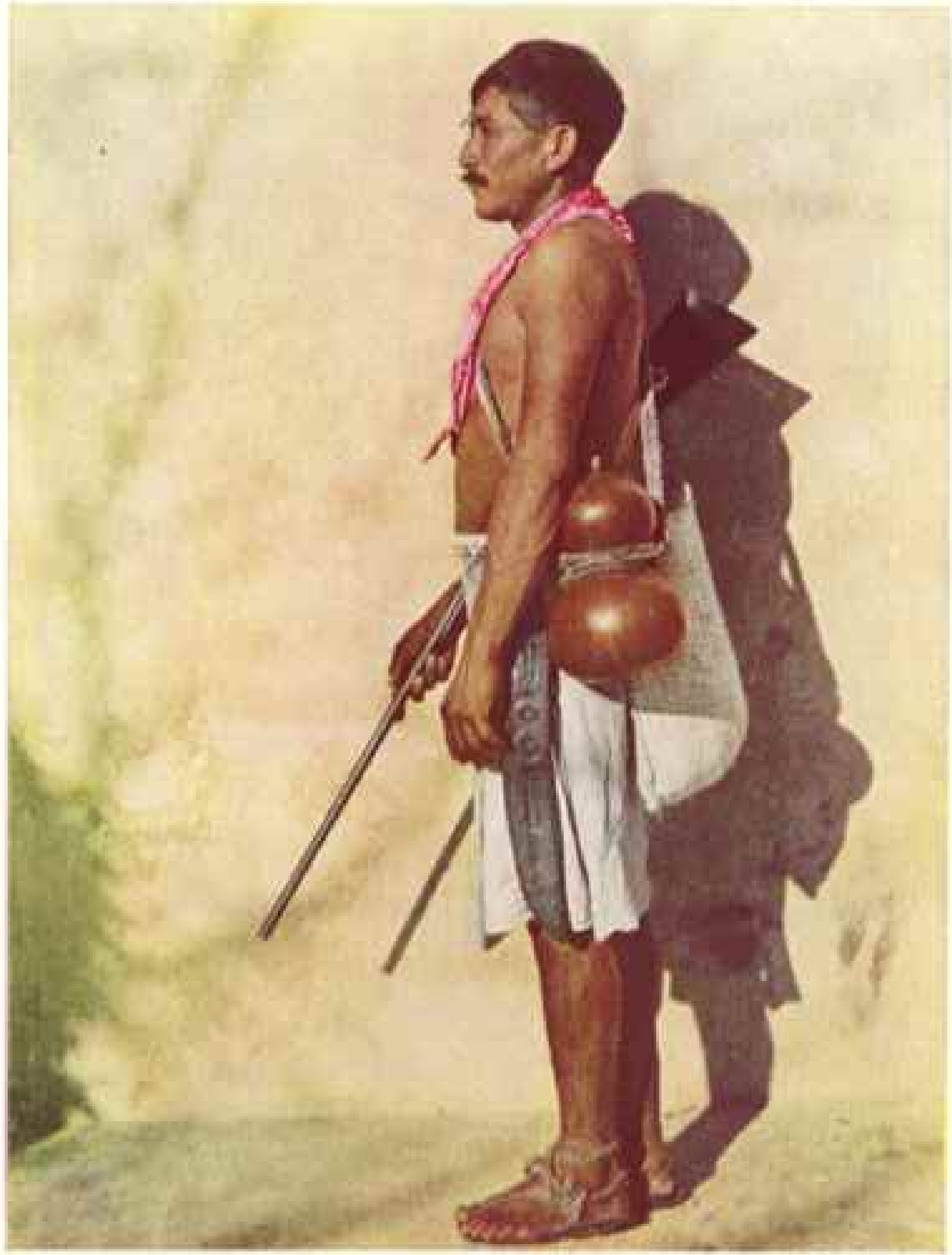
AMATEUR TOREADORS PARADE INTO AN IMPROVISED BULL RING OVERFLOWING WITH FIESTA CROWDS

The bull, now roped by the horns to a stake, will be goaded to action by a string of firecrackers tied round the body and set off the moment he is released. As soon as the matador, right foreground, dispatches the bull, the carcass will be cut up and sold as meat. This temporary ring occupies the main square of Dzitás, a village near Chichen Itzá. Behind it is the thatched roof of a large Maya house (Plate IV).



"LITTLE MONKEY" BAGS AN IGUANA

He can bring down a lizard, bird, or opossum with nearly every shot —a valuable art in Yucatán, where ammunition is costly. Angel, nicknamed Tuchin (Little Monkey), is the son of a Maya woman and the Korean major-domo of the Carnegie Institution's hacienda at Chichen Itzá.



Finlay Photographs by Luis Marden

A MAYA HUNTER TRAVELS LIGHT

When the stalwart foreman of the Chichen Itzá excavation gang goes shooting in the bush, he needs only shotgun, water gourd, food bag made of henequen, and a broad-bladed machete imported from Connecticut. He is a fine Maya type, with well-shaped head.

LIKE THEIR ANCESTORS, THE MAYA OF TODAY BUILD OVAL, WINDOWLESS HOUSES

Murals in the Temple of the Jaguars at Chichen Itzá depict dwellings identical with this one of near-by Pisté. A framework of saplings, with a door in each long side, is plastered with mud and thatched with palm leaves or grass. Domestic animals share the single room.

 Finlay Photographs by Luis Marden

FROM 75 TO 85 PER CENT OF A MAYA INDIAN'S DIET IS CORN

It is eaten mainly in the form of tortillas (Plate VII), of which the average native consumes about 20 at a meal. A sick person explains his state of health by saying: "I ate only one or two tortillas this morning." In ancient times, the Corn God was a principal Maya deity.

USING A HOOKED KNIFE AS "BOTTLE OPENER," HE WHITTLES A COCONUT TO GET A DRINK

The milk of the green fruit is safe as well as refreshing, and wherever coconut trees have been planted in Yucatán, they prove a boon to the traveler. The sharp, curved knife is used for many purposes, such as harvesting corn and cutting wood (Plate VI).

 Finlay Photographs by Luis Marden

PAPAYAS FIT FOR A GIANT'S BREAKFAST GROW AT CHICHEN ITZÁ

Fresh from the tree in the hacienda gardens, the fruit under the Indian's arm weighs 19 pounds and is about two feet long. Papayas resemble melons, but are not so sweet or strongly flavored as a cantaloupe. A favorite fruit in their native tropical America, they flourish also in southern Florida.



THIS MAYA WOOD CARRIER USES HIS HEAD

The tumpline across his forehead is made of henequen. Many of the Indians work on Yucatán's vast plantations, which export about fifty per cent of the world's supply of this fiber, used in making binder twine and rope. The hooked knife is a chopping and cutting tool.

Finlay Photographs by Luis Marden

A SCARLET HIBISCUS FOR THE RISING GENERATION

No less showy than the real blossom are the embroidered designs on the women's spotless "Mother Hubbards." Long petticoats, sometimes edged with lace, are part of the usual Maya costume, which on feast days may include earrings and high-heeled shoes.



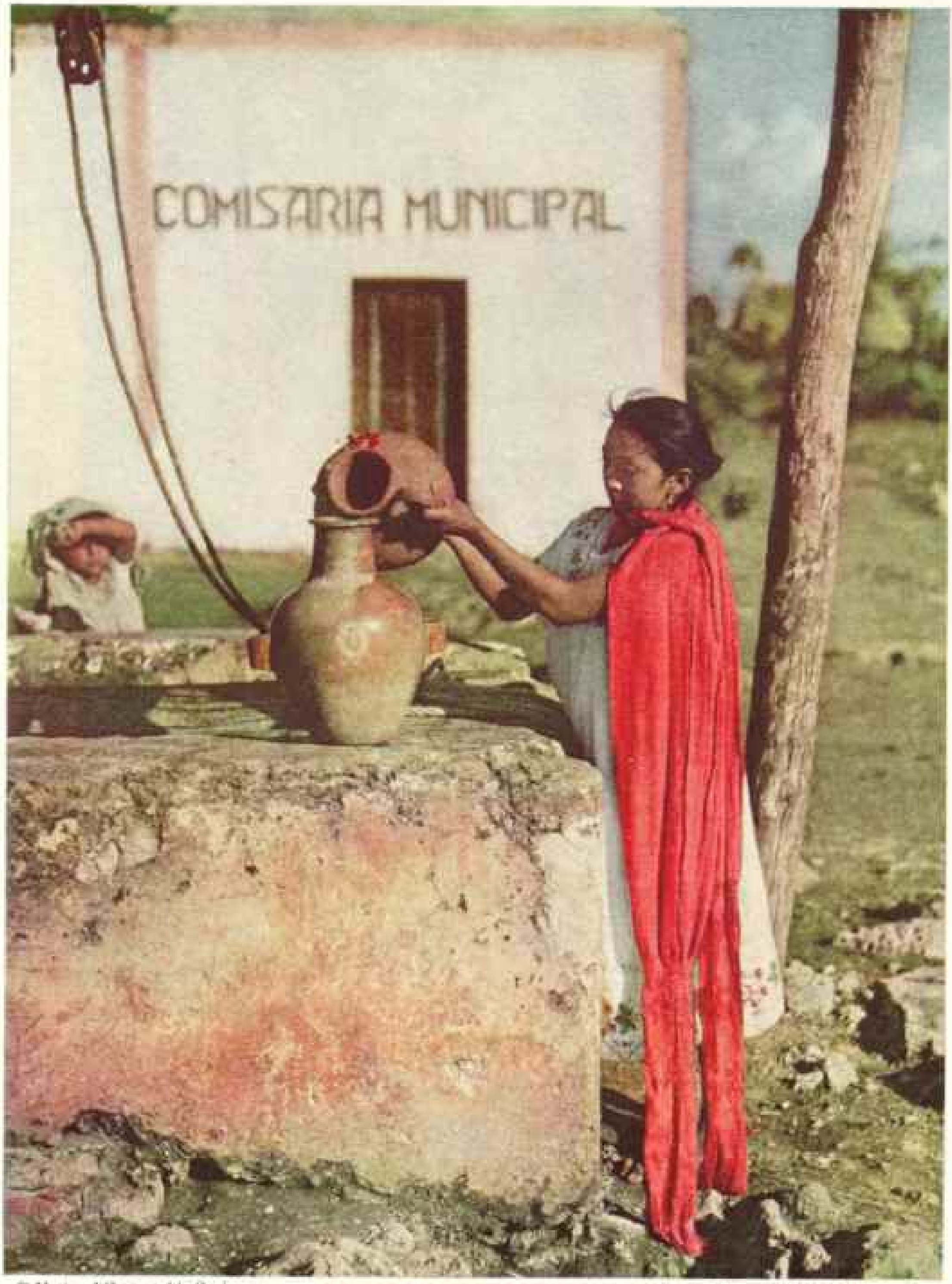
A HOUSEWIFE GRINDS CORN THE AGE-OLD WAY

She pushes the stone roller over maize on the stone and moistens the meal to make paste for tortillas. Modern grinders are displacing this method. The Maya civilization was based on corn (Plate XXIV).

Finlay Photographs by Luis Marden

TORTILLA MAKING IS WOMAN'S WORK

But the youngster seems interested as his mother deftly shapes the dough on a piece of banana leaf. She bakes the flat, round cakes on an iron pan over an open fire, then puts them in the hollow gourd, ready to serve.




 Finlay Photograph by Luis Marden

IN GAY SCARF AND FLOWERED GOWN, A MAYA MATRON FILLS HER FAMILY WATER JAR

From time immemorial, the women and girls of Yucatán have come with jars on heads or hips, in the morning and again before sundown, to draw water at the village wells, where they gossip and order the community's affairs like housewives in old-fashioned sewing circles. The sign on the "Municipal Commissary" is in Spanish, but many Maya speak only their native tongue.

 Finlay Photograph by Luis Marden

A MAYA "TARZAN" INSPECTS A COLUMN HIS ANCESTORS PAINTED CENTURIES AGO

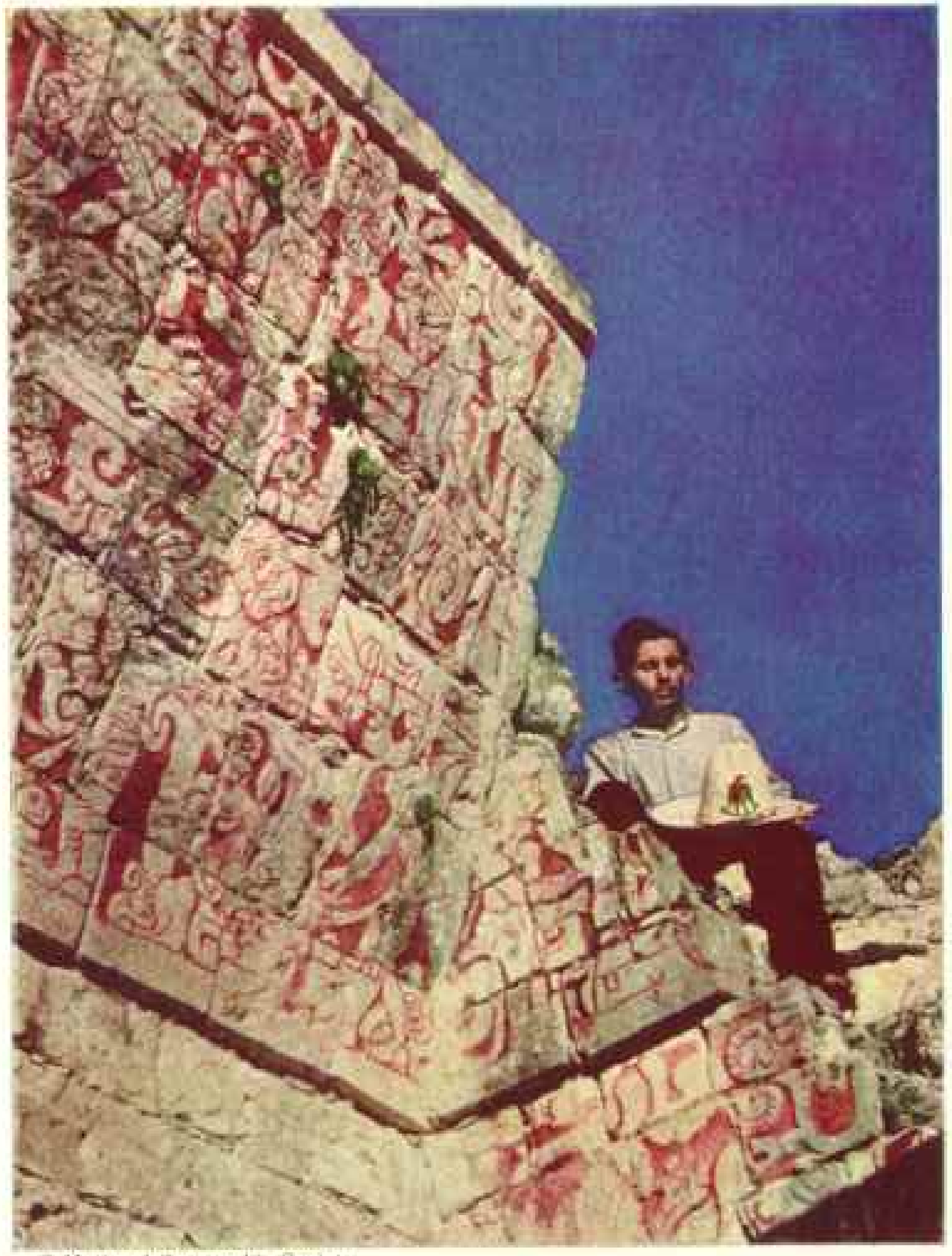
Its brilliant colors would have faded long since, had not this Temple of the Chac Mool been filled in and buried as part of the foundation for the later Temple of the Warriors (Plate XV). Each face of the limestone column bears the carved figure of a god or warrior, covered with fine white plaster and painted. A jaguar skin such as the youth wears for the camera was often part of the costume of the ancient Maya, to whom the animal symbolized bravery.



Finlay Photograph by Luis Marden

CEREMONIES OF BARBARIC SPLENDOR TOOK PLACE AT CHICHEN ITZÁ'S CHIEF SANCTUARY, CALLED "EL CASTILLO" BY SPANIARDS

Priests in gorgeous feather cloaks and jaguar skins probably led Maya maidens as sacrificial victims down the main stairway, right, and out along the Sacred Causeway to the Well of Sacrifice a quarter-mile distant (Plates XVI and XVII). Largest building in the city, the terraced limestone pyramid covers nearly an acre and was dedicated to Kukulcan, the Feathered Serpent. At the base of the reconstructed stairway gape two giant serpent heads,





RESTORING THIS VAULT WAS LIKE DOING A JIGSAW PUZZLE

The sculptures of warriors and other figures were only a jumbled heap of fallen stones. Mexican archeologists blocked out the background in red, so they could follow the design and fit the pieces together.

Finlay Photographs by Luis Marden

A FEATHERED SERPENT STANDS ON ITS HEAD

The open-jawed monster, a favorite Maya design, forms a column in the Temple of the Warriors (Plate XV). Now that the roof is gone, the overhanging tail, with rattles, is bolted to the body to keep it from falling.



Finlay Photograph by Luis Marden

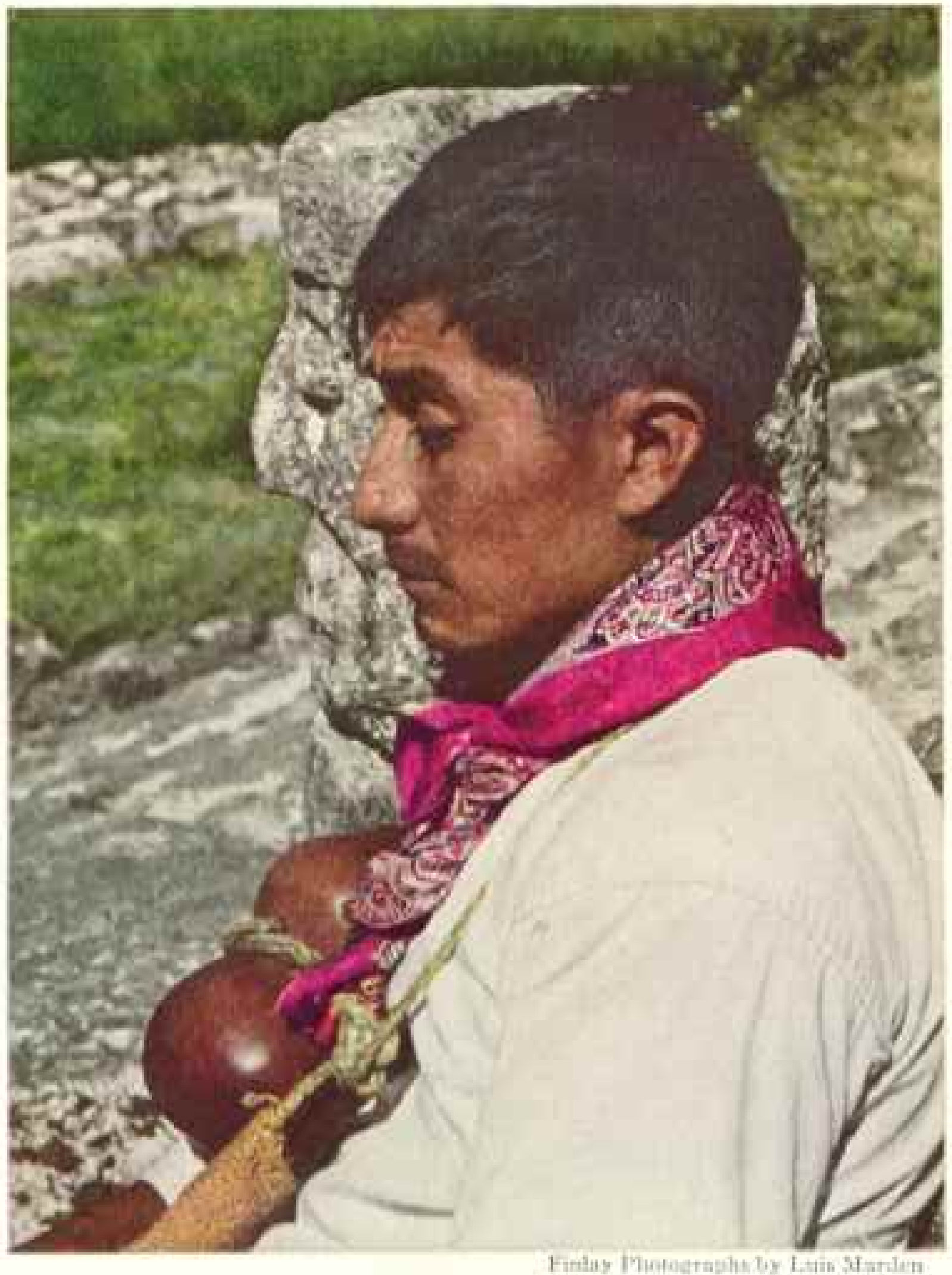
"GREEKS OF THE NEW WORLD" BUILT THIS ASTRONOMICAL OBSERVATORY AT CHICHEN ITZÁ

Spaniards named the Maya structure "El Caracol," from the resemblance of its interior spiral stairway to the whorl of a snail shell. Astronomers took observations through the windows near the top along definite "lines of sight." For example, the line of sight formed by the inner north jamb with the outer south jamb of the left-hand window bisects the sun as it sets on March 21, the vernal equinox (Color Plate XX).



A DOORWAY BUILT 600 YEARS BEFORE COLUMBUS CAME

Between sphinxlike faces flanking the entrance of a little ruined temple, a scientist studies the stone lintel, where hieroglyphics on the front show that the edifice was dedicated about A. D. 876. An extraordinarily accurate calendar was perfected by the ancient Maya.



Finlay Photographs by Luis Marden

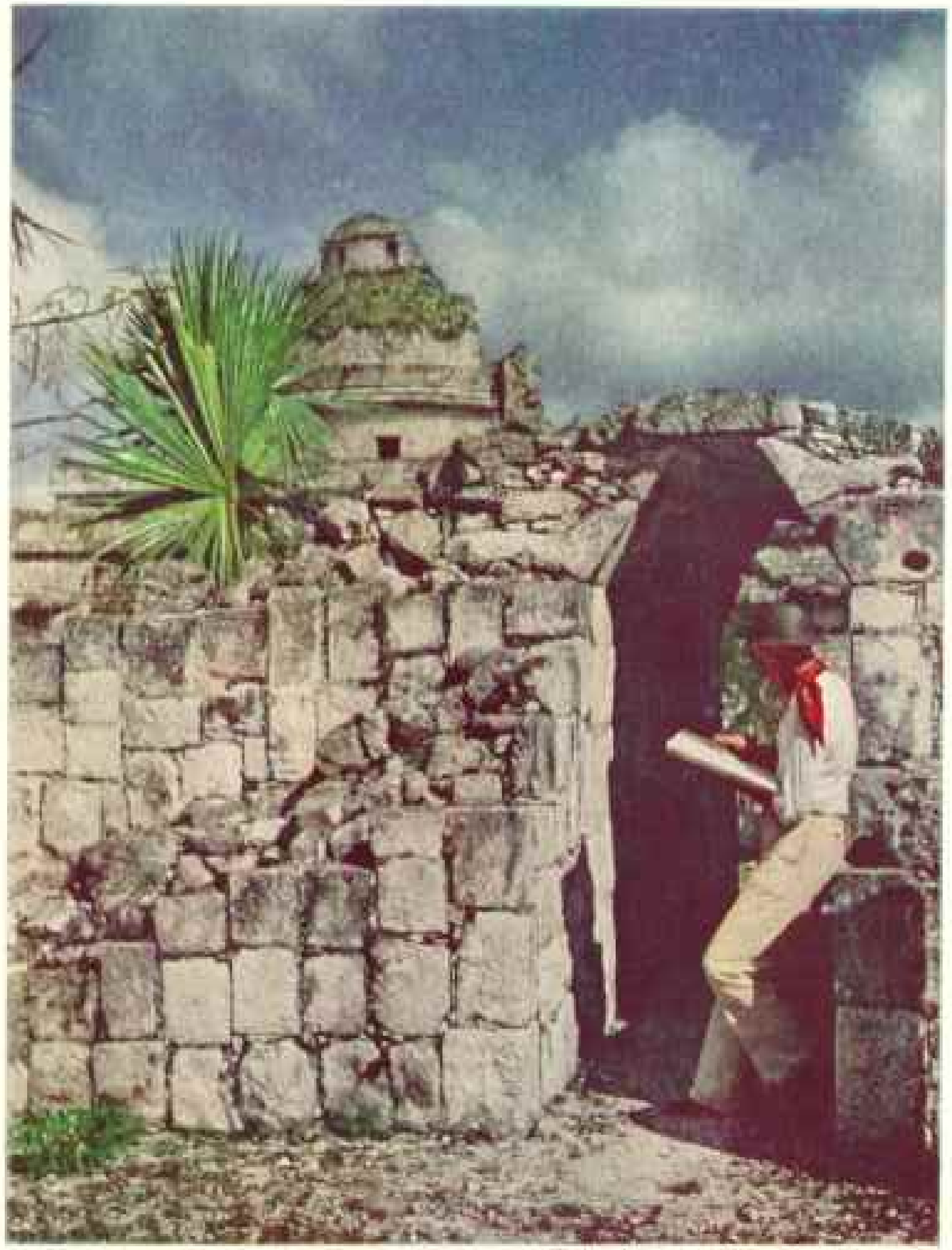
A GRAVEN IMAGE COMES TO LIFE!

Posed beside a hollowed stone fire pot or incense burner on the Caracol (opposite plate), this modern Maya in profile shows that his race has retained the strong aquiline nose, drooping eyelids, and roundel head that old sculptures depict.



THIS LAD KNOWS LITTLE OF HIS RACE'S BYGONE GLORY

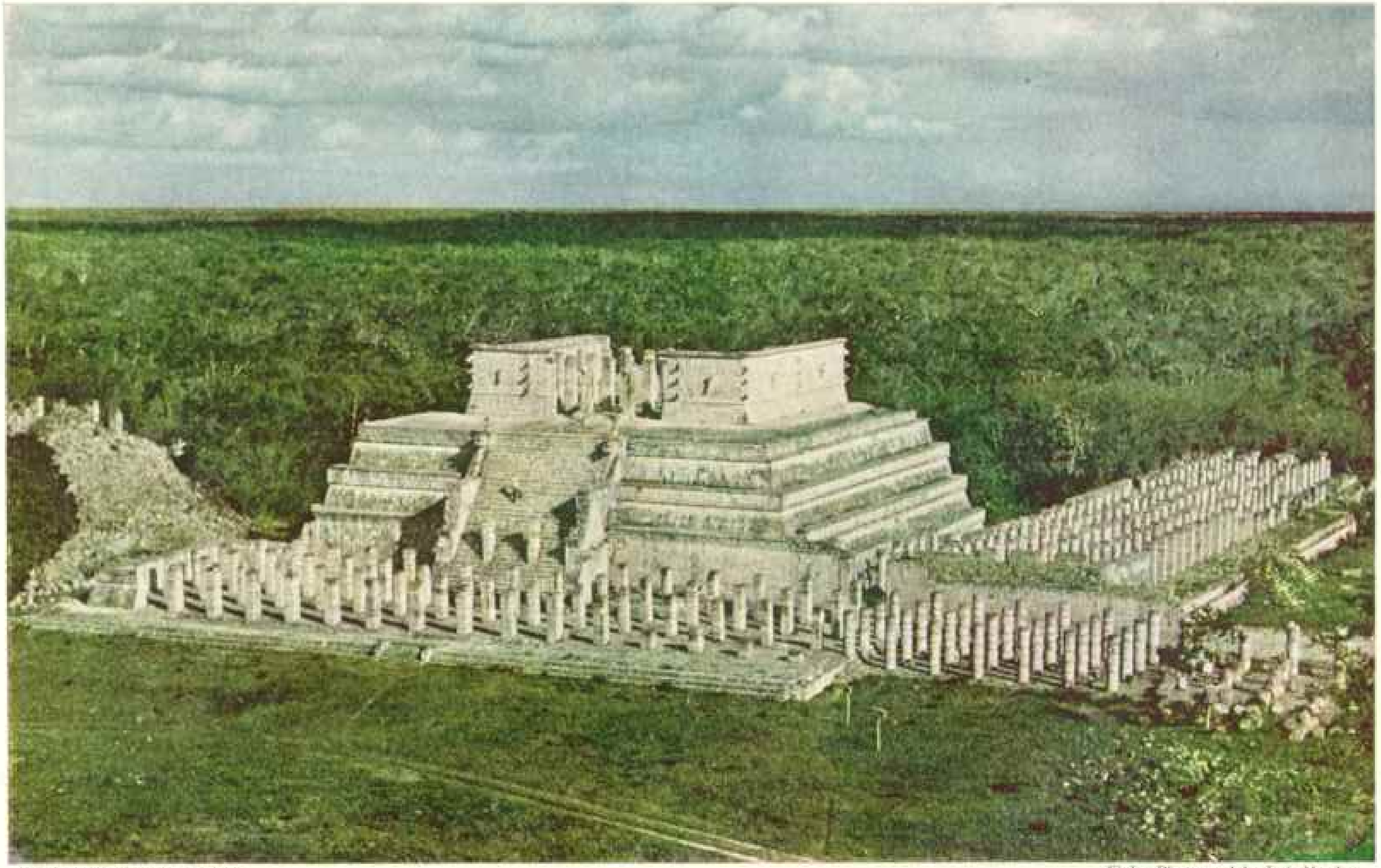
To a present-day Maya, the reliefs sculptured by his ancestors on the Temple of the Wall Panels would be virtually meaningless unless explained by an archeologist. Men, jaguars, monkeys, and thatched houses are depicted on the blocks.



Finlay Photographs by Luis Marden

A MAYA "ARCH" HAS NO KEYSTONE

This arcade in a temple beside the Caracol was formed by extending the side walls inward until they almost converged; then a flat capstone was laid across them. Roofs of temple colonnades constructed in this manner have all fallen in ruins.





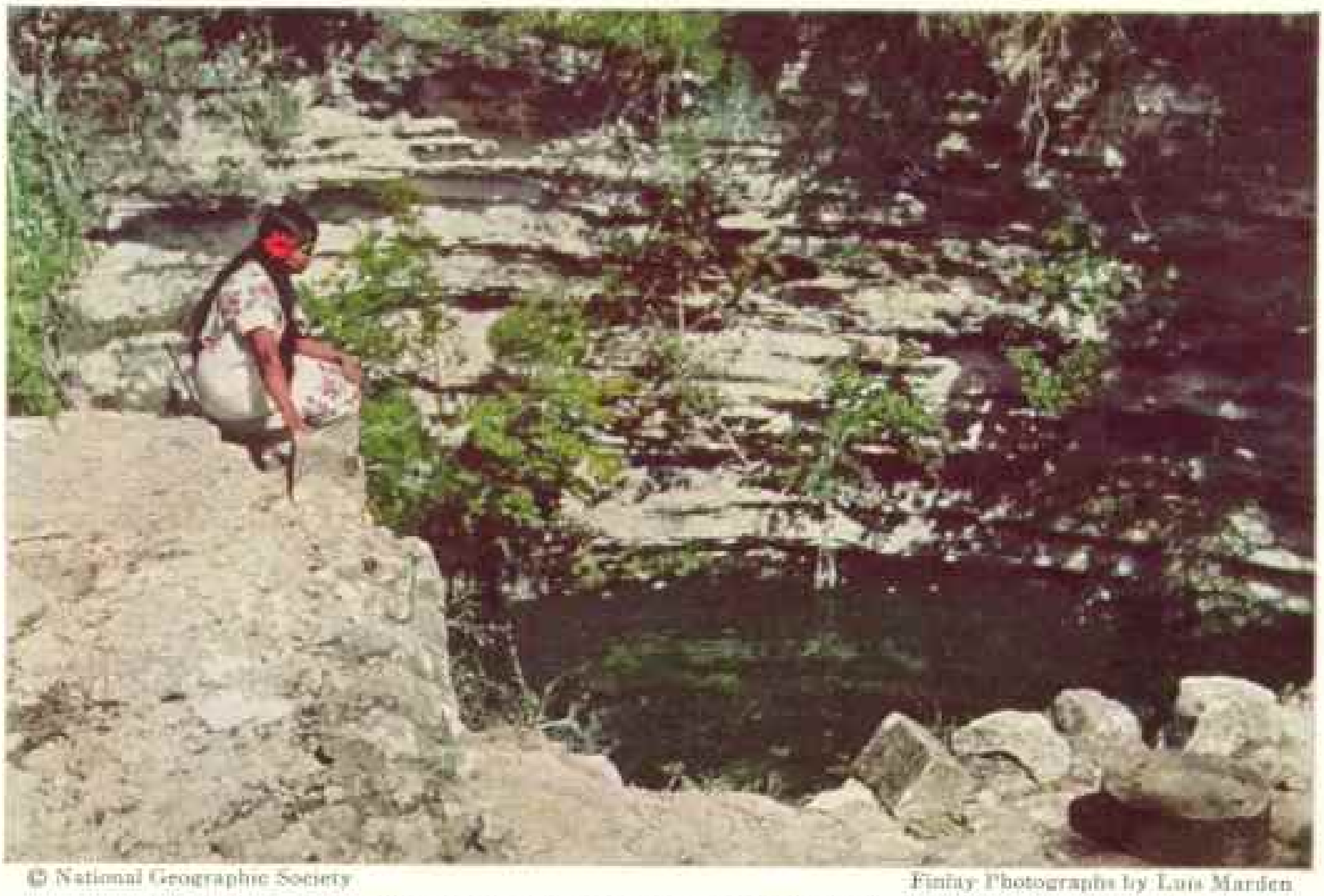
Finlay Photograph by Luis Marden

FOUR YEARS OF DIGGING AND REBUILDING HAVE REVEALED MUCH OF THE TEMPLE OF THE WARRIORS' FORMER GRANDEUR

This pyramid-sanctuary and colonnade at Chichen Itzá was nothing but a mound, covered with stones and overgrown with trees and bushes, when the Carnegie Institution commenced work on it in 1925. Archeologists named the now roofless building after the sculptures of fighting men found on pillars. Beyond the temple stretches the bush which covers much of level Yucatán. An automobile road runs from Mérida, capital of the State, to the ancient Itzá metropolis, where a modern hotel accommodates the numerous visitors to the ruins.

A SINGLE PIECE OF STONE FORMS THIS FEATHERED SERPENT'S HEAD

It is the base of one of two columns which originally flanked the principal portal of the buried Temple of the Chac Mool (Plate IX). America's habit of chewing gum is responsible for the finding of many Maya cities, for chicle hunters were among the first to report ruins.



 Finlay Photographs by Luis Marden

THE WELL OF SACRIFICE HOLDS NO TERRORS FOR A MAYA OF TODAY

A few centuries ago this girl might have been among the beauties cast from the stone platform, right, into the forbidding green water (Plate XVII). The round stone supported the dredging equipment of an American archeologist, who retrieved skeletons and sacrificial treasure from the well.

weeds a third year in the same field. Thus most of the total area available for cultivation must have been lying fallow in ancient times, when the population was much denser than it is today, awaiting reforestation, so that it could be cleared and burned again.

Today, depending upon the natural fertility of the region, this process of reforestation takes from three to ten years.

The second drawback to this agronomic system, which has been called *milpa* agriculture, after the Aztec word for cornfield, is even more serious than the first, though its ill effects are not so immediately apparent. If these repeated burnings are continued long enough, a point is eventually reached where the process of reforestation is retarded, and instead of woody growth returning to the abandoned cornfields, they become overgrown with grass. When this stage was reached, agriculture, as practiced by the ancient Maya, was at an end.

### LACK MODERN FARM IMPLEMENTS

Even today the modern Maya have no way of turning the stony soil, everywhere interspersed with outcroppings of the native limestone. They have no hoes, picks, harrows, shovels, spades, or plows. Indeed, the ground is so rocky that no attempt is made to turn it and their only agricultural implements are the ax, the *machete*, or cutlass, with which they fell the forest, and the wooden planting stick with which they make holes in the ground and plant the corn. Their ancestors had only the stone ax and planting stick.

In ancient times the trees were killed by cutting a ring around the bark with a stone ax, and when they had dried out they were burned standing.

I believe that by the eighth century, after perhaps a thousand years of intensive occupation, the Old Empire region had been gradually transformed from a heavily forested area to vast man-made savannas. The forests were replaced by grass lands, and agriculture, as practiced by the Maya, was at an end.

This naturally did not take place all at once, but slowly, the forest gradually retreating before the advancing savannas.

The ancient Maya priests surely must have foreseen what was impending and many, if not most, of the religious ceremonies toward the end of the Old Empire were doubtless special appeals to the gods to send more abundant crops.

The archeologic evidence, however, indicates that the Maya deities did not hearken to these prayers.*

### THE MAYA REACH YUCATÁN

Long before affairs had reached this crisis in the south, however, parties of Maya had been pushing northward into the Peninsula of Yucatán. One of the early Spanish chroniclers, Father Bernardo de Lizana, writing at the end of the 16th century, mentions a tradition that the pioneer entry into Yucatán by the Maya was from the east and that at first only a few people came, for which reason this first Maya immigration was called the *Conial*, or "Little Descent." Later many people came from the west, which movement was called the *Nohenial*, or "Great Descent."

In Lizana's time these two words were used metaphorically for east and west, respectively, instead of the usual Maya words, *likin* and *chikin*.

If we substitute "southeast" for "east" and "southwest" for "west" in Father Lizana's statement, we shall find that this tradition agrees with the archeologic evidence. For there is a chain of dated cities extending from northeastern Petén up the east coast of the peninsula and thence inland (Ichpaatun, Tulum, Cobá, and Chichen Itzá) and another up the west side of the peninsula (Santa Rosa Xtampak, Etzna, Holactun, and Jaina).

Moreover, the eastern cities, with one exception, all have earlier dates than the western ones.

The first Maya probably reached Yucatán from the southeast, but there is strong, indirect archeologic evidence that they found an earlier people already settled there who may or may not have spoken the Maya language, but who certainly did not have Maya culture. They had no stone architecture, no chronology or calendar, no hieroglyphic writing and no typical Old Empire pottery.

And herein lies the archeological catch.

If the Maya had found no previous occupants of the region, the pottery they made after reaching Yucatán would have been the same, given minor variations due to local differences in clay, as they had made in their former homes in the south.

* I have recently told the story of the Old Empire civilization and the cause of its fall in a "Guide Book to the Ruins of Quirigua," published by the Carnegie Institution of Washington, D. C.

"THE FEATHERED SERPENT" GUARDS THE TEMPLE OF THE WARRIORS

The two high columns, flanking the central doorway, are representations of the Maya god Kukulcan, patron deity of Chichen Itzá. The heads with widely opened mouths lie on the ground and the tails above terminate with tufts of feathers. The reclining human figure in front holds on its belly a flat disk where offerings were placed by the faithful before entering the building. This ruin was excavated in 1925-1926.

But such is not the case. H. E. Roberts, the Carnegie Institution's expert on Maya ceramics, finds that the pottery used throughout Yucatán in New Empire times is entirely different from that used in the Old Empire region from whence they came.

The easiest explanation for this apparent archeologic paradox is that a distinctive indigenous ceramic art had already been developed by previous inhabitants of Yucatán before the arrival of the Maya cultural complex. The bearers of the Maya tradition simply took over native styles of pottery—much the easiest thing to do—but imposed the other elements of their own culture, such as the architecture, art, calendar, and hieroglyphic writing, on the earlier inhabitants of the region.

### THE MAYA RENAISSANCE AND THE LEAGUE OF MAYAPAN

Chichen Itzá, in northeastern Yucatán, later destined to become the most holy city of the New Empire, seems to have been founded toward the end of the seventh century, and Uxmal and Mayapan, other important cities of the north, somewhat later, perhaps by the end of the tenth century.

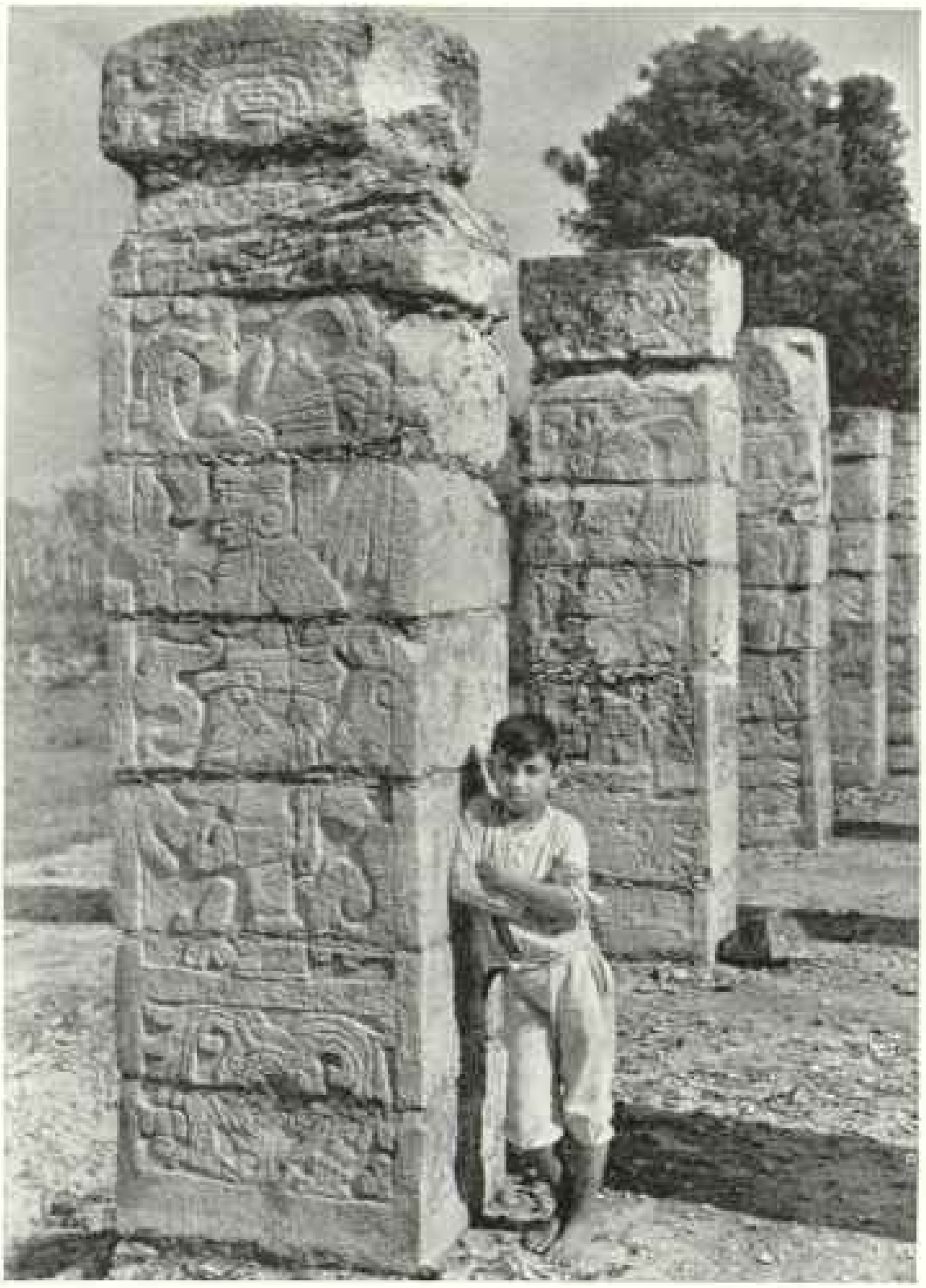
The earliest period of the former possibly goes back to the "Lesser Descent," the two latter to the "Greater Descent."

Early in the 11th century the three most important city-states of northern Yucatán, Chichen Itzá, Uxmal, and Mayapan, established a confederacy called the League of Mayapan, under which the country was divided into three spheres of influence, one of these three city-states being pre-eminent in each.

Under the peaceful conditions which followed, the Maya civilization blossomed anew, the arts revived, and architecture flourished as never before, not even in the

heyday of the Old Empire.

The façades of the New Empire buildings, instead of being decorated with stucco, were elaborately sculptured with geometric designs, mask panels of the Rain God and other decorative elements, and brilliantly painted, while sculpture as an independent art seems to have languished, being used chiefly as an adjunct to architecture. The Maya were at peace, the country prospered under wise leaders, and a true Renaissance flowered and endured for two centuries.



RELIEFS SHOW HUNDREDS OF WARRIORS, NO TWO ALIKE

Each of the four sides of these rectangular columns in the northwest colonnade at Chichen Itzá is carved to represent a fighter in full regalia. Originally the eyes of these figures were exceedingly lifelike, for they were made of incrustations of white shell with small circles of black pitch or resin to form the pupils. Finally, as in all other Maya sculptures, the relief was painted in a variety of bright colors: red, blue, green, yellow, brown, and also black and white.

### THE MEXICAN PERIOD

Toward the end of the 12th century the League of Mayapan was disrupted by a fierce quarrel between the rulers of Chichen Itzá and Mayapan. Uxmal, standing on the side lines, watched her former allies fight it out.

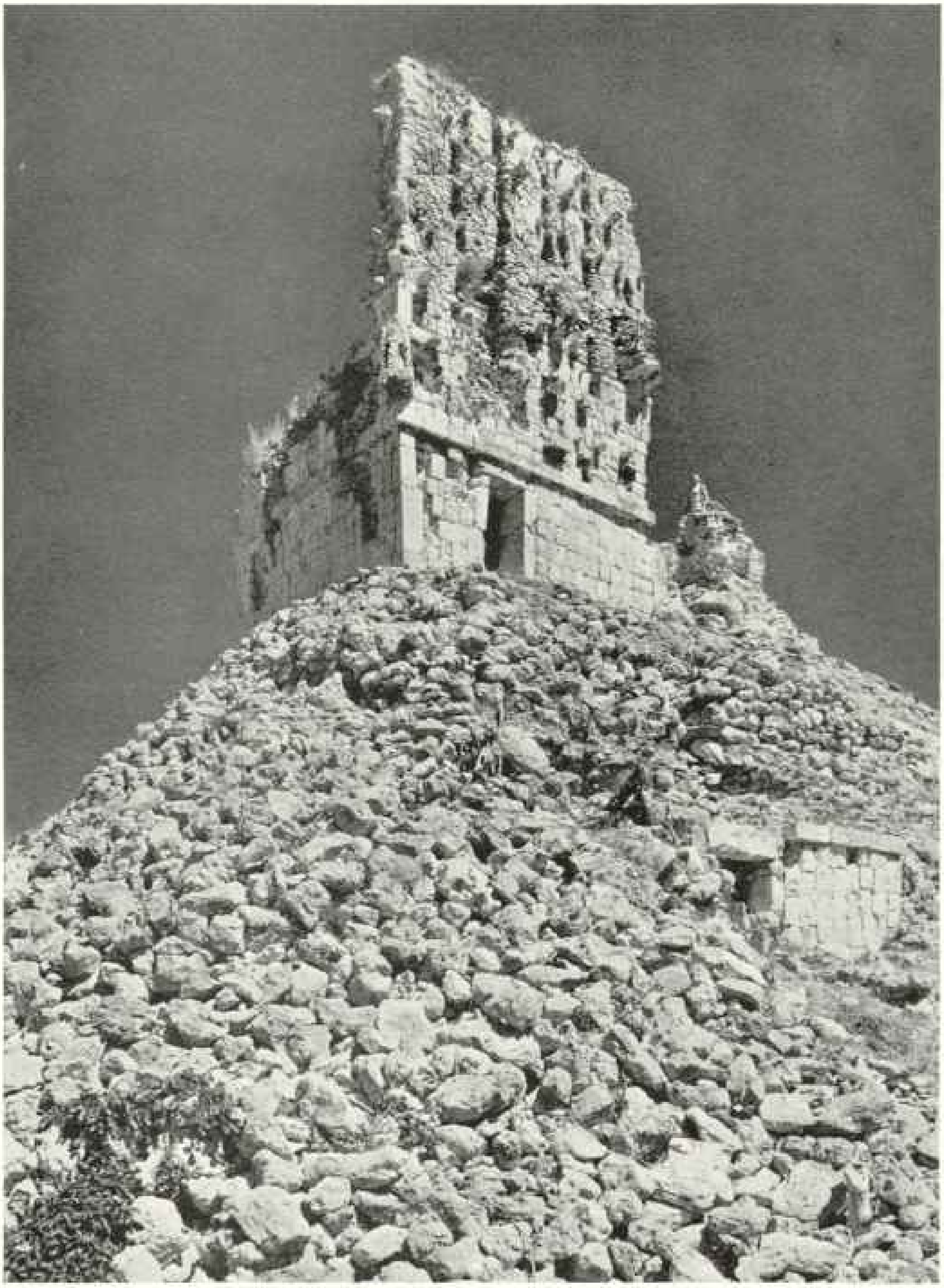
The "True Man" of Mayapan, as the ancient Maya called their ruler, Hunnac Ceel (Plate XXII), finding himself hard pressed in the ensuing war, brought over foreign allies from the interior of Mexico.

These were not Aztecs, nor perhaps even Toltecs, who preceded the Aztecs in the central Mexican highlands, but more probably a closely allied people speaking a dialect of the same language as that of the Aztecs, namely, Nahuatl.

With the aid of his Mexican allies, who possibly introduced the bow and arrow into Yucatán, which in turn may have been partly responsible for the victory which followed, Hunnac Ceel defeated Chac Xib Chac, the ruler of Chichen Itzá.

Though the fragmentary pre-Spanish chronicles are silent on the point, it appears highly probable, nevertheless, that Chichen Itzá was given to the Mexican allies as their share in the spoils of war.

During the closing period of Chichen Itzá's history (the 13th, 14th, and first half of the 15th centuries), the city fell under a strong Mexican influence, clearly reflected in its art and architecture.

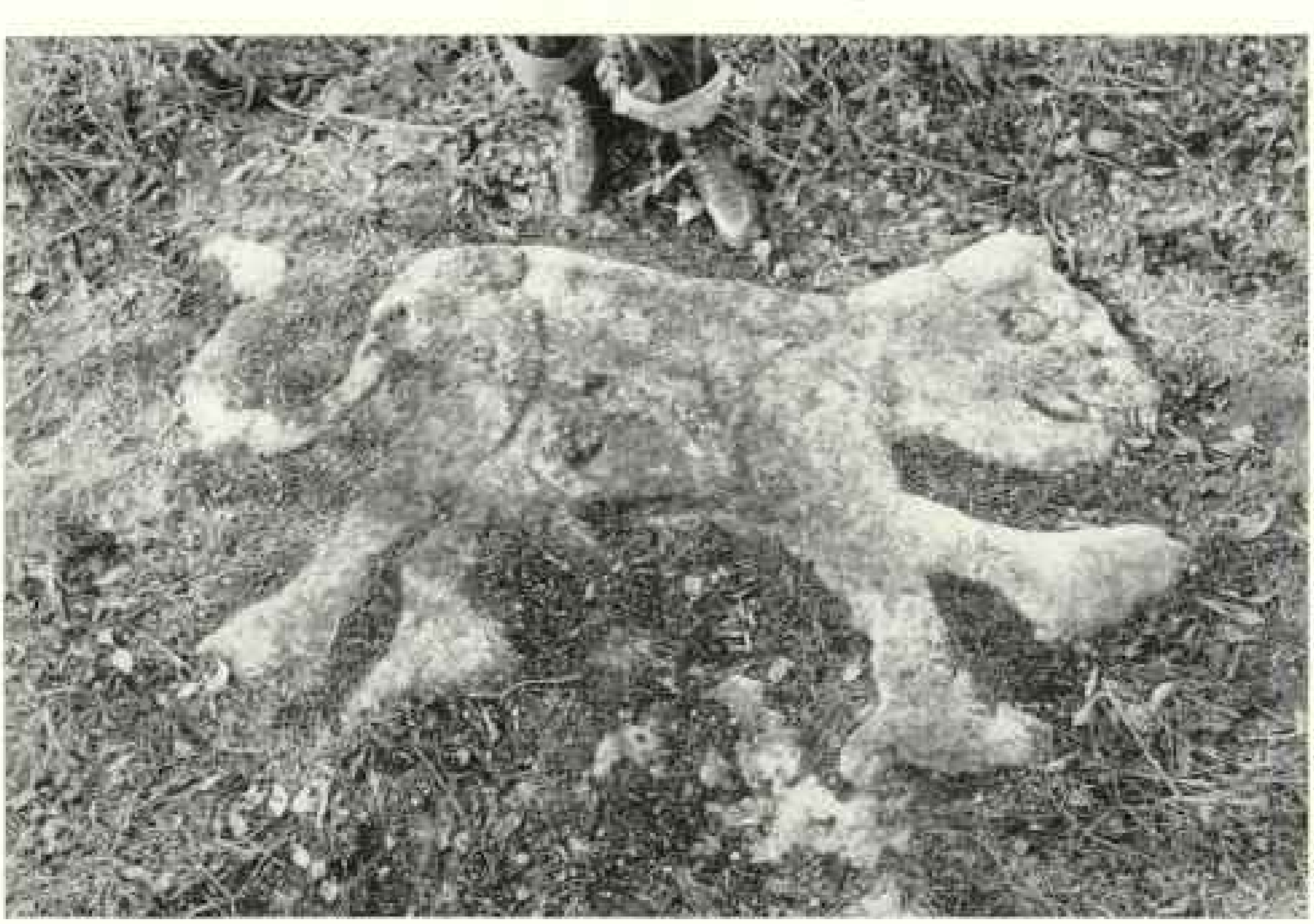


HIGH, DECORATIVE WALLS SURMOUNT ROOFS OF MANY MAYA TEMPLES

These superstructures, sometimes towering 30 feet, were purely decorative. They were used as the framework to support an elaborate design worked out in stucco, which in most cases has been destroyed. A few examples, however, are still fairly well preserved and these indicate the character of the relief formerly presented on them: figures of gods, rulers, animals, and masks.

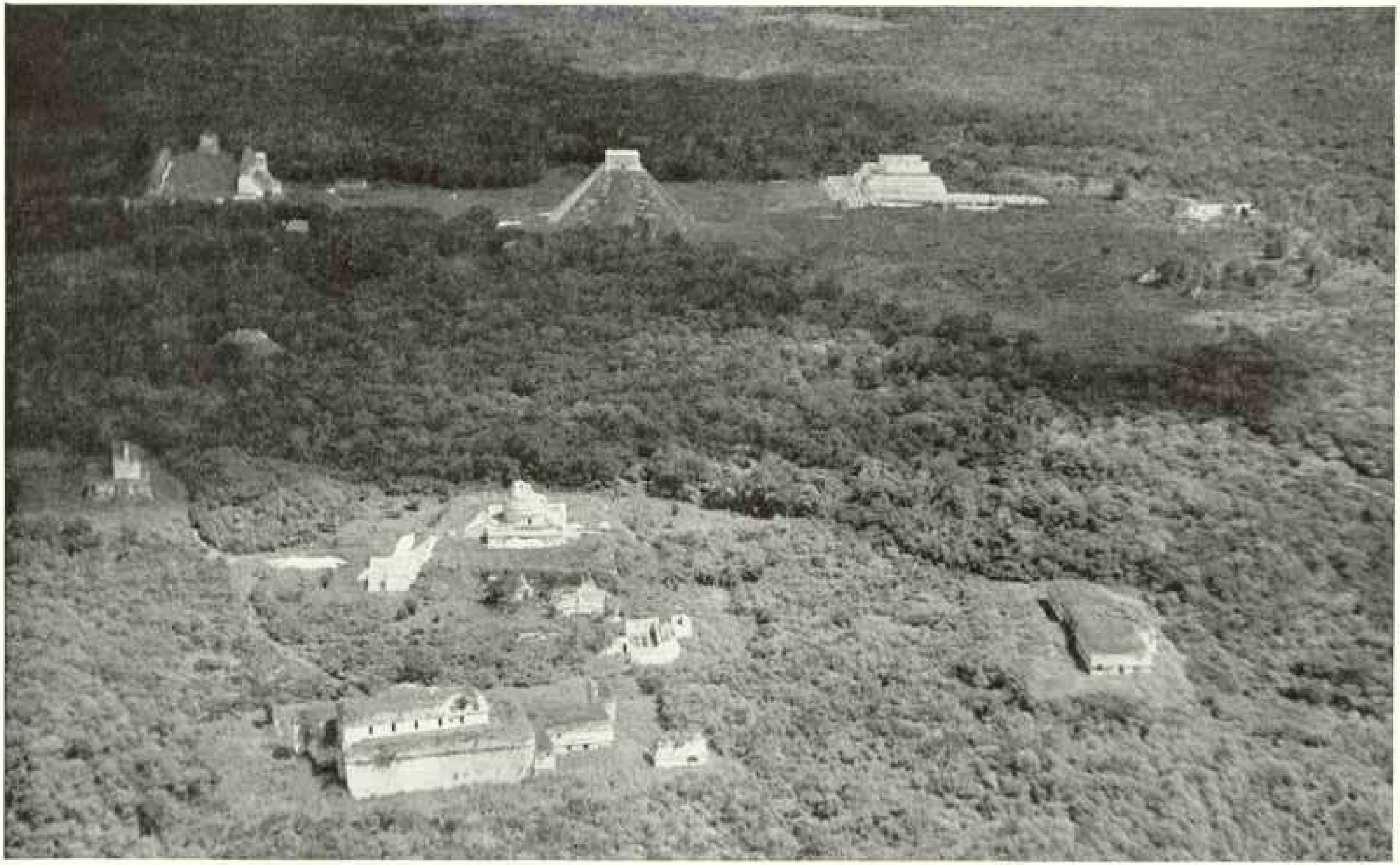

THE THREE R'S REACH COUNTRY VILLAGES

Schools in Yucatán are of three kinds: some Federal; others State, and a few private. This one at Pisté, two miles from the ruins of Chichen Itzá, is a Federal school.



A JAGUAR FIGURE ADORNS A LIMESTONE OUTCROP NEAR THE HACIENDA AT CHICHEN ITZÁ

Representations of this animal were important in Maya symbolism. Capes, breechclouts, and headdresses made of jaguar skins are frequently portrayed in reliefs and wall paintings, as also double- or single-headed jaguar thrones.

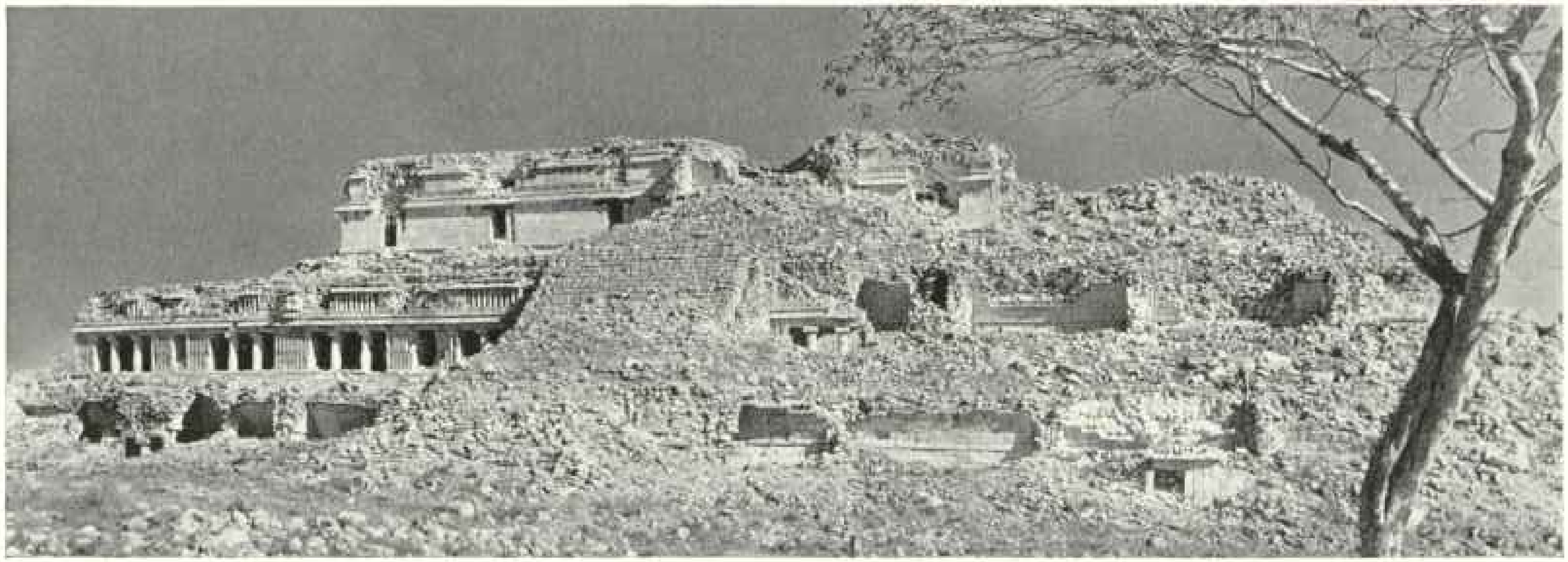


Photograph by Colonel and Mrs. Charles A. Lindbergh

THE LINDBERGHS OBSERVED CHICHEN ITZÁ FROM THE AIR

The famous aviators made a series of flights in October, 1929, exploring the eastern part of the Yucatán Peninsula. The aerial surveys were sponsored by the Carnegie Institution of Washington and the Pan American Airways. Dr. A. V. Kidder and Dr. O. G. Ricketson, Jr., of the Carnegie staff, accompanied the flyers. Photographs were made of ruined cities; this shows the New Empire site of Chichen Itzá, with the Monastery in the foreground, and the principal temple in the center background.

PRIESTS OF THE TEMPLE "THE HOUSE OF THE MAGICIAN" AT UXMAL (RIGHT) PROBABLY LIVED IN THE MANY CELL-LIKE CHAMBERS (LEFT)



THE THREE-STORY PALACE AT SAYIL CONTAINS 100 CHAMBERS

As in the majority of structures by the ancient Maya architects, who seem to have distrusted the weight-supporting properties of their typical corbel-arched roofs, the two higher stories were set back, being built on solid foundations rather than directly over the rooms beneath. Because the prevailing winds and rains in Yucatán are from the east, the right half of this building (the eastern half) has suffered more than the left.

As a result of the breaking up of the League of Mayapan, Chichen Itzá seems to have acquired a new and non-Maya dynasty, which introduced a new religion, a new art, a new architecture, and many new customs and ideas. Because it presents a blending of the two most important native cultures of North America, the Maya and the Aztec, Chichen Itzá was selected by the Carnegie Institution of Washington as a center for intensive explorations.

Excavations begun there in 1924 have continued ever since. Many imposing structures have been revealed and a flood of light thrown upon the life of the New Maya Empire (page 620).*

Chichen Itzá has an abundant water supply, which doubtless, from the beginning of man's occupation of Yucatán, predetermined that an important center of population should grow up there. The site is provided with two cenotes, each more than 200 feet in diameter, with the water level 90 feet below the ground.

The city takes its name from these two natural wells, Chichen Itzá meaning in Maya "The mouths of the wells of the Itzá."

One well, the Xtoloc Cenote, or Lizard Well, in the center of the city, had two masonry stairways descending its precipitous sides. The Xtoloc Cenote was used as the water supply of Chichen Itzá in ancient times, but the other cenote, at the northern end of the city, served a far more sinister purpose.

This was the Well of Sacrifice, and into its gloomy depths in times of great national necessity, such as drought, young maidens were hurled at daybreak as living sacrificial victims (Plates XVI and XVII).

The Spanish chronicles naïvely observe that if the girls managed to survive until midday, ropes were lowered to them and they were pulled out. Then they were questioned as to what the gods had told them was in store for the Itzá, whether an abundant year or famine. If the deities' reply indicated the former, there was great rejoicing, but if the latter, stones were hurled into the well and the people fled from the place with loud cries.

Not only were human sacrifices flung into this Well of Death but also the most highly prized possessions of the Itzá people: jade earplugs, noseplugs, beads, plaques and pendants, gold beads, bells, plaques and rings, copper bells and rings, carved bones, shells, elaborate weapons of wood, pottery, and masses of the sacred copal incense.

Some of this material was recovered thirty years ago by dredging, and now is on exhibition at the Peabody Museum of American Archeology and Ethnology, of Harvard University. Judging from the objects recovered, practically the entire cult of the Well of Sacrifice would seem to have been of Mexican rather than Mayan introduction at Chichen Itzá.

### FEATHERED SERPENT THE PATRON DEITY

The patron deity of the city in late Mexican times was Kukulcan, the Feathered Serpent, a direct Maya translation of the Mexican deity, Quetzalcoatl, immortalized by General Lew Wallace in "The Fair God."

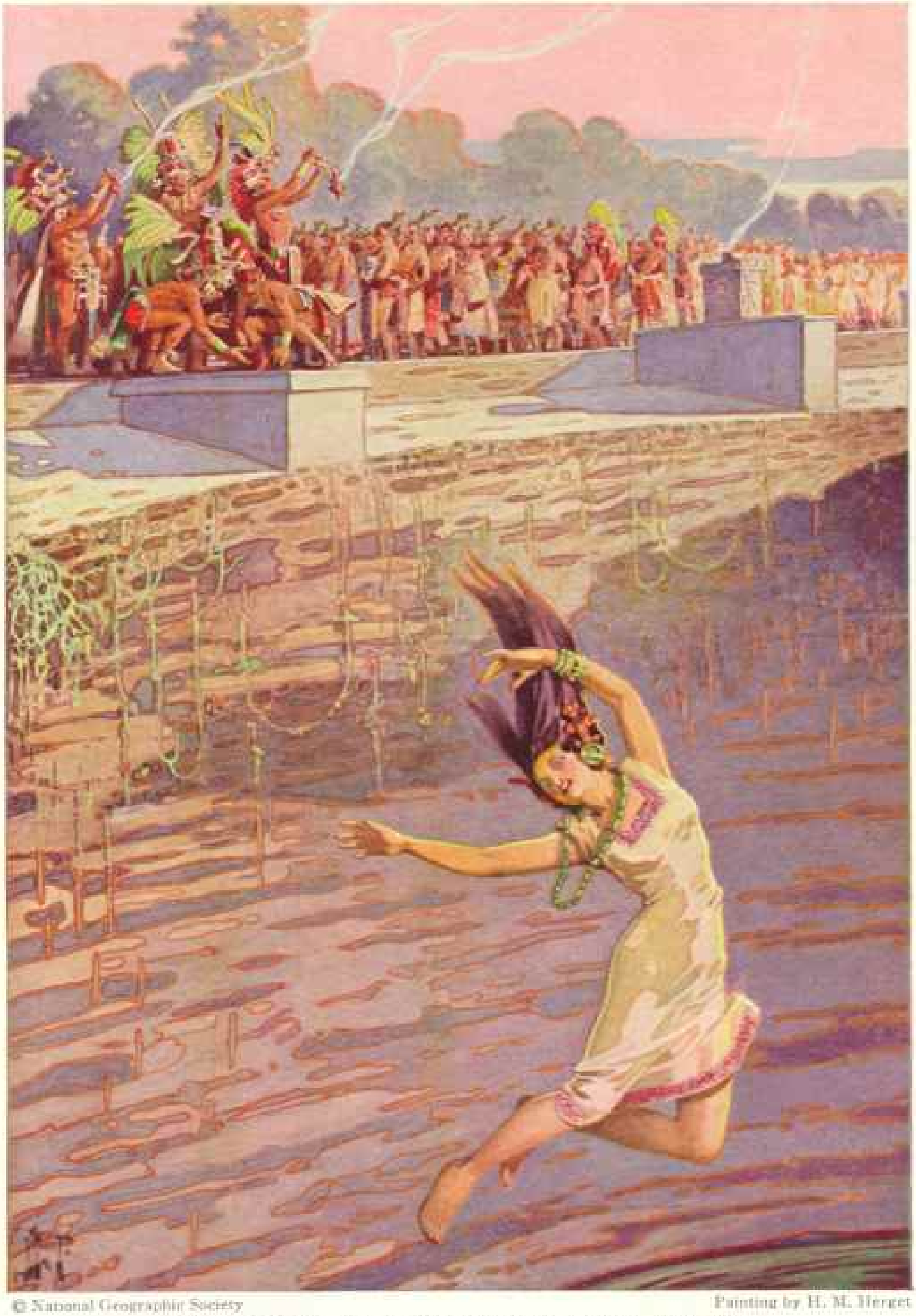
The feathered serpent columns, which guard the portals of so many of the temples at Chichen Itzá (page 616); the Atlantean column altars (page 596); the so-called "Chac Mool" statues of reclining human figures; the stone fretwork roof ornaments, the jaguar and eagle sculptures, the turquoise-crowned figures in the reliefs, and the exquisite turquoise mosaic plaques, of which four have been found at Chichen Itzá; even some of the hieroglyphics—all are Mexican importations.

Moreover, the ball game, though of Maya origin, as played at Chichen Itzá had a strong Mexican flavor (Plate XXIII). In fact, during the last two and a half centuries of the city's occupancy, Chichen Itzá, under the stimulus of its new rulers and the new religion they had introduced, with its spectacular rite of living human sacrifices hurled into the Sacred Well, became the most holy place in Yucatán, a center for pilgrimages from far and near.

During the 13th and 14th centuries, as a result of the fall of Chichen Itzá and the end of the League of Mayapan, the Cocoms, ruling house of Mayapan, became the leaders in the northern half of the Yucatán Peninsula.

By the clever expedient of compelling all the other Maya chieftains to reside at Mayapan, the Cocom capital, and to administer the affairs of their respective towns and villages through deputies, the successive Cocom rulers in effect held the other Maya chieftains in hostage while they

* See "Chichen Itzá, an Ancient American Mecca," in the NATIONAL GEOGRAPHIC MAGAZINE, January, 1925.





Painting by H. M. Herget

A HUMAN SACRIFICE IS HURLED INTO THE SACRED WELL

Young girls were flung into the pit at daybreak in times of drought or other national crises to intercede with the gods in behalf of the Itzá tribe. If they survived the 80-foot plunge, they were hauled out at noon and questioned as to what the gods had in store. If the maidens failed to reappear, it was considered an evil omen; rocks were thrown into the well, and onlookers fled with loud lamentations. The sinister place is a natural hole in the limestone, 180 feet across (Plate XVI).



Painting by H. M. Herget

BRONZED WARRIORS LOOK WITH STOLID PRIDE UPON A CITY THEIR FOREARS CONQUERED

From the southwest came a sturdy non-Mayan horde which stormed Chichen Itzá during the 12th century. These were the Toltecs. Under their vigorous leadership were built the largest structures in the city, including the principal temple which looms at the right (Plate X).



Painting by H. M. Herget

MAYA PRIESTS IN JAGUAR SKINS, WRITHING QUETZAL FEATHERS, AND JADE GESTICULATE BEFORE A MASSIVE TEMPLE

Their influence over the lives of the common people was tremendous. Priests alone could fathom the intricacies of the Maya calendar, which was so accurate that the occurrence of eclipses could be successfully predicted. Certain classes of the priesthood, especially those versed in calendric lore, were carried in litters borne upon the shoulders of the faithful whenever they appeared in public.



Painting by H. M. Herget

FROM A FROWNING GARGOYLED TURRET MAYA ASTRONOMERS PEERED AT THE SKY

In mathematics and astronomy the Maya surpassed the ancient Egyptians and Babylonians. This round tower, the Caracol at Chichen Itzá, was the most important astronomical observatory in all Yucatán. Narrow openings through the thick walls to the circle of windows near the top formed "lines of sight," or lensless telescopes. Through these, observers watched the heavenly bodies which enabled them to fix the date (Color Plate XII).



BEARING AND DRESS REVEAL HER NOBILITY

This Maya maiden might have been a chieftain's daughter, for she wears a richly embroidered kirtle fringed with jade beads, an elaborate headdress, and heavy bracelets. A small figure of Yum Kax, God of the Harvest, rests in her hands.

Paintings by H. M. Herget

A MASTER CRAFTSMAN OF THE OLD EMPIRE

Pottery making became a fine art among the ancient Maya, whose exquisitely painted ceremonial ware was the most beautiful produced by the American Indian in pre-Columbian times. With sure touch, this artist depicts religious rites and scenes on a graceful jar.



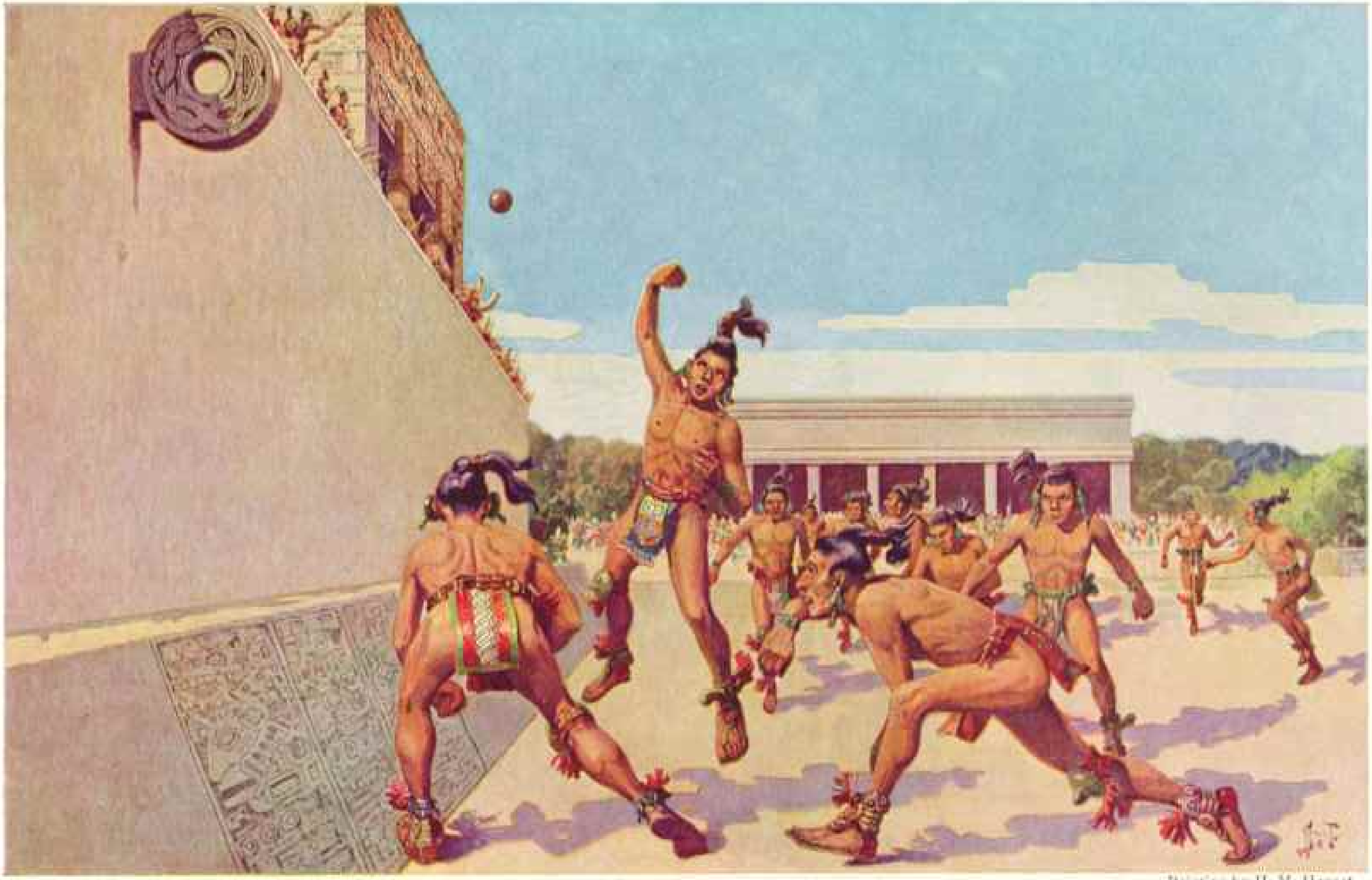
"TRUE MAN" ANCIENT MAYA CALLED THEIR RULER

For him were reserved the finest quetzal plumes, jades, embroideries, and jaguar skins. Here he carries the Manikin Scepter, symbol of supreme authority—a short baton bearing a figure of the Long Nose God.

Paintings by H. M. Herget

THIS LESSER CHIEFTAIN WAS THE RULER'S VASSAL

His dominion extended over a small town or village. If he belonged to one of the Maya military orders, the "Jaguars" or the "Eagles," he brought a band of warriors to aid the "True Man" in time of war.





Painting by H. M. Herget

MAYA YOUTHS MANY CENTURIES AGO PLAYED A GAME THAT SUGGESTS BOTH SOCCER AND BASKETBALL

Six courts have been found at Chichen Itzá, the largest 490 feet long and 100 feet wide, with two side walls 27 feet high. The players, using only their elbows, knees, and hips, tried to drive the solid rubber ball through a stone ring. At the winning stroke all the spectators took to their heels, for ancient custom decreed that the lucky player should receive all their clothing and jewelry. They were hotly pursued by the player's friends.

 Painting by H. M. Herget

ANCIENT MAYA, LIKE THEIR MODERN DESCENDANTS, WERE CORN FARMERS

Their only agricultural implement was the planting stick, a pointed pole about five feet long. Forest trees were felled and allowed to dry out under the fierce suns of March and April. Then they were burned and the corn was planted. Ripened ears were bent over and left to dry on the stalks until December or January. One of the planters drinks from a gourd water bottle, without which even today no Maya goes out to plant corn or to hunt (Plate III).

pursued their tyrannical way, backed by their powerful Mexican allies.

Finally, in the middle of the 15th century, after two and a half centuries of increasing oppression, the Maya, goaded to desperation, banded under the leadership of the then Lord of Uxmal, Tutul Xiu, and attacked Mayapan.

The city was captured and sacked. The ruler and all his family were slain, except one son, who was absent from the city at the time, and Mayapan was depopulated.

A curious result of this war of independence was that both vanquished and victors abandoned their former capitals and established themselves elsewhere.

The Cocoms, under the leadership of the single surviving son of their royal house, founded their new capital at Tihoión, in the north-central part of the Yucatán Peninsula.

The Tutul Xiu, although victorious in the recent war, abandoned Uxmal, where they had ruled for about five centuries, and founded their new capital at a place which they named Maní, meaning "It is finished."

The remainder of the Itzá not only abandoned Chichen Itzá but withdrew entirely from the peninsula, migrating southward into northern Guatemala, whence the Maya had originally come some six or seven centuries earlier.

There, on a peninsula at the western end of Lake Petén Itzá, the Itzá established a new capital called Tayasal. And there, in 1525, the Itzá ruler, Canek, was visited by Hernando Cortez on the latter's heroic march from Puerto Mexico, Mexico, on the edge of the Maya country, across northern Guatemala and southward to Honduras.

This last independent branch of the Maya managed to survive, because of their extreme isolation, for another century and a half, until 1697, when they were finally conquered by the Captain General and Governor of Yucatán, Martin de Ursua y Arizmendi.

### THEN CAME THE SPANIARDS

The foregoing brings the story of Yucatán down to the beginning of modern times and the epoch of the Spanish Conquest.

W. H. Prescott's stirring accounts of the conquest of Mexico by Cortez in 1521, and of Peru by Francisco Pizarro in 1533, are familiar to most readers, but the conquest of Yucatán by the two Francisco de Montejos, father and son, from 1527 to 1541, is less well known, having had no Prescott to chronicle its heroic achievements.

Francisco de Montejo, the elder, was one of that band of valiant Spanish *hidalgos* who accompanied Cortez to Mexico in 1519. This expedition touched at the island of Cozumel, off the northeast coast of Yucatán, early that year, and also at places on the adjoining mainland.

These visits constituted Montejo's first real acquaintance with the land of which he and his son were subsequently to become the conquerors, though he had seen Yucatán the previous year on Grijalva's expedition.

Later, when he was in Spain on a mission for Cortez before the Spanish King, Charles V, Montejo obtained from his sovereign the right to conquer the Province of Yucatán at his (Montejo's) own cost, in return for which he was to be named *Adelantado* of the new province, the title to descend to his heirs, and he also was to be given a large grant of land in recompense for his original outlay.

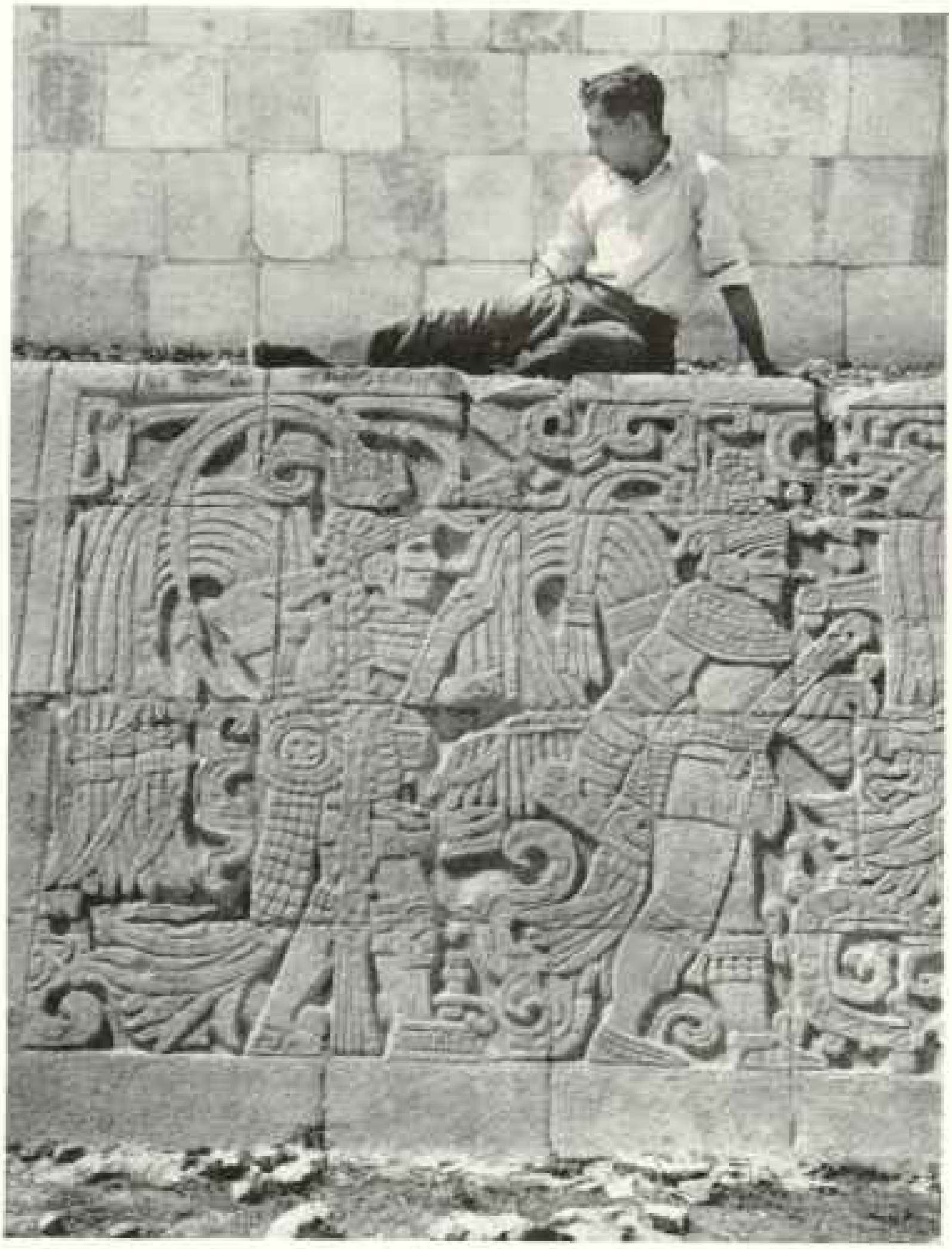
The first attempt to conquer Yucatán in 1527 failed, as did the second, in 1531, but the third and last attempt, in 1540 and 1541, was successful. The army, under Montejo the younger, landed at Champotón on the west coast, proceeded northward, and seized the Indian town of Kin Pech (Campeche). The Spanish *villa* of San Francisco de Campeche, founded there in 1540, is the oldest permanent Spanish settlement in the Yucatán Peninsula.

From Campeche the army pushed on to Mérida, the ancient Maya city of Ichcansiho, where in the middle of 1541 Montejo inflicted a crushing defeat on a coalition of Maya chieftains, which brought about the surrender of the country, and here, on January 6, 1542 (Old Style), the noble and loyal city of Mérida was incorporated by Montejo the younger (page 633).

Yucatán remained a province of the Crown of Spain until the Independence of Mexico in 1821, and has since been a part of the Republic of Mexico.

The second city in size in the peninsula is Campeche, capital of the State of the same name, which has a population of about 18,000. It is more Spanish in character and less modern than Mérida (page 637).

Its narrow streets with old colonial houses; the section of the wall, which formerly surrounded the city, now preserved only on the land side; the land gate facing



RELIEFS AROUND THE BALL COURT AT CHICHEN ITZÁ ARE LOW BUT WELL PRESERVED

The slightly sloping faces of the benches at the bases of the walls bear some of the finest sculptured figures in the Maya area: files of gorgeously dressed fighting men marching toward a centrally placed altar. In several places are represented decapitated warriors with streams of blood spouting from their necks, the streams terminating in serpent heads. Near-by figures hold the severed human heads.

toward Mérida, equipped with portcullis, moat, and drawbridge, the last long since lowered for the last time—all are strong reminders of a day when pirates plied the Spanish Main, landing and looting the Spanish coast towns.

### YUCATÁN CARRIES HER ONLY ECONOMIC EGG IN ONE BASKET

Yucatán virtually is dependent upon a single industry. What wealth has come to this isolated region during the past forty years has been through the fiber obtained from the *Agave fourcroydes*, a relative of our own century plant, which seems to be perfectly adapted to the stony, shallow soil of northwestern Yucatán, the principal sisal belt of the peninsula.

The fiber is known locally as henequen, after its Aztec name. Commercially, however, it is called sisal, after the name of a small town on the northwest coast (see map, page 595).

When John L. Stephens, American traveler, amateur archeologist, and diplomat, visited the peninsula in 1840-41, Yucatán was known as the poorest State in the Republic of Mexico. The land was largely owned by a landed aristocracy of some 60 families, and the Indians mostly lived on large *haciendas*, or estates, under a patronal system of peonage made possible by legalized indenture for debt.

By law the Indian could not leave the service of his master so long as he owed him anything. Since the master kept the books and since the Indian's need for money was constant—now a christening, now a marriage, now a burial or an occasional Mass—he was practically never free from debt. The debt even descended to his children. Thus the larger estates never lacked for labor.


ONLY THE CENTRAL SECTION REMAINS OF THE GRAND PALACE REARED BY THE FOUNDER OF MÉRIDA

When Francisco de Montejo (the younger) laid out the city 394 years ago, he reserved for himself the entire block on the south side of the plaza, where in 1551 he built his luxurious house. All that is now left of the palace is the two-story central section with the great entrance below. The elaborate carving of this façade with the Montejo coat of arms above and the figures of two knights in full armor standing on the anguished heads of conquered Indians amply attest its former magnificence (page 631).

VISITORS TO THE CHICAGO FAIR OF 1893 SAW A FACSIMILE OF THIS PORTAL

These arcades are not uncommon in the ruined cities of north-central Yucatán, examples having been found at Uxmal, Kabah, Chichen Itzá, and Tulum, as well as here at Labna. They seem to have served as ceremonial entrances or gateways to sacred enclosures.

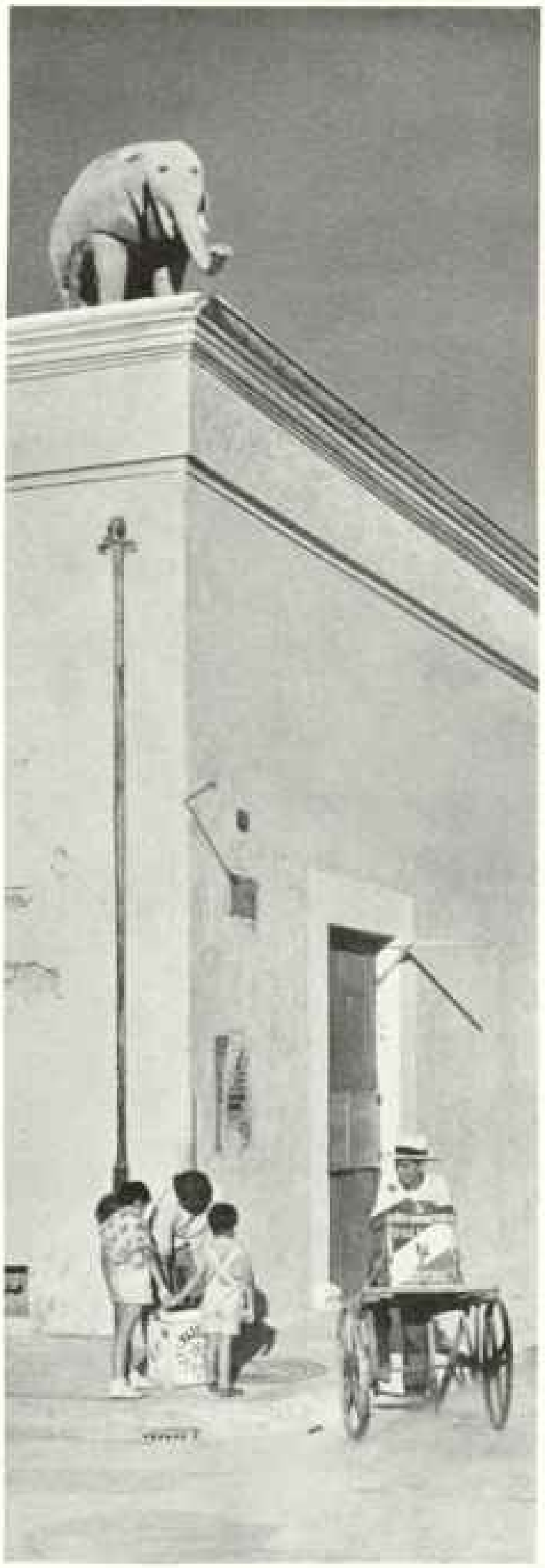
Photograph by Franklin L. Fisher

THIS DANCE USUALLY LASTS ALL AFTERNOON AND EVENING

Every fiesta has its *baile* under the arched porch in front of the town hall (page 643). The girls wear embroidered dresses and brilliant scarfs with bright silk bows at the back of their hair. The men express their love of color in lavender, blue, pink, and yellow shirts, with silk handkerchiefs of every shade.

THIS CATHEDRAL OF MÉRIDA IS ONE OF THE FINEST IN THE REPUBLIC

The building, located on the east side of the main plaza, was completed 22 years before the *Mayflower* landed at Plymouth Rock. The majestic dignity of the nave, flanked by six enormous plain, round columns on each side, is happily not spoiled by a centrally placed choir, as are so many of the other early Spanish churches. To the right is the former palace of the Bishop, now used as a Government building. Yucatán is the oldest bishopric in North America.



CHILDREN SHOP AT "ELEPHANT CORNER"

In Spanish colonial times the Indians could not read, and effigies of animals and fruits were set up as street signs on the roofs of corner houses at Mérida. Very few of these relics remain, a system of numbering having replaced them.

A little sugar was raised and exported. But Yucatán could not compete with Cuba in this field and the peninsula remained a self-supporting agricultural community, consuming what it raised and raising mostly corn and cattle. Sisal was grown for the excellent fiber in its leaves, but the demand was limited.

Before 1897 the fiber used in making binder twine for harvesting our great American wheat crop had been Manila hemp.

One of the first results of the Spanish-American War was the cessation of shipments of Manila fiber to the United States. Immediately began the search for a satisfactory substitute to be used in binder twine.

The *Agave fourcroydes* of Yucatán, growing almost next door, less than 600 miles south of New Orleans, was cheap; its production could be stepped up, and it had no natural enemies to interrupt production, no killing frosts or blights. Its chief Nemesis was fire, the danger of which could be more or less eliminated (page 639).

During the war, Yucatán fiber was increasingly used in binder twine in place of Manila hemp and worked admirably. However, after the war, when Manila hemp again appeared in the American market, it did not replace sisal (page 640).

Discovery of oil could not have been more revolutionary in its effect on Yucatán. Families became millionaires almost overnight. The price of sisal, which had been about five cents before the war, doubled in six months. The crop was raised so cheaply with peonage labor that, after the war was over, by the simple expedient of always keeping its price just below that of Manila hemp, the Yucatecan planter easily held the market.

### THE GREEN GOLD OF YUCATÁN

Those were the bonanza days of Yucatán. Under the wise administration of Governor Olegario Molina, Mérida was swiftly transformed from a backward provincial town into an attractive modern city.

Before the sisal prosperity, the unpaved streets were lakes of mud and water in the rainy season, billowing clouds of dust in the dry months. All year round outcroppings of the native limestone made them all but impassable for vehicles except large wheeled *diligencias* and carts. By an export tax on every bale of sisal, Mérida was paved with cement, brick, and asphalt in

Compañía Mexicana Aerofoto

OLD CAMPECHE LANGUISHES BESIDE ITS SHALLOW GULF

When commerce departed for deeper roadsteads, the port fell into disuse and only the wall built to protect the city against the raids of the buccaneers remained. This barrier had been built so high that it kept out not only pirates but sea breezes; and about 30 years ago it was torn down except for a small section on the land side (page 631).

less than four years. Waterworks were built and palatial mansions of the sisal aristocracy were erected along the Paseo de Montejo, Mérida's Park Avenue.

Fine coaches and horses were imported, later automobiles. Planters and their families traveled in Europe, returning with many trunkfuls of Parisian creations for the pre-Lenten balls of El Carnaval, which New Orleans celebrates as the Mardi Gras.

Luxury, splendor, princely magnificence were rife, and still the green gold continued to flow.

However, in 1915 the Mexican Revolution, in the person of the Carranza general Salvador Alvarado, hit the peninsula, and in 1917 the United States entered the World War.

Almost overnight General Alvarado consolidated the marketing end of the sisal industry into a single selling agency, to force higher prices from the American purchasers.

### INDIANS EMANCIPATED FROM DEBTS

The Government undertook to market the sisal crop, and since the Government controlled all the railroads in the peninsula, and wharfage and warehouse facilities at the port of Progreso, those few planters who refused at first to sell to the Government marketing agency found themselves

MÉRIDA BRISTLES WITH WINDMILLS

Nearly every house has its own well dating from Spanish times, when there were no waterworks. The trade winds furnish free power most of the time for some 14,000 of these pumping devices, which rise above the flat-topped houses (pages 591, 636-7).

FIRE IS THE PRINCIPAL DREAD OF SISAL FARMERS

Because the plant will burn green on the stem, high towers are built in the fields from which watch is constantly kept in the dry season, December to May, to prevent the start and spread of devastating conflagrations. The long, fibrous leaves require eight years to reach the point where they may be cut for commercial use, though during this period the crop needs no care beyond bushing twice a year between the rows. A good plant will continue to bear from 15 to 20 years.


HENEQUEN, OR SISAL, IS THE GREEN GOLD OF YUCATÁN

This bale of henequen fiber, ready for shipping at the Hacienda Chichi, near Mérida, will be carried by autotruck to Progreso, the port of Yucatán, and thence shipped to New Orleans. From there it will be sent to a factory making binder twine. Eventually it will find its way to the farms of the wheat belt, where it is used in tying the cereal into shocks (pages 632, 639).

unable to obtain freight cars to move their crop. Soon they, too, signed on the dotted line.

General Alvarado did not stop there. He wiped out the debts of the Indians to their masters, and the former, no longer bound to the plantations by debt, began to roam.

In the meantime, the bumper American wartime wheat crops of 1917, 1918, and 1919 lifted the price of sisal sky-high.

Whereas the highest price paid for Yucatán fiber during the Spanish-American War had been 11½ cents a pound, Alvarado advanced the price to 19¼ cents a pound. American farmers, in spite of the aid of a Congressional inquiry, had to pay.

But Alvarado allowed the helpless planter only 7½ cents a pound for his sisal, although the cost of production had advanced sharply after cancellation of the laborers' debts.

When I first visited Yucatán in 1907, the Indian was receiving 25 cents for cutting a thousand leaves of sisal, but in 1918 he demanded and got $1.25 per thousand leaves. Even at these all-time high wages he would work only one or two days a week. The rest of the time he quietly swung in his hammock and watched the world roll by.

In those days one saw the amazing economic paradox of an increasing demand and a rapidly rising price accompanied by a diminishing supply, because of labor's refusal to participate in the golden harvest.

The altitudinous price of Yucatán fiber brought other fields into production, principally in areas of Africa, the Bahamas, and Cuba, so that when the bottom dropped out of the market after the war, prices plunged to new lows from which even today they have only partially recovered.

### CHICLE HUNTERS FOUND IMPORTANT SITES

Though by no means the poorest State in the Mexican Republic, as Stephens called it a hundred years ago, Yucatán is very far indeed from having the largest income, as it did in 1918. Thus, for nearly the last

THE TINY CHAN YUC IS A FAVORITE PET IN MÉRIDA

Meaning "small wrist," its Maya name obviously was inspired by its extremely slender legs. Two of these native deer were presented to the National Zoological Park, at Washington, D. C., by the author's wife in 1935. They were brought to the field quarters of the Carnegie Institution of Washington at Chichen Itzá when they were very young, one of them only two weeks old. Their mothers had been killed by Indian hunters. Both thrive in their new home in the United States.

four decades sisal has been the most important economical and social factor in contemporary Yucatán history.

Yucatán's second most important industry is chicle, the only commercial use of which is to make chewing gum "chew." Chicle is obtained from the sap of the *sapote* (sapodilla) tree. When this sap is boiled, it hardens and forms pure (unsweetened, unflavored) chewing gum.

The sapote trees grow most abundantly in southern Yucatán, Campeche, and Quintana Roo, where Maya ruins are most numerous.

For many years the writer offered the chicle hunters rewards for information leading to the discovery of new groups of ruins buried in the dense forest hinterland. As a result of these rewards, a number of important archeological sites have been discovered.

The modern Maya, who still comprise probably half the population of the peninsula, are cheerful, friendly folk, endowed, in my opinion, with more likable qualities than any other Indian people.

They are short in stature, the men averaging about 5 feet 1 inch and the women only 4 feet 8 inches. All Maya have exceedingly broad heads, which is probably their most marked physical characteristic; their hands and feet are small and beautifully formed.

Add to this eyes nearer black than brown, a strong, well-formed Roman nose, an equally well-formed, expressive mouth, and a skin of dark, golden brown, with warm high lights, and you have one of the handsomest native races in America.

They are cheerful, friendly, not quarrelsome even when drunk, exceedingly clean, home-loving, and, when the need arises, industrious.

The Maya home consists of a palm- or grass-thatched hut with sides of saplings, which may or may not be daubed with

"LOVE SEATS" INVITE A REST IN MÉRIDA PLAZA

These concrete equivalents of an American lawn chair popular in this country in the nineties are found in many public squares in Yucatán.

mud. These are rectangular, with rounded ends, usually about 25 feet long, 10 to 12 feet wide, and 15 feet high to the ridgepole of the steeply sloping roof.

There are no windows in typical houses and only two doorways, one in the middle of each of the long sides, directly opposite each other (Plate IV).

Doors usually are made of woven withes. Directly behind the house is a lean-to, the *koben*, which serves as the kitchen. The house proper has only one room.

Furniture comprises hammocks, which are rolled up on the rafters during the day, a few low, comfortable stools, a table with the figure or painting of a saint, often surrounded by colored pictures from old American magazines, catalogues, even calendars and rotogravure sections of newspapers, and artificial flowers.

A box or tin trunk may hold a few valuables, the women's gold chains and fiesta jewelry. Frequently there is a sewing machine. Above the rafters corn, beans, and odds and ends are stored.

Everybody sleeps in this combination living room, bedroom, dining room, and chapel, frequently two to a hammock, with the dogs lying beneath and occasionally a setting hen in a corner. The men and boys of the family eat in the main house, and the women and girls in the kitchen.

The Maya Indian is devout. He was in ancient times, when, under the direction of his own priests, to his own gods he reared tremendous stone pyramids and temples, the ruins of which by the thousands now lie buried in the forests from northern Yucatán to the highlands of Guatemala.

### CHILD'S NAME INDICATES BIRTHDAY

He was equally devout during the Spanish colonial period, when, under the supervision of the Franciscan fathers, he built the enormous churches and spacious monasteries with their cloistered courts, and exchanged his own pagan deities for the White man's God. Even today much of his own former religious beliefs colors his comprehension of the Church's teachings.

He names his children not for himself or his wife or other members of the family, but for the name of the saint on whose day the child happens to be born.

There is an almanac in Yucatán called "El Calendario de Espinosa," from the name of its founder. This has been published since 1824 by succeeding generations of the Espinosa family and is the source of all given names used by the Maya. The name in practically every case indicates the birthday.

Maya fiestas are usually those of the Church, the biggest fiesta of the year in any village being the day of its particular patron saint. These patron-saint fiestas usually last a week or ten days, culminating on the saint's day.

They suggest village fairs. Booths are set up, games, shooting galleries, always a superannuated merry-go-round, and a bull ring, while under the broad cloisters of the town hall there are Indian dances morning, noon, and night (page 634).

### DANCER NOT CONSULTED ABOUT PARTNER

The Maya dances of today are not those of the old pagan times. The latter were thought by the early Franciscan fathers to be immoral, pertaining to the Devil, and they were speedily replaced by Spanish dances, such as the *jarana* and the *zapateo*.

Though the Indians dance in couples, it is considered improper if the partners touch each other.

The man, with his hands hanging at his sides or one hand resting on his hip, circles slowly about the girl with a shuffling step; the latter bobs around still more slowly and less gymnastically. The man does not pick out the girl with whom he dances. This highly important duty is performed by a sort of master of ceremonies. He asks the girl to dance, escorts her to the dancing floor, and then selects her partner without consulting her.

The man commences dancing and presently the girl joins him. The music keeps up until the last girl has nodded curtly to her partner and returns unescorted to her seat.

Formerly it was the custom for the Maya boys, when some girl was exceptionally graceful, to take off their broad-brimmed straw hats, in which they usually dance, and crown the fair *bailadora* with them. Sometimes a really beautiful dancer might have as many as four or five straw hats pyramided on her head during one dance.

After she had returned to her seat with the hats in her hand, their respective owners came forward and bought them back from her, each giving her two or four *reales*, as their pocketbooks permitted.

These delightful old customs are passing, however, and now "el fox" and "el one-step" are beginning to displace the more picturesque *jarana* and *zapateo*.

But the chief business of the Maya man today, as it has been of his forefathers for century after century, is to raise corn for his family, and the chief occupation of his womenfolk today, just as it was a thousand years ago, is to prepare that corn into *tortillas* for the family's daily meals.

The way each goes about his or her task has remained practically unchanged throughout the intervening centuries. The man now has a steel ax and machete to fell the forest, instead of ringing the trees with his stone ax. His wife, when she lives in a village, takes her own corn to the local mill and has it ground for a few *centavos*.

In the remoter villages a few women have hand-turned grinders somewhat like a small coffee grinder, but the great majority still use a slab of stone with a stone grinder held in the hand (Plate VII).

An important task facing the Carnegie Institution investigators in Yucatán has been to determine what the dietary of the average Maya family was in ancient times, so that estimates may be made of the former population Yucatán might have supported with the system of agriculture then employed.

### THE MODERN MAYA MENU

The best approach to this important question has been to study the dietary of the modern Maya, which, in spite of the introduction of certain European foods, chiefly animal proteins, such as beef, pig, and chicken, seems to have remained much as it was in ancient times.

The relative percentages of carbohydrates and animal proteins are probably about the same today as they were before the discovery of America.

While the animal proteins of the modern Maya come chiefly from beef, pork, and chicken, in former times they were derived principally from deer, peccary, and wild turkey, all abundant.

The affectionate nickname the Maya

FOR HIRE, A MÉRIDA "TAXI," AT 28 CENTS AN HOUR

Yucatecan horses are small, probably because of scanty grazing. Since the streets are very narrow, the sidewalks less than a yard wide, and the houses built to the edge of the property lines, most corners are blind. Mérida *coches* are built so that the front wheels can swing in under the driver's seat for short turns.

gave to their country in ancient times was "The Land of the Wild Turkey and the Deer" (Plate I).

But the percentage of animal protein in the Maya dietary is not high, and if anything was even less, formerly, than it is today.

Exhaustive studies by different investigators in various parts of the peninsula all yield the same result: from 75 to 85 percent of everything the average Maya eats is corn in one form or another.

The remaining 15 to 25 percent of his food consists of *frijoles* (beans), chili, chocolate, honey (which is his sugar), squashes, a few native tubers, and fruits.

A careful study of Maya agriculture by agronomic experts has established two interesting facts. First, the simple system of raising corn practiced today throughout the Yucatán Peninsula would support indefinitely, without the necessity of importing any food whatsoever from the outside, a minimum of five times the peninsula's present population of about 400,000, or at least two million people. Second, to support the average family of five, a Maya Indian has to work in his cornfield altogether only about sixty days out of the entire year.

The first fact easily accounts for the more numerous population which undoubtedly occupied this region in pre-Columbian times, as compared with today; and the second as clearly explains how the ancient Maya found time to build their many cities of cut stone.

An environment admirably suited to the Maya system of raising corn, which made the food quest relatively simple; a superabundance of excellent and easily quarried building material, the local limestone, which when burned gave them lime for their mortar and also furnished a coarse marl gravel that served as sand; wise leaders, who developed a highly efficient governmental organization under which large public works were planned and successfully carried out; and, finally, the native genius of the Maya themselves, elevated and sustained by a lofty religious philosophy—these are the principal factors that made the Maya civilization the most brilliant cultural achievement of ancient America.

# NEW ENGLAND SKI TRAILS

## Snow and Ice Sports Transform Whittier's Winters of Snowbound Seclusion Into Seasons of Outdoor Recreation

By Daniel Rochford

TUCKERMAN'S Ravine, one of the most famous skiing spots of New England, looked in the first picture I saw of it like the dreamland of all dub skiers. It seemed so big and round and comfortably full of snow that I thought it would be simple to climb up one side of the huge snow bowl, shoot down into the bottom, kill my speed by coasting up the farther slope, and then turn and repeat the performance as long as the thrills lasted.

When actually I stood, a winter later, my knees trembling with the fatigue of climbing about one third of the way up the headwall of Tuckerman's Ravine on Mount Washington, and gazed down at those terrifying distances, I remembered how as a small boy I went to a lake for swimming, intending to walk boldly beneath the water, see the fish swim about, and then walk out.

Arrived at the lake, I was badly frightened when my big brother tried to pull me out into the water.

### EASY TRAVERSES UNHEROIC BUT SAFE

I was scared in Tuckerman's that first trip. I did manage to ski down from where I had climbed, but not in the brilliant *schuss* (page 646) I had visioned.

Instead, I took it in an unheroic series of easy traverses, zigs and zags, saving all attempts at anything but stopped turns for the humbler gradients of the vast snow apron that fans out to the little headwall, an eighth of a mile below.

True, I had picked the worst day of the year to ski in Tuckerman's. It was the day of the U. S. Eastern Olympic ski trials, March 31, 1935, and a thousand people, spotting the ravine, added the hazards of collision to the terrors of terrain (page 656).

A thousand feet it is from the lip of the headwall to the floor of the ravine, just 50 feet less than the drop from the observation tower of the Empire State Building to the street!

That afternoon 55 contestants started from the cone on the top of Mount Washington, ran down its 45-degree slope, slowed at the lip of the headwall, and then slipped over its rim and shot at dizzy speed down its sheer steeps.

Alexander H. Bright, seeded number one, took the cone straight, shot over the rim of the headwall, fell 20 feet, landed facing the wrong way, made a complete jump turn (page 658), traversed, turned for the control flags high on the slope, and *schussed* to the finish in 1 minute 36.2 seconds from the top of the mountain.

John Durrance, elder brother of the Olympic star Richard Durrance, made a single traverse and ran the headwall straight. His speed was so terrific that his legs failed beneath him, and he fell almost at the finish. He lay there for an awful second, staggered to his feet, and slid on through the finish flags for a time of 1:37.

The next eight men, in order of times, varied from 1:42 to 2:34.

Starters left the summit at one-minute intervals and the timing was by short-wave radio. More than half the men, including champions who later represented the United States in the Olympic races abroad, fell. And once a man fell high on that headwall, he rolled heels over head, skis and all, twenty times his length before he could even begin to slow his slide.

### SKIING OFFERS PERSONAL TRIUMPH

When one has learned to enjoy it, skiing wins an affection akin to that of a golf addict for his game. No other sport, it seems to me, is so much a matter of self. Skiing is essentially a solo performance.

In my own limited experience, I have tried many sports. Polo has its tremendous thrills, but, after all, the horse does much of the work. Sculling has its charms, but also its labors. I have never ridden a free surfboard. Perhaps that is as thrilling, for the sport resembles skiing. I have soloed gliders. Soaring certainly is "tops." But even there, the machine introduces an impersonal element.

I suppose the first man to stand on the top of Everest will have a feeling of personal achievement beyond that of any other mountaineer. But in a more humble way, every skier who stands at the top of a beautiful, unmarked stretch of new snow, waiting for the clean, flowing track of his own skis, experiences that exaltation. It is like being the first one out in the crisp frosty air of an autumn morning. The skier gets a chance to breathe it before anybody else has breathed it.

Racing has its place. It is a thrill to see a well-co-ordinated, confident runner come streaking down a narrow trail, cutting a hot corner by a graceful quick thrust with his heels and an almost instantaneous skidding of his skis, which changes their course; or to watch a skier in a slalom race, riding a steep slope in easy *schusses*, checking his speed with broken cristies, or "tail-wagging," taking deep or soft snow in a graceful telemark, or steered turn.*

Some racers crouch very low to keep their center of balance near the ground. Others ride erect and confident.

The most experienced make their control movements so easily that they seem to float while the skis do the turns. "Tempo stuff," that, the acme of controlled skiing.

But a person alone in the wilderness, finding a pair of skis and knowing what they were, could find fun long before he found technique.

As a child on the Kenwood hills behind my home in Minneapolis, I learned to stand on skis, then to walk on them, then to run on them, then to slide on them, and then to stop and maybe fall down on them.

The stopping was the hardest part. I'm still working on that phase of it.

No matter what language one uses to name it, that sequence is about all that skiing is. I used to crouch down when I was afraid of falling. It was 25 years before I knew I was doing an "Arlberg crouch."

I still lose patience when I hear some fairly good veteran chilling the ambitions of a would-be skier with a display of ski terminology. Yet even the most kind-hearted group of novice skiers, each owning skis and harnesses from which price marks have not rubbed off, will register derision when they notice some uninstructed girl or boy with a pair of store skis having only the leather loop, or toe strap, on them. "Toe-strapper" is a word of open scorn.

### CHILDREN AND GIRLS HELP THE SPORT

Children always have learned skiing with only toe straps. Grown people will find for themselves that toe straps are good for nothing except straight-ahead, easy slides. A pair of skis which do not turn with the feet obviously cannot be controlled. I have kind silence for the toe-strappers.

Of course, when a grown girl comes to my snow-covered golf course in the winter with high-heeled shoes and tries to ski, that is asking too much of tolerance. When she falls and twists her ankle, as she well may, her suffering is a just reward for her stupidity.

Girls, however, must be credited with much of skiing's popularity. I suspect many became interested when attractive ski costumes were made available. They looked so swagger in the clothes that they had to carry on, buy skis, board the snow trains, and become skiers. And when all the pretty girls were going on the snow trains, they were not going alone.

I have no intention of ever running the full headwall in Tuckerman's. My racing days are all behind me. The only skiing championship I hold and cherish is the neighborhood championship won for riding down the vertical pitch from the high tee by the bridge on the Winchester, Massachusetts, golf course on a single ski without falling.

My victory there was due, undoubtedly, to the fact that I was one of eight children and that as youths we frequently had to get along on half a pair of skis apiece.

I used to argue with some of our Olympic skiing stars that New England's down-mountain trails were not so important as they asserted. Today there are many, even some Olympic racers, who agree that racing trails are not sufficient diet for the best good of skiing.

To have the world's most extensive network of down-mountain trails, more than 300 miles of them, as New England has,

*"Schuss," a German word meaning "rush," or "swoop," has been adopted by American skiers, both to describe the steep slope down which they shoot straight ahead, or the act of skiing thus. "Cristy" is an Americanized abbreviation of "Christiania," meaning a turn accomplished by skidding the skis. "Tail-wagging" denotes a series of interrupted cristies. A telemark is a turn accomplished by steering the skis.

 Finlay Photograph by R. Anthony Stewart

PULL YOUR FEET IN, CROWD CLOSE, AND HANG ON TIGHT!

Now and then a toboggan ride at North Conway, New Hampshire, comes to a sudden end when a careless foot is caught in the narrow runway. Chief contributor to New England's boom in winter sports has been the enthusiastic public support of the "snow trains," which carry thousands from New York and Boston to popular skiing centers or to the nearest good snow.

NEW WORLDS TO CONQUER—ON SKIS!

At such famed resorts as Pecketts, on Sugar Hill, near Franconia, New Hampshire, skiers can learn the fine points from recognized experts, many of them imported from Europe. Togs are warm but light, allowing freedom of movement.

 Finlay Photographs by B. Anthony Stewart

CITY FOLK WITH SLENDER "SEVEN-LEAGUE BOOTS" STOP TO STARE AT PLODDING OXEN

A citizen of North Conway uses old-fashioned ox power for some of his winter chores. Roads kept open by powerful plows bring distant skiing centers within easy reach by bus or automobile.

READY FOR A MILE-A-MINUTE SPIN ON LAKE CHAMPLAIN—IF ONLY WIND COMES!

In a good breeze and when the ice is smooth and clear of snow, ice boats at Burlington, Vermont, race with the speed of the wind. Often the craft lift their windward runners two or three feet from the ice and buck like broncbos. Crews find the sport bitterly cold.

 Finlay Photographs by B. Anthony Stewart

ALL OUTDOORS FOR A DINING ROOM, AND THE PRESIDENTIAL RANGE FOR A BACKDROP

Hot coffee, cheese, cold meats, and fruits are served in mid-afternoon at this resort near Franconia. Warmly clothed and with plenty of healthy exercise, lovers of winter sports defy zero temperatures.



Finlay Photograph by B. Anthony Stewart

GOOD FELLOWSHIP THRIVES AMID THE CLEAR-CUT WINTER BEAUTY OF THE MOUNTAINS

Against a majestic background formed by New Hampshire's spreading Intervale and the snow-capped Presidential Range of the White Mountains, three skiers stop while an expert dryly explains that both skis must be kept going in the same direction—unless you want an awkward spill. Skiers usually emerge unscathed from falls that would mean broken bones without the friendly cushion of the snow.



OFF FOR A MORNING'S FUN

Girls become as expert as their escorts, and, at a distance, look the same! New England ski trails vary from mild pasture runs to breath-taking zigzag plunges down the sides of mountain ravines.

Finlay Photographs by B. Anthony Stewart

ICICLES MAY MEAN FAST SKIING

A thaw, then a freeze, forms an icy glaze, and a light snowfall over the crust makes a good skiing surface. Instead of heavy furs, this modern skier wears a windproof fabric shirt and loose woolen trousers.

NEW ENGLAND TOWNS ARE KEEN ABOUT "THE FASTEST GAME ON FEET"

On the rink at North Conway, the local hockey team meets a rival sextet from Concord, New Hampshire. A lad of 14 played for the home team with all the rugged daring of his older mates. Heavily padded is the crouching "goalie," who must stop the whizzing puck.

 Finlay Photographs by R. Anthony Stewart

BEGINNERS TEST BALANCE AND PATIENCE ON "NURSERY SLOPES"

Smooth, easy grades on this golf course at Kearsarge, New Hampshire, afford novices a gentle initiation into the tricky arts of snowshoeing and skiing. Now the skiers' cries of "Track!" echo over fairways where "*Fore!*" is heard in summer.

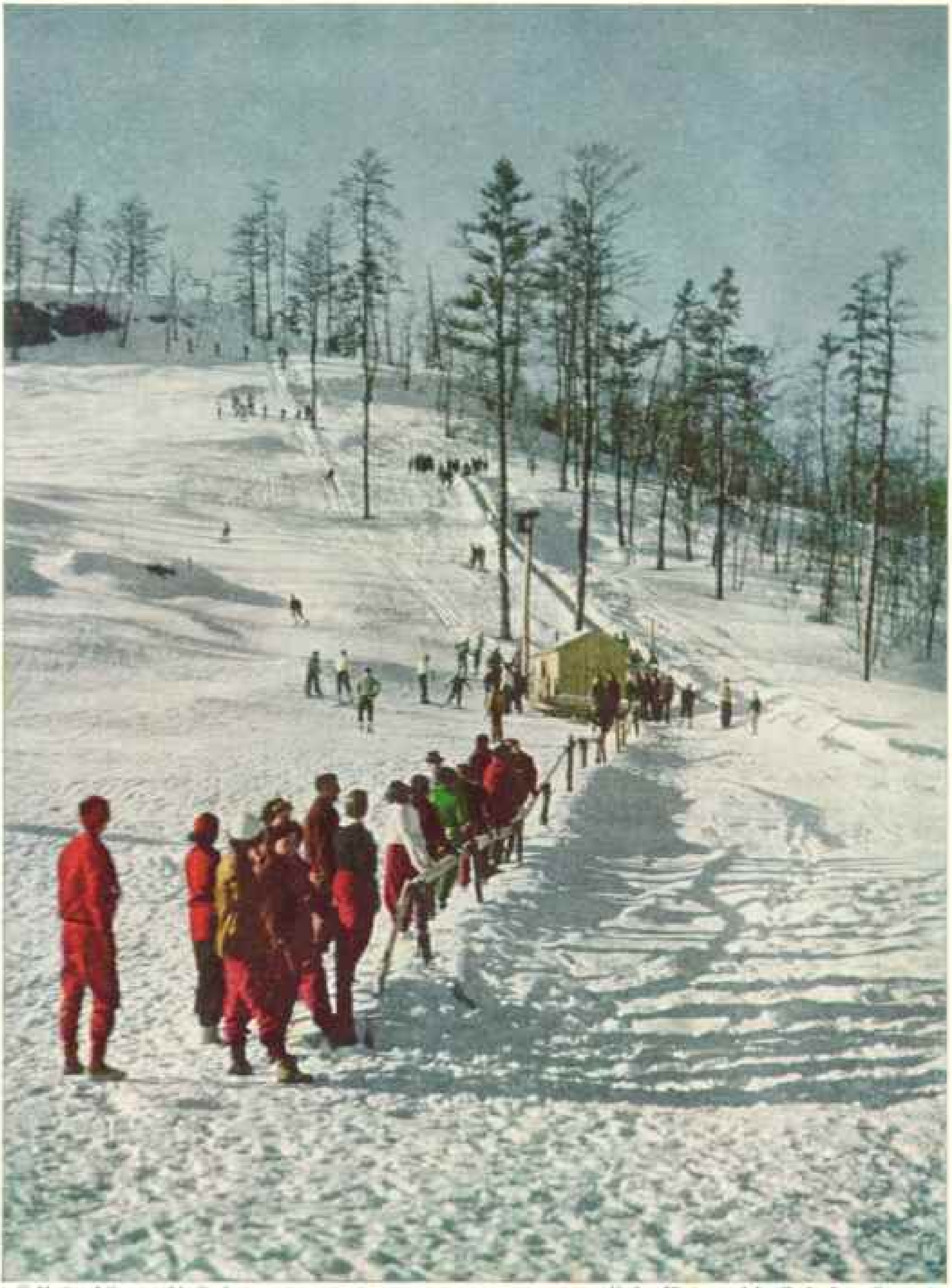
CAREFREE SUN BATHERS LOLL IN THE LEE OF AN ICY PARAPET

Snug steamer chairs in the ice palace appeal to those who like to take the air and sunshine lying down at this pleasure spot in the White Mountains. Many a New England inn, formerly open only in summer, now caters to guests for winter sports.

 Fenlay Photographs by R. Anthony Stewart

WEEK-END TRAINS POUR EAGER CROWDS INTO QUIET VILLAGE STREETS

Snow trains from New York and Boston, often in several sections, may drop as many as 1,500 or 2,000 skiing and snowshoeing devotees at a selected goal in the middle of the morning and pick them up again at night. Here they invade North Conway.



© National Geographic Society Finlay Photograph by E. Anthony Stewart

DOWN HARD-PACKED SLOPES THE SKIERS SWOOP—AND THEY DON'T HAVE TO WALK BACK UP

From the little house under the hill, a motor-driven endless rope pulls enthusiasts to the top of Jockey Cap at Fryeburg, Maine. The skiers on the track in the left center are riding uphill. Such devices, built on many of New England's most popular runs, save precious time for the exhilarating downhill plunge. At the left are the fast, tricky slopes for skiing; at the right, a toboggan slide.

guarantees its popularity as a mountain runner's paradise.

### SPECTATOR TRAILS NOT FOR TYROS

I like to know that there are fast mountain trails handy, if I am having a good day. But many of the existing trails, despite the effort to classify them as "expert," "intermediate," and "novice," vary so much from day to day with weather and snow conditions that under certain circumstances even some of the novice trails will scare the beginner.

After all, how much multitude appeal is there in mountain trails with such reassuring names as "Hell's Highway," "Chin Clip," "Nose Dive," "Wildcat," and "Thunderbolt"?

Those are actually the names of five New England trails. They have spectator appeal. People would want to go and watch others risk their necks on them. Such names, however, have not the persuasive lure that attracts participants rather than spectators.

Obviously, if a steep mountain trail has plenty of turns, a skier will automatically slow down when he makes the turns, or in trying to turn he will fall harmlessly. In either case, he has killed the speed which can be so dangerous.

A mountain trail with such frequent turns would not be fast enough for Olympic-caliber racing runners; most of the New England down-mountain trails were laid out according to the preferences of racing men.

Fortunately, New England has not stopped with its down-mountain network. Skiing, like golf, requires facilities. And communities, sensing the winter business possibilities, have undertaken to provide suitable open slopes, woods roads, new connecting trails, slopes which can be floodlighted for nighttime skiing. They have constructed ski tows, American developments which pull the skier to the top of the hill and increase manyfold the amount of sliding down which one can do in a day (Plate VIII).

The snow trains, which brought 35,000 skiers to New England ski areas last winter, have created an interesting new problem. It is difficult for the New York, New Haven and Hartford Railroad, for example, to locate areas near enough to New York, for a one-day excursion train trip, where the snow is sure to be satisfactory and where the skiing terrain can accommodate thousands of skiers.

If only the people who arrive on the train had to be accommodated, that would not be so difficult, but the whole countryside seems to want to come and ski with the visitors (Plate VII and page 659).

The first regular snow train was run by the Boston and Maine Railroad from Boston in 1931. That winter these trains carried 8,371 passengers. Last winter they carried 24,240 passengers. Eighty percent of these passengers were skiers.

Being nearer the more mountainous section of New England, the Boston and Maine has a wider choice of one-day snow train destinations than the New Haven. However, New York has solved that problem by introducing the "week-end snow train."

Such trains bring even the highest mountains of New England into excursion range, Mount Mansfield in Vermont, Mount Washington in New Hampshire,* and, when the proposed skiing areas are completed, even Mount Katahdin in Maine.

Skiing has had a peculiar development in America. It was introduced originally by the Scandinavians, with whom cross-country skiing and ski-jumping were the vogue. Cross-country skiing did not capture popularity in America. Ski-jumping did develop here as a sport spectacle.

It was the development of mountain skiing in Switzerland † and Austria which suggested to New Englanders their own mountain possibilities.

### NEW TECHNIQUE DEVELOPED HERE

The technique of central Europe was adopted here and our down-mountain trails were found suited to that technique. Subsequently, they have brought about an even more versatile technique, incorporating both the Scandinavian and central-European methods, plus new ones developed in the United States (pages 658, 662).

Today, cross-country skiing over mountainous regions seems to be the coming thing. A series of shelter huts was built in the White Mountain National Forest last summer, supplementing the Appa-

* See "Skiing Over the New Hampshire Hills," by Fred H. Harris, NATIONAL GEOGRAPHIC MAGAZINE, February 1920.

† See "Skiing in Switzerland's Realm of Winter Sports," 10 illustrations in duotone, NATIONAL GEOGRAPHIC MAGAZINE, March 1933.

Photograph by Winston B. Pote

OLYMPIC CONTESTANTS TRIED OUT IN TUCKERMAN'S RAVINE

The race was from the summit of Mount Washington, over the rim of the headwall, and down the sheer steeps to the "floor" (left foreground). Of the 55 skiers climbing the slopes (upper right) to the starting point, 41 were timed at the finish (page 645). The course required a careful turn on a 60-degree slope and a long traverse to reach the control flags at the left. This photograph was taken before the race began and before the big crowds had arrived in the ravine.

lachian Mountain Club trail cabins. Individual skiing trail systems have been linked together and mapped for touring.

A skier can start off now and pass several days or weeks covering new, interesting country. Even a difficult down-mountain trail gets tiresome if one runs it often enough. People like a change, the sense of progress. Lack of places to pass the night has hitherto slowed this development of the sport.

Anybody who has done mountain hiking in the summertime knows that high altitudes have their hazards. Winter multiplies them. Despite repeated warnings by authorities, skiers continue to take unwise risks in the mountains.

SNOWSHOEING HAS ITS DEVOTEES

Certain mountain areas and paths are open to the snowshoer and not the skier.

There used to be considerable friction at Appalachian Mountain Club meetings between the skiers and the older crowd, who swore by snowshoes and opposed having the club sponsor skiing. That opposition has disappeared now and many of the oldsters are enthusiastic skiers.

For extended mountain trips the wise ones carry snowshoes as well as skis and

Photograph by R. Anthony Stewart

SNOWSHOES ARE MAGIC CARPETS TO FAIRYLAND

After a light fall of feathery whiteness, a walk in the forest affords exhilarating exercise and deep satisfaction to the lover of unsullied Nature.

pack a pair of ice crampons just in case they hit icy going.

Sometimes more humble things than avalanches threaten the comfort of the wintertime mountain traveler. I often think of the adventure that befell my friend Winston Pote, the ski photographer.

Pote was making a trip to one of the A. M. C. mountain cabins with hutmaster Joseph Dodge. They arrived soaking wet from climbing.

Joe put a frozen can of beans on top of the stove, put the coffeepot in front of the beans, then forgot about them. Win was drying out his clothes and was standing with his belt loosened and back to the stove, soaking up the warmth.

Suddenly the can of beans exploded, knocking the boiling pot of coffee over and pouring its contents upon Pote's back. Pote let out a bloodcurdling yowl and jumped clear to the cabin wall. It was a week before the blisters healed. The beans may still be seen, driven into the walls and ceilings, where they stayed and dried.

I have watched the thousands of skiers jamming Grand Central Station of a Sunday morning in New York. Non-skiers are amazed. "It's a fad. It can't last" (page 660).

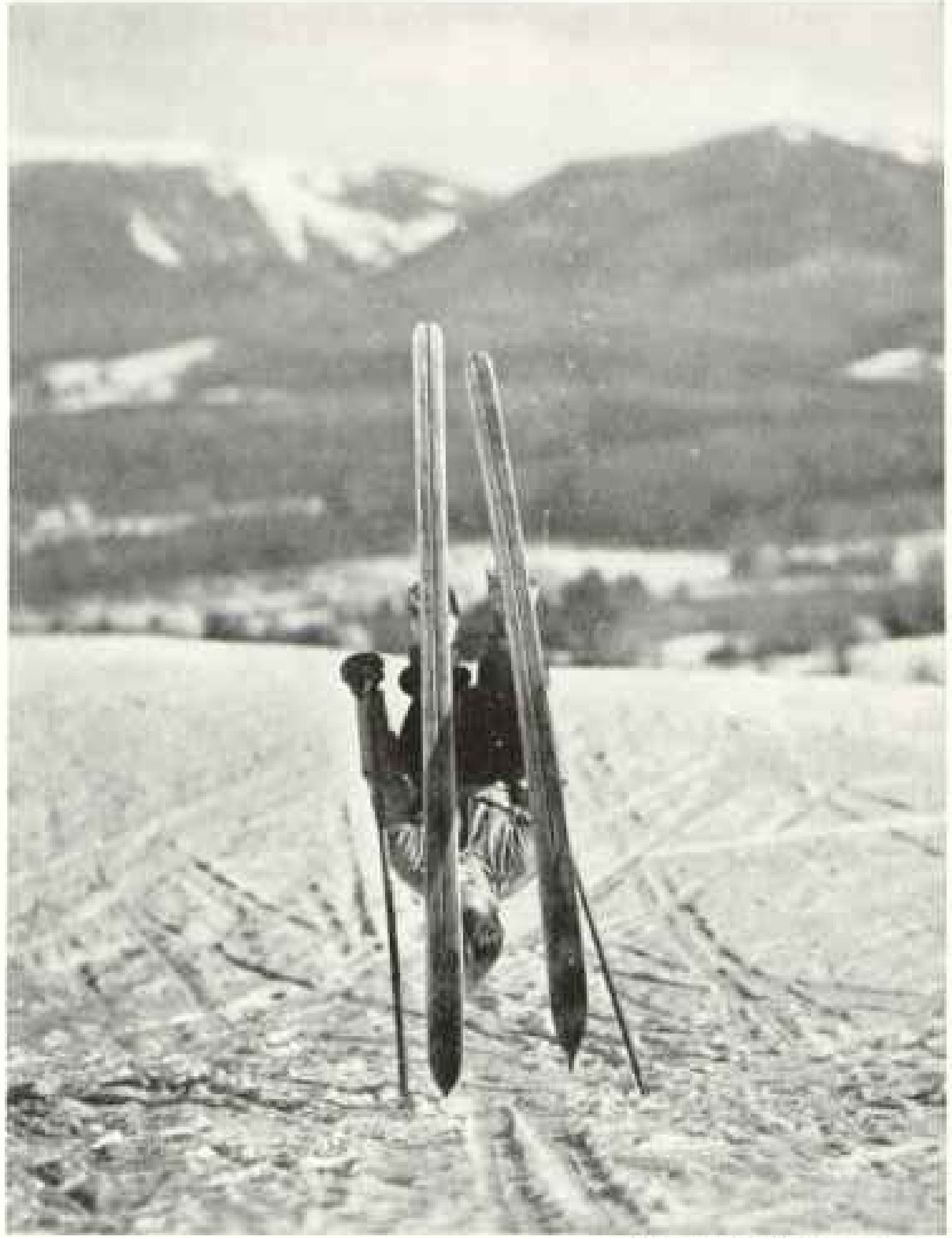
### WHY SKIING IS POPULAR

I think they are wrong. Skiing is real fun. It's a sociable sport, and healthful. Romance rides the snow train and romance

Photograph by Winston H. Pote

THE JUMP TURN AT THIS SPOT IS HAIR-RAISING

Only an expert should attempt such a feat as this on the north side of the headwall, in Tuckerman's Ravine, Mount Washington, New Hampshire.



Photograph by Roger L. Moore

YOU DON'T HAVE TO DO THIS TO SKI

An expert in the ski school at Peckett's, near Franconia, New Hampshire, executes a ticklish backward somersault. He is shown at the top of his turn.

Photograph by Acme

A CROWDED SNOW TRAIN UNLOADS ITS PASSENGERS AT NORTH CREEK, NEW YORK

In addition to Pullmans and coaches, there is an equipment car where one may rent any kind of gear, from skis to boots and bonnets. In 1933 a New York department store would not venture to buy harnesses for the 300 pairs of skis in stock; today it is estimated that 250,000 pairs are owned in Greater New York and New England. The sport is growing each year and promises to become to northern winters what golf is to summertime.

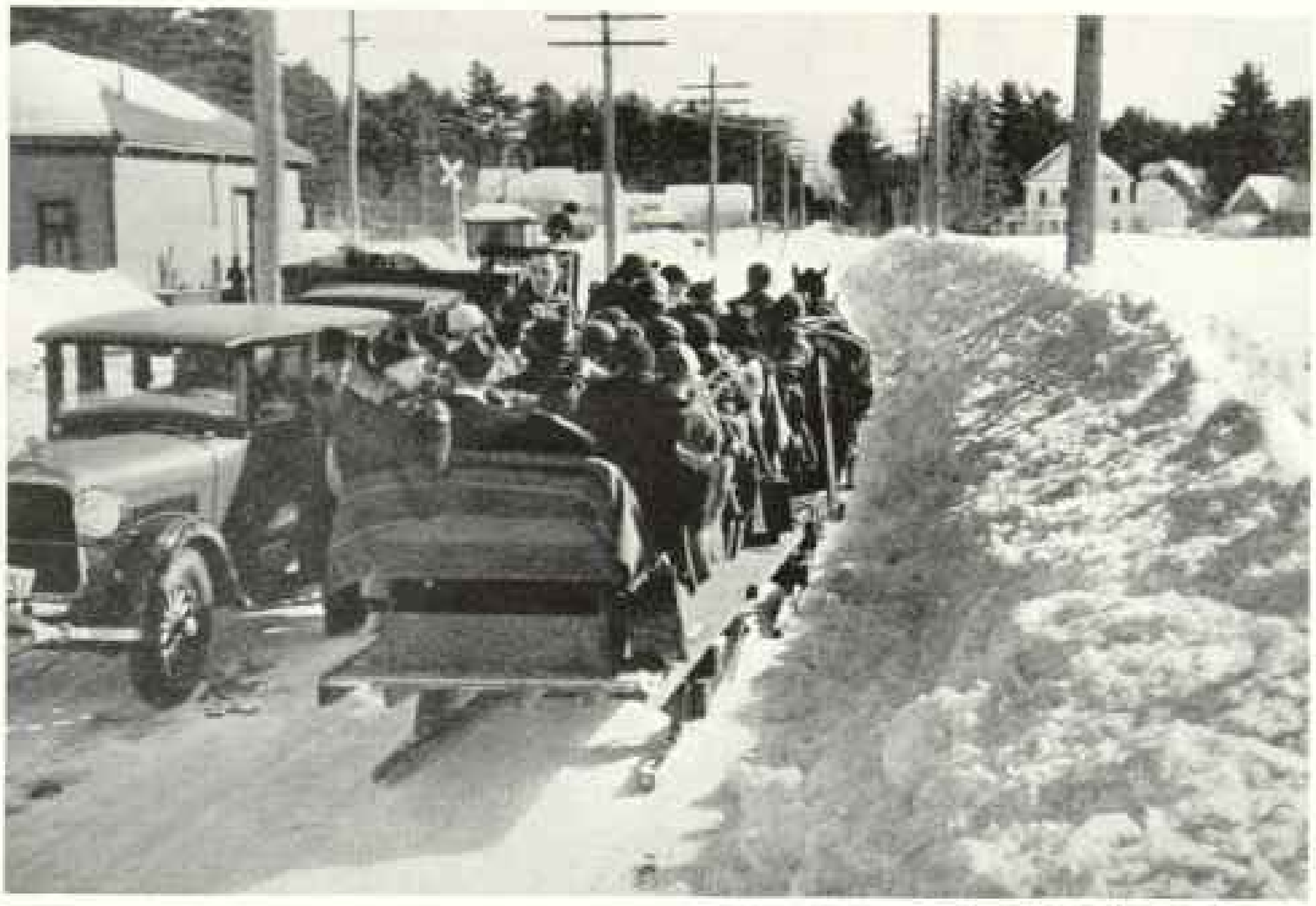

SKIERS, HOLIDAY BOUND, THRONG GRAND CENTRAL STATION

They are waiting for the snow train which runs on regular schedule to Pittsfield, Massachusetts. So rapid has been the growth of winter sports that travel to centers where they may be enjoyed now rivals the summer excursion crowds.

Photographs from Acme

"THE MUSHER" WON THE SCULPTURE PRIZE AT DARTMOUTH'S ICE CARNIVAL

To a bevy of coed guests of a fraternity at the annual winter fete at the college in Hanover, New Hampshire, the successful artist explains how he modeled the figures with a soldering iron and glazed them by using a blowtorch.



Photograph by R. Anthony Stewart

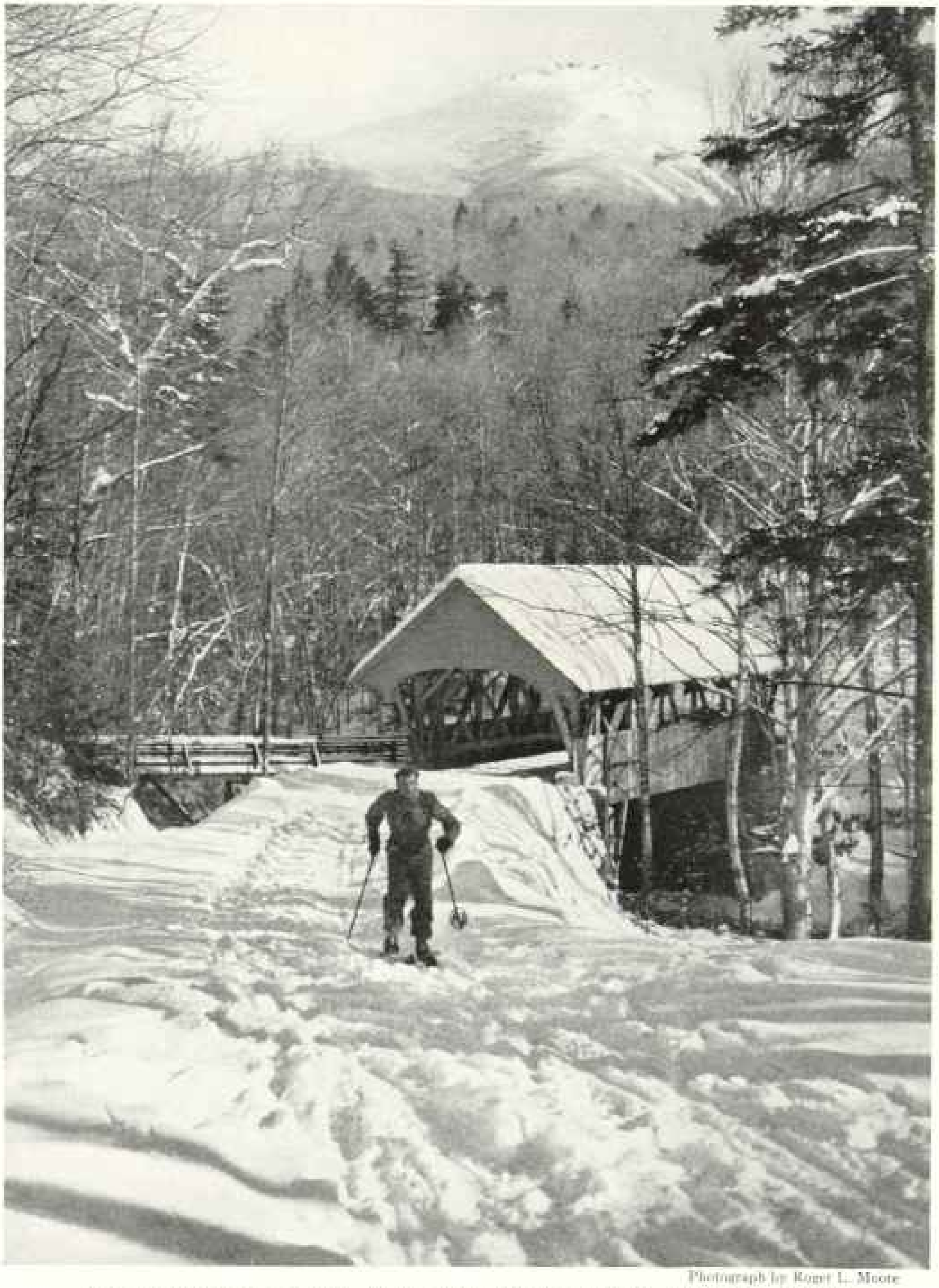
"OVER THE RIVER AND THROUGH THE WOODS"

Passengers from the snow trains enjoy the sleigh and pung rides to hotels and other week-end accommodations in country that brings to mind memories of Whittier's "Snow-Bound." These merrymakers have just arrived at Intervale, New Hampshire.

Photograph by George S. Clark

READY TO HIT THE TRAIL AT THE CRY OF "MUSH!"

Sled races with dogs are becoming increasingly popular in New England winter sport areas (see text, page 664). This team from the Chinook Kennels won second place in an important meet at Plymouth, New Hampshire, last winter.



Photograph by Robert L. Moore

WINTER WEAVES ITS SPELL ABOUT THE FLUME TRAIL IN FRANCONIA NOTCH

With a good pair of skis and poles, a winter sports enthusiast climbs to the summit of a hill for an exhilarating run. Mount Liberty looms in the background. The foot of the famous Flume, where a brook cascades down rounded granite slopes, is just out of the picture to the right. In winter the water gurgles beneath heavily crusted pitches and an occasional open spot gives welcome liquid refreshment to the skiers.

Photograph by Harold Orne

A SNOW TRAIN PASSENGER RUBS EXTRA SPEED INTO HER SKIS

Waxing prevents running surfaces from "caking" in wet snow. At the right are two upended ski poles, showing the metal spikes at the tips and the leather-webbed rings that give purchase in soft snow. The mere male author surmises that natty costumes have something to do with the feminine vogue of the sport (page 646).

rides the thousands of skier-filled automobiles that take to the 14,000 miles of plowed highways which serve New England and its winter sports lands.

I have seen youngsters of eight and nine tackling mountain ski trails with safety and I know several excellent skiers, men and women, who took up the sport after their fiftieth birthdays. Skiing is occasionally strenuous, but it need not be violent. I believe it is a permanent development because it is a participant sport, rather than a spectator sport.

Ski-jumping, by contrast, is essentially for spectators. Viewed from below the take-off, the sport is tremendously thrilling. The take-off hill or tower enables the skier to build up terrific speed and shoots him out into the air above a steep lower hill down which he lands.

If he landed on a flat, he would probably injure himself. Landing on the slope, he strikes a glancing blow and then skis to a stop at the foot of the run-out.

"There's nothing to it," said one of my jumper friends as I stood at the top of the Lancaster hill.

"When it comes your turn, be sure your skis are tight, take a step or two to kick free any snow or slush, then bring your skis and knees together and crouch so low you are practically sitting on your skis.

"Ease over the crown of the hill and let her go, keeping your body low to cut wind resistance.

"As you near the take-off, raise your body easily to a chair-sitting position, leaning forward with your hands down backward by your sides. Gaze into the open space above the take-off jump, and the very instant before your skis flash over the edge of the abyss, spring upward on your feet and leap ahead into the air, diving upward. Swing your arms slowly like a windmill.

"Lean on the air with your body straightened out. Don't worry.

"As the hill comes racing up to smack you, wham your skis hard upon it, continuing to lean forward. In a second you'll feel yourself skiing again. Ride her out and make a conventional stop when you have slowed down enough."

I gazed down those narrow, slippery ski tracks to the place where the run ended and the air began, and saw the tiny lines of spectators waiting for the next victim. They seemed a mile away. There was one awful, imaginative moment when I thought I might; and then I realized with joy that I had no skis on my leaden feet.

I watched my friend streak away, a smaller and smaller dot on the run, blossom suddenly into a little flailing figure in the air, and disappear below the hill line.

The roar of the crowd echoed up the hill.

In a half minute the telephone tinkled and we had a reassuring report. He had landed badly, broken his ski and twisted his shoulder, but was able to walk.

New England's snow sports season runs from late December through March, with good spring skiing in the higher altitudes on into May. Snowfall averages 45 to 60 inches in south-central New England and increases to as much as 175 inches in the mountains. For 85 days between November 20 and February 24 last winter, the temperature on top of Mount Washington was continuously below freezing.

Skiing facilities include the regular bulletin services on snow conditions published in the New York and Boston newspapers on Fridays and Saturdays; published lists of trails with their classifications; ski-trail patrol on race days; Red Cross emergency caches and rescue toboggans at strategic points throughout the mountains; lighted ski slopes at Stowe, Vermont, and Laconia, New Hampshire; ice-cake enclosures for winter sun-bathing at a number of resorts; and many ski tows (page 655).

### OTHER WINTER SPORTS LURE THOUSANDS

New England has many other joyous sports of winter. We have mentioned snowshoeing, which its enthusiasts term the prose of motion, as against skiing, which is the poetry of motion.

Sled-dog racing has begun to receive amateur support. Last winter 28 teams participated in eight races under the New England Sled Dog Club auspices (p. 661).

I added up the racing records of last winter in New England and if one driver and his team had won all the races, he would have covered 243 miles in 21 hours, 16 minutes, 24 seconds. That makes their speed about a mile in 5¼ minutes.

This winter the indoor winter sports carnivals in Boston and New York hope to stage pursuit races with these dog teams.

Skating is widely enjoyed, with publicly maintained rinks and skating areas available. Ice conditions in southern New England are too uncertain to permit regular harness horse racing on the ice or iceboating (Plate III). We have a racing club on the Mystic Lakes northwest of Boston and there is a fleet at Burlington, Vermont; but elsewhere only occasional iceboats are seen. Skate-sailing is more common.

Fishing through the ice, as practiced around Paugus Bay, on Winnipesaukee, and on Newfound Lake, in New Hampshire, is a popular pastime.

"Bobhouses" are built, small shacks with room for four persons, a table, and a stove. These shacks are on runners and are used either directly over a hole cut through the ice, or as shelter from which the fishermen watch their "tilts," gadgets which tilt and show a flag when a fish takes the bait at open holes out on the ice.

Harness racing on ice is popular in New Hampshire and Maine, and regular Saturday and Sunday races are run all winter. Horses are owned locally, and the owners usually drive. The racers are all trotters.

Toboggan slides, built of snow and sprinkled with water to ice them, are found where terrain and temperatures permit them (Plate I). Sliding slopes for children's sleds are provided by most communities.

And the old-fashioned winter sleigh ride in a big wagon box filled with hay, and with bells jangling, carries jolly parties down moonlit country roads to some inn for steaming chowder and a midnight barn dance.

Here and there skiers may be seen trailing a horse, sack stretched across the lines to keep the clods the horse kicks back from pelting the driver's face. This is skijoring.

North of Boston New England's sport planes take to skis in wintertime. Winter carnivals are held in almost every community at least once each year.

Thus, in New England winter has become a season of outdoor fun and recreation.

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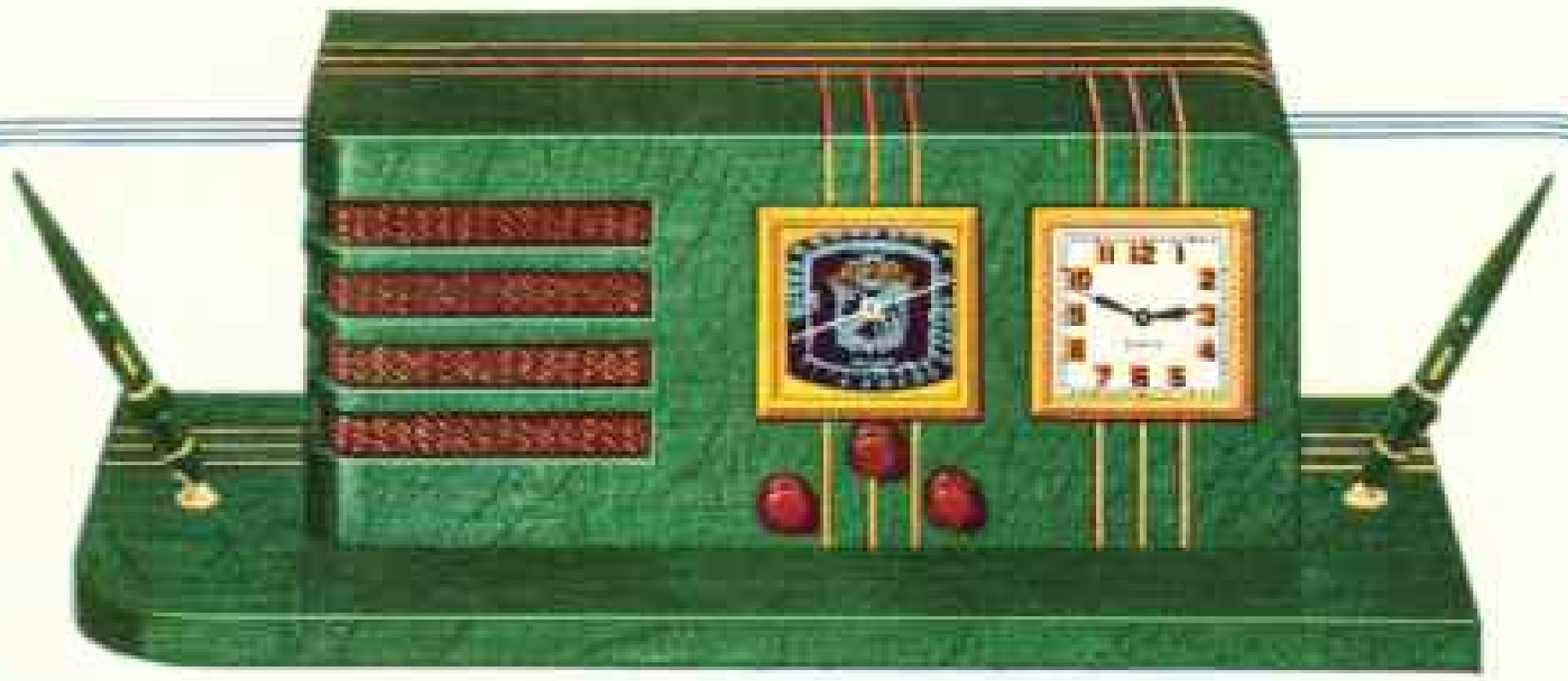
The Society cooperated with Dr. William Beebe in a deep-sea exploration of undersea life off Bermuda, during which a world record depth of 3,028 feet was attained August 15, 1934, enabling observations of hitherto unknown submarine creatures.

The Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole, and contributed $100,000 to Admiral Byrd's Antarctic Expeditions.

The Society granted $23,000, and in addition $25,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

The Society's notable expeditions to New Mexico 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 have solved secrets that have puzzled historians for three hundred years. The Society is sponsoring an ornithological survey of Venezuela.

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 an officially recognized altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, which obtained results of extraordinary value.



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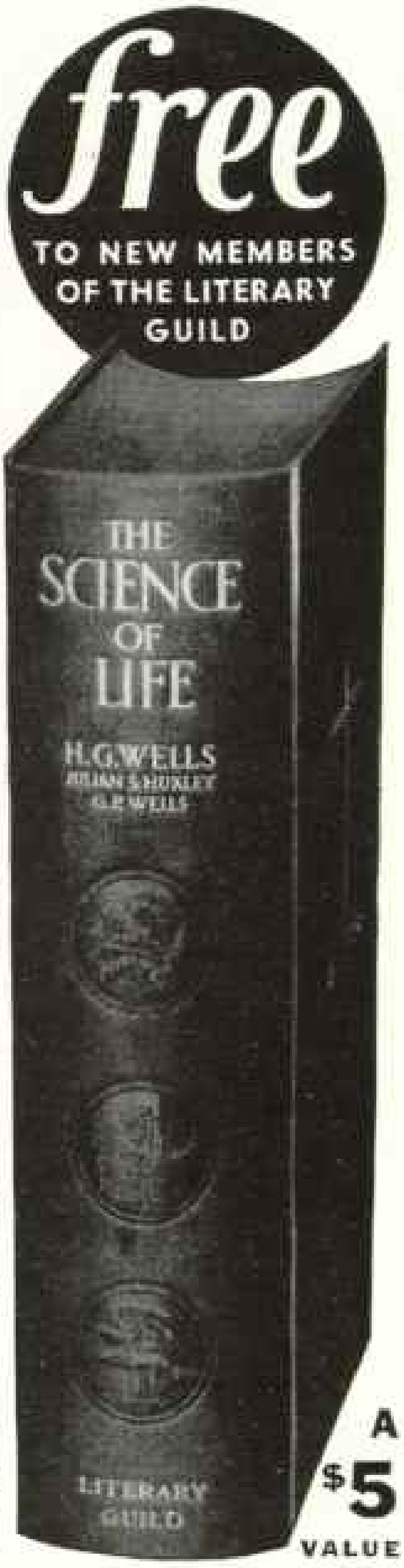


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*with*

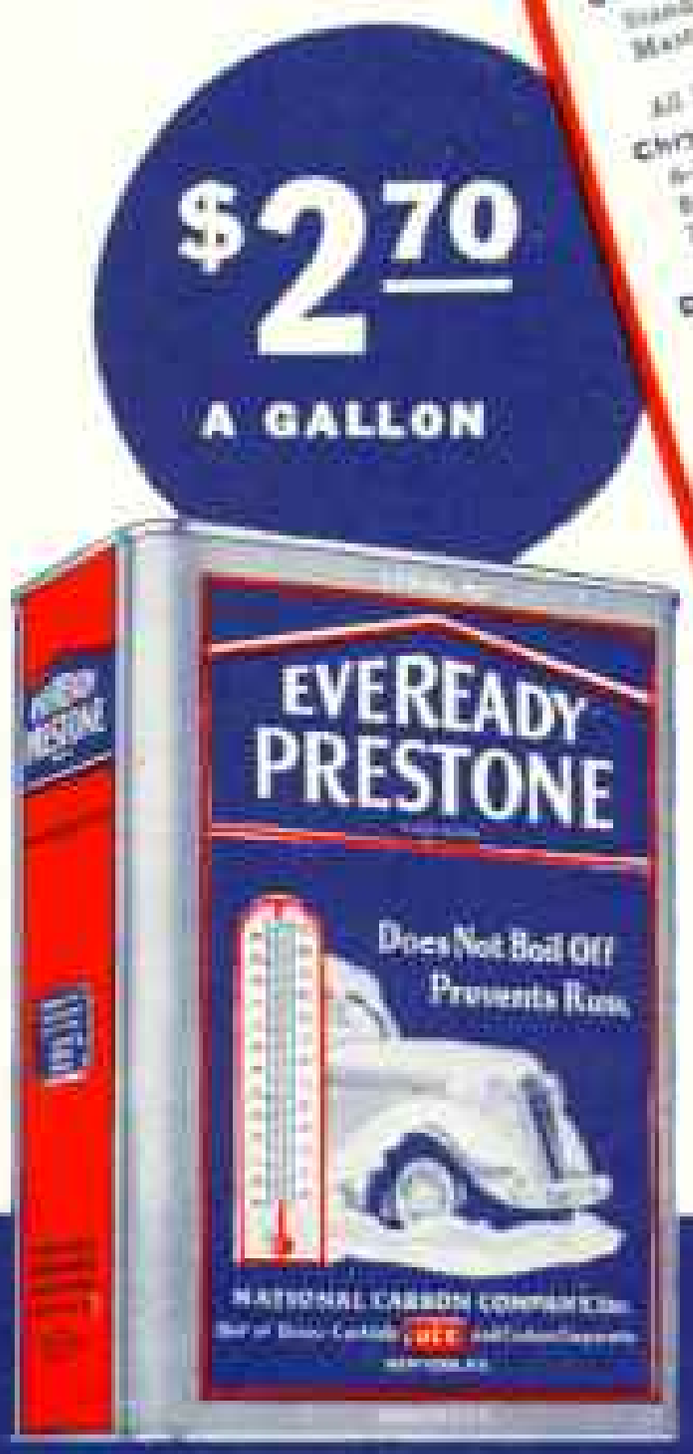
## FIND YOUR CAR ON THIS CHART

IMPORTANT! The price per gallon of an anti-freeze means nothing unless you know how many *gallons* you will need during the entire winter. You can't get that information on a boil-away anti-freeze. But you can get it for "Eveready Prestone" anti-freeze — and here it is. See how reasonably you can get two-way protection all winter long against both freeze-up and rust with one shot of "Eveready Prestone" anti-freeze—one shot because it won't boil off, no matter how warm the weather gets between the cold snaps. If your car isn't on this chart, your dealer has a chart showing all cars, and amounts needed for temperatures to 60° below zero.

***Find your car and read from left to right.*** *The first figure shows the protection you get with one gallon of "Eveready Prestone" anti-freeze in the cooling system; the second with one and a half gallons—and so on. "+" means above zero. "—" means below zero. If your car has a hot water heater, add ¼ gallon to the quantity called for.*

| MODEL | 1 GAL. | 1½ GAL. | 2 GAL. | 2½ GAL. |
|---|---|---|---|---|
| **Auburn** | | | | |
| 6-52, '34; 6-53, '35; 8-14, '36 | +12 | — 4 | —27 | —59 |
| 8-120, '32; 8-120, 8-120, '33 | +15 | + 2 | —15 | —42 |
| 850, '34; 851, '35; 852, '36 | +17 | + 6 | — 9 | —28 |
| **Buick** | | | | |
| 40, '34, '35, '36 | + 6 | —18 | —54 | |
| 60, '32; 50, '33, '34, '35 | +10 | — 8 | —34 | —62 |
| 80, 80, 80, '36 | +12 | — 4 | —27 | —59 |
| 90, 90, '32; 90, '33, '34, '35 | +13 | + 2 | —16 | —42 |
| 90, 90, '33; 90, '34, '35 | +15 | + 6 | — 9 | —28 |
| **Cadillac** | | | | |
| 370-D, '34, '35 | +14 | 0 | —23 | —50 |
| 355-D, '34, '35; 80, 85, '36 | +15 | + 4 | —12 | —39 |
| 452-D, '34, '35; 90, '36 | +19 | + 8 | — 3 | — 9 |
| 370-A, '35; 355-B, '32; 355-C, '33 | +21 | +13 | + 3 | — 9 |
| 60, 70, '35, '36 | +22 | +15 | + 6 | |
| **Chevrolet** | | | | |
| Std., '33, '34, '35 | | | —12 | —62 |
| Master, '32, '34, '35 | | | — 6 | —47 |
| '34, '35 | | | + 1 | —34 —62 |
| All Models—'36 | | | + 6 | —12 —41 |
| **Chrysler** | | | | |
| 6-32, '33, '34, '35 | +12 | — 4 | —27 | —59 |
| 8-35, '32; AF, Imp. '33; 6-'36 | +15 | + 2 | —15 | —42 |
| Airf. 8, Imp. 8, '33; Air 8, '35 | +16 | + 4 | —12 | —34 |
| '32, '35; DeLuxe 8, '36 | +18 | + 8 | — 6 | —23 |
| **De Soto** | | | | |
| 6, '33, '34, '35; 8, '32 | +15 | — 6 | —34 | —62 |
| 6, '36; Airflow 6, Airstream 8, '36 | +19 | + 4 | —12 | —34 |
| Airflow, Airstream '35 | +22 | + 6 | —23 | —50 |
| **Dodge** | | | | |
| 6, '33, '34, '35, '36 | + 8 | —17 | —43 | |
| Senior 6, '32; 370, '35 | +12 | — 4 | —27 | —59 |
| 8—'33 | +15 | + 2 | —16 | —42 |
| **Ford** | | | | |
| 8, '30, '31; 18, '32, '33 | + 8 | —14 | —42 | |
| V-8, '32, '33, '34, '35 | +14 | + 8 | — 6 | —23 |
| V-8, '36 | +18 | + 6 | —12 | —34 |
| **Graham** | | | | |
| 80, 90, 110, '36 | +10 | — 8 | —34 | —62 |
| 75-Sup. 6, 95-8, '35 | +14 | 0 | —21 | —50 |
| 14-S, '35; 80, '35 | | —14 | —42 | |
| 6, 8, '32; 6, 8, '34; 75, '35 | | + 4 | —12 | —34 |
| **Hudson** | | | | |
| 6, '36 | + 3 | —25 | —62 | |
| 8, '31, '32, '33; 6, '35 | +12 | — 6 | —27 | —59 |
| 8, '35; '36 | +17 | + 6 | — 9 | —28 |
| 8, '34 | +19 | + 9 | — 3 | —19 |
| **Hupmobile** | | | | |
| 8, '31; Cent. 8, '32; 521, '33 | +10 | — 8 | —34 | —62 |
| 617, 621, '34; 521, '35 | +10 | — 8 | —34 | —62 |
| 522, '32; 622, '34; 518, '35; 6-618-G '36 | +17 | + 8 | — 9 | —28 |
| 416, '33; 420, '34; 525, '35; 8-621-SE '36 | +17 | + 8 | — 9 | —28 |
| | +19 | + 9 | — 3 | —19 |
| | +19 | +10 | — 3 | —19 |

| MODEL | 1 GAL. | 1½ GAL. | 2 GAL. | 2½ GAL. |
|---|---|---|---|---|
| | +15 | + 2 | —16 | —42 |
| **Lafayette** | | | | |
| '34, '35, '36 | +10 | — 8 | —34 | —62 |
| | +15 | + 2 | —16 | —42 |
| **La Salle** | | | | |
| 50 (50, 8) '35 | +21 | +13 | + 3 | — 9 |
| 350, '34; 45-50, '35 | | | | |
| 345-B, '32; 345-C, '33 | +21 | +13 | + 6 | — 9 |
| **Lincoln** | | | | |
| Zephyr, '36 | +15 | + 2 | —16 | —42 |
| 136, 34, '34, 35, 36 145, 54, 55, 56 | +19 | + 6 | — 9 | —28 |
| **Nash** | | | | |
| 40, 70, '31; 980, 690, 'T2 | + 3 | —25 | —62 | |
| 1130, 1075, 1170, '33; 1220, '34 | +13 | — 6 | —27 | —59 |
| 1020, 3040, 3640A, '35 | +14 | + 6 | —21 | —50 |
| 1285, '34; 3580, '35; 1080, 1180, '33 | +17 | + 6 | — 9 | —28 |
| **Oldsmobile** | | | | |
| F-30, '30; F-31, '31; F-35, '32; | + 3 | —25 | —62 | |
| F-30, '35 | +13 | — 6 | —27 | —59 |
| F-32, F-32, '33; F-30, '34 | +13 | + 4 | —19 | —43 |
| L-35, '35; L-38, '36 | +15 | + 2 | —16 | —42 |
| L-23, '33; L-38, '34 | | | | |
| **Packard** | | | | |
| 120—'35, '36 | +14 | 0 | —21 | —50 |
| Sup. 8, '33, '34; 8, '35, '36, '35 | +16 | + 4 | —12 | —34 |
| Sup. 8, '35 | +18 | + 8 | — 6 | —23 |
| 745, '36; 845, '35; Deluxe, '32 | +21 | +13 | + 3 | — 9 |
| 12, '33, '34, '35, '36 | +22 | +15 | + 6 | |
| **Pierce-Arrow** | | | | |
| 41, 42, 43, '33, 34, '35; 836-8, '34 | +21 | +13 | + 3 | — 9 |
| 1601-8, '36 | +21 | +13 | + 3 | — 9 |
| 840-8, '34; 845, '35 | +22 | +13 | + 6 | — 9 |
| 1602-8 (12), '36 | +25 | +17 | +10 | — 3 |
| **Plymouth** | | | | |
| '30, PE, PD, '34 | + 6 | —18 | —54 | |
| PA, '35; PB, '35; PE, '36; P3, '35; | +10 | — 8 | —34 | —62 |
| P1, P2, '36 | +10 | — 8 | —34 | —62 |
| PC, PD, '35 | + 3 | —25 | —62 | |
| **Pontiac** | | | | |
| '30, '31; 6-'32; '33 | + 8 | —14 | —42 | |
| 6-'34, '34, '35; 6-'36 | + 8 | —12 | —42 | |
| 6-'36 | +12 | — 8 | —27 | —59 |
| **Reo** | | | | |
| 8-21, 8-25, '32; FC '35; Roy. '35; | +15 | + 2 | —16 | —42 |
| 6D, '36 | +15 | + 4 | —12 | —34 |
| 8-25, '34; 8-2, '35; 8-5, '34 | +18 | + 6 | — 6 | —23 |
| **Studebaker** | | | | |
| Dict. 8, '30 | + 6 | —18 | —54 | |
| Comm. 8, '31, '32, '33; | +10 | — 8 | —34 | —62 |
| Dict. 6, '34, '35 | +10 | — 8 | —34 | —62 |
| Dict. '35; Comm. 8, '34, | +10 | 0 | —23 | —50 |
| Pres. 8, '35, '34, '35 | +14 | + 6 | —21 | —50 |
| Pres. 8, '33, '32, '35; Comm. 8, '35 | +17 | + 6 | — 9 | —28 |
| **Terraplane** | | | | |
| 6, '32, '33; 8 Spec. '35; 6, '36 | + 3 | —25 | —62 | |
| 8, '35; 8 DeLuxe, '35 | +10 | — 8 | —34 | —62 |
| 6, '34 | +14 | 0 | —23 | —50 |




**CONTAINS NO ALCOHOL**

# *and* SAVE

# "EVEREADY PRESTONE"

## ANTI-FREEZE

tart the winter *right,* with "Eveready Prestone" anti-reeze in your car, and you finish the same way. Save ourself from freeze-ups, rust clogging, the perils of verheating and from worry.

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• • •

Put in one shot of *guaranteed* "Eveready Prestone" anti-freeze today and your cold-weather troubles are over for the whole winter. Look up your car now on the chart at the left and see how little you have to pay for guaranteed all-winter protection.

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NATIONAL CARBON COMPANY, INC.
*specifically*
GUARANTEES

*that "Eveready Prestone" anti-freeze, if used according to printed directions, in normal water-cooling systems, will protect the cooling system of your car against freezing and clogging from rust formations for a whole winter; also that it will not boil away, will not cause damage to the finish, or to the metal or rubber parts of the cooling system, and that it will not leak out of a cooling system tight enough to hold water.*

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Stop this common, yet costly experience
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*Stays* FULL *longer*

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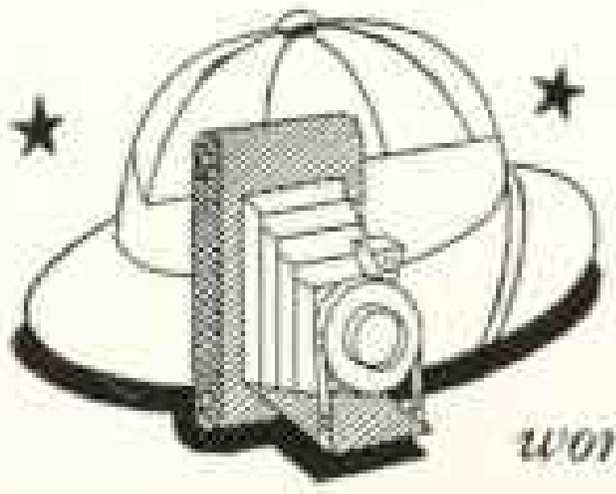

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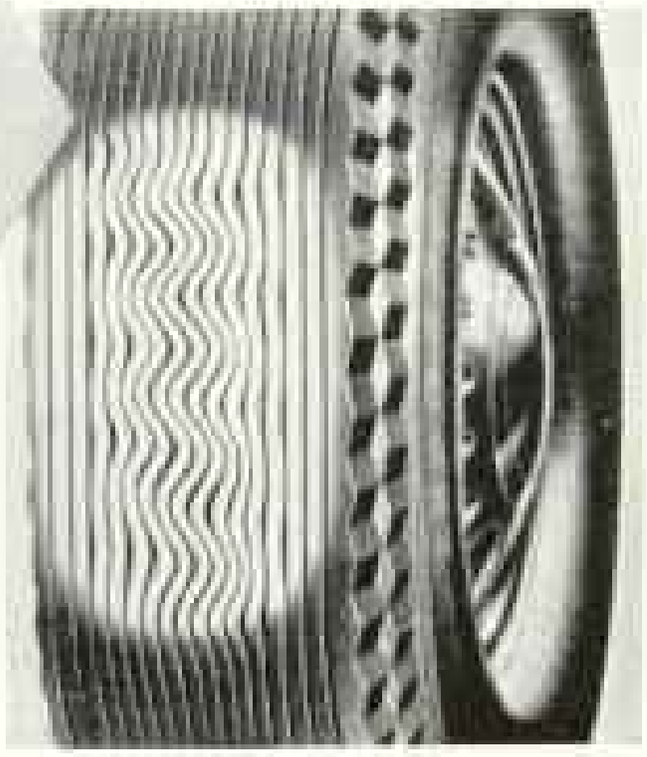

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*—that the speed of freight trains has been stepped up 45% in recent years?*

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*—that you are far safer on a railroad train than you are in your own home?*

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THERE IS – in the speed, comfort, safety and dependability of the modern American railroad train – something for *each* traveler especially to enjoy.

You can do the thing you *like* to do, while you ride, almost with the same freedom and peace of mind that you would have in your own home.

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*For the first time in history,* first-class roundtrip fares practically as low as summer fares are in effect all winter on Southern Pacific, between eastern cities and California, Oregon, Washington, Arizona and other western regions.

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Wherever electric current is available, it is only a question of time when every man who shaves will use a Schick Shaver.

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Come away from cold weather to this charming seaside city. Home Port of U. S. Battle Fleet. Center of Southern California's countless points of interest. Rest and recuperate under sunny skies. Enjoy golf, fishing and other outdoor activities every day all winter. You'll find living costs no higher than at home. Mail coupon now for free illustrated booklet.

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A ship at sea becomes the center of the universe . . . today as when sailing ships were uncharted points on the blue of the globe. The men on the bridge of a modern liner know that destiny is in their hands as inexorably as it ever was. They check their bearings still by sun, moon and stars. The size of their ship only multiplies their responsibility . . . makes more vital, more valuable the stern tradition of Britain on the seas.

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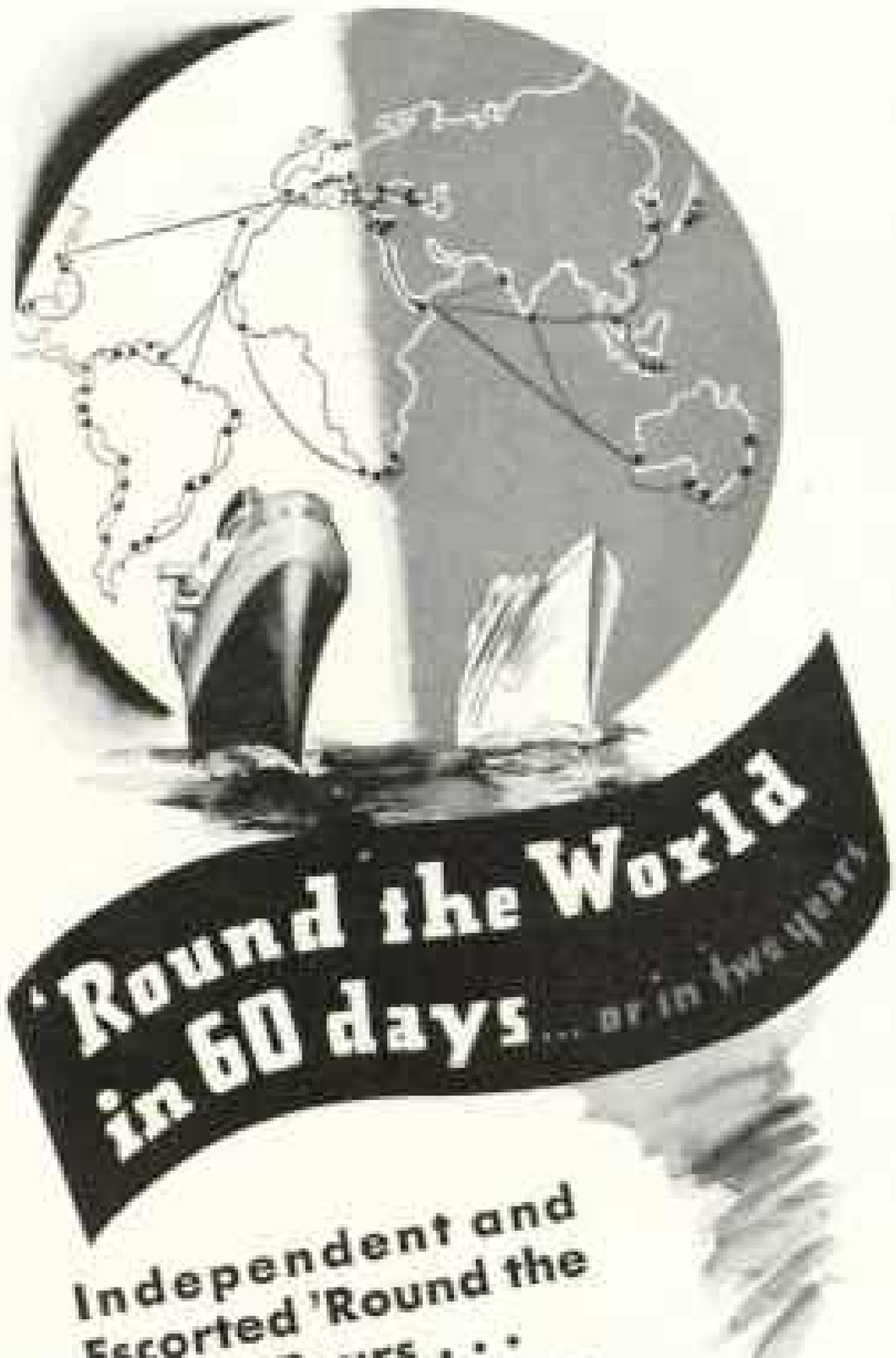

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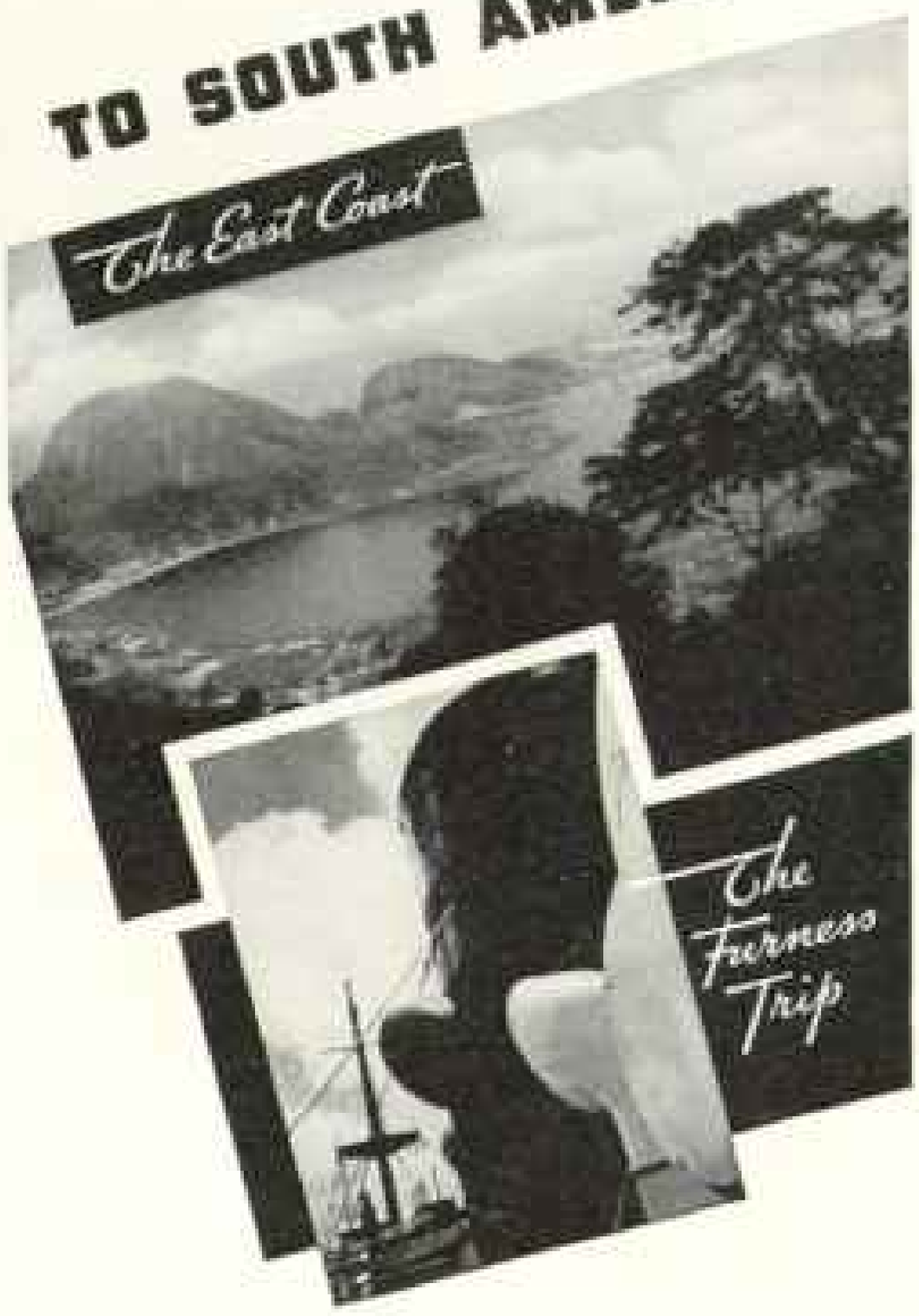


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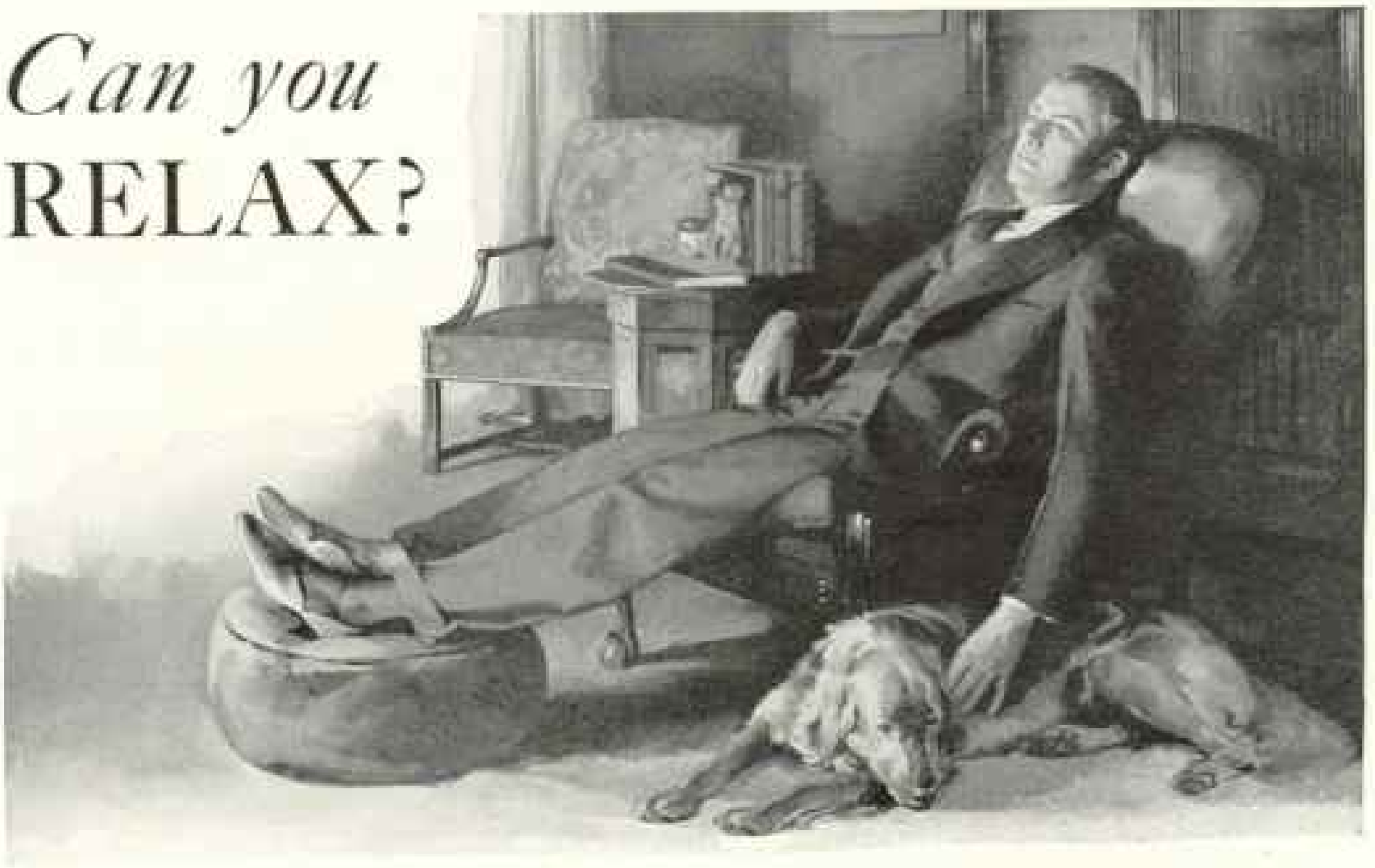
# *Can you* RELAX?

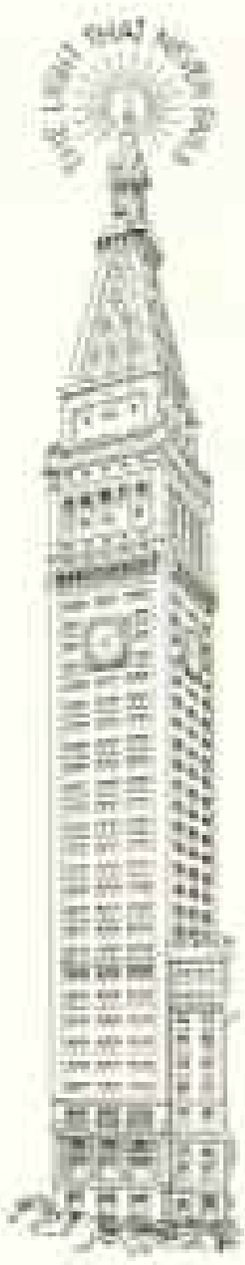


PERHAPS, at this moment, you are frowning or hunching your shoulders, clenching your hands or holding your neck stiffly. Do you notice any physical strain? Now let the muscles go limp for just three minutes and notice how much "smoother" you feel.

When the muscles relax, the nerves to and from those muscles are relieved of tension and get much needed rest. If you are nervous and high-strung, the chances are that some of your muscles are tightened and are wasting your nervous energy.

In this high-speed age, "nervousness" is becoming more and more common. Too many people work, play, travel—even sleep—under tension. They pay little attention to fatigue until they near exhaustion.

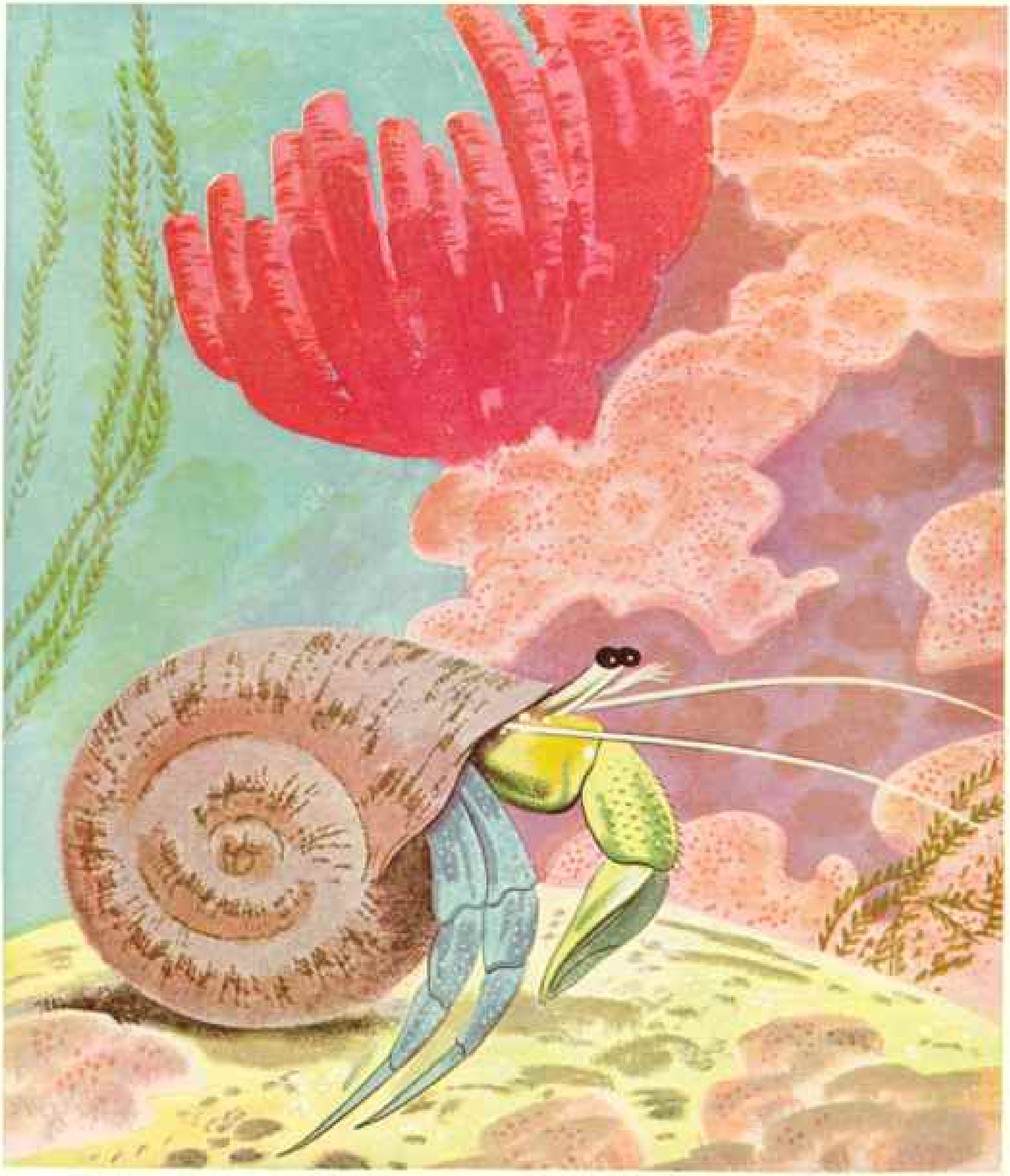
You may not realize what a severe toll tightened nerves will take. Long continued high tension is often associated with high blood pressure, heart symptoms, intestinal disorders, insomnia or nervous irritability. One of the first signs of nerve tension is irritability, most likely to occur during the years when you strive with all your might to reach your goal.



Some persons can relax naturally, but for the majority it is an ability to be acquired only by practice. If you are one who cannot relax easily, try lying down regularly each day and train yourself in relaxing groups of muscles—those of the hand, arm, or face—until you can relax the entire body. When not called upon to work, every one of your muscles should be thoroughly relaxed.

Muscular and nervous tension can in many cases be overcome by a hobby or some healthful game, or by sufficient rest or massage. Warm baths may be helpful. But if, despite your best efforts, you are unable to relax, see your doctor. Most likely he will soon find the cause of your difficulty and start you on the road to better health.

*Keep Healthy—Be Examined Regularly*



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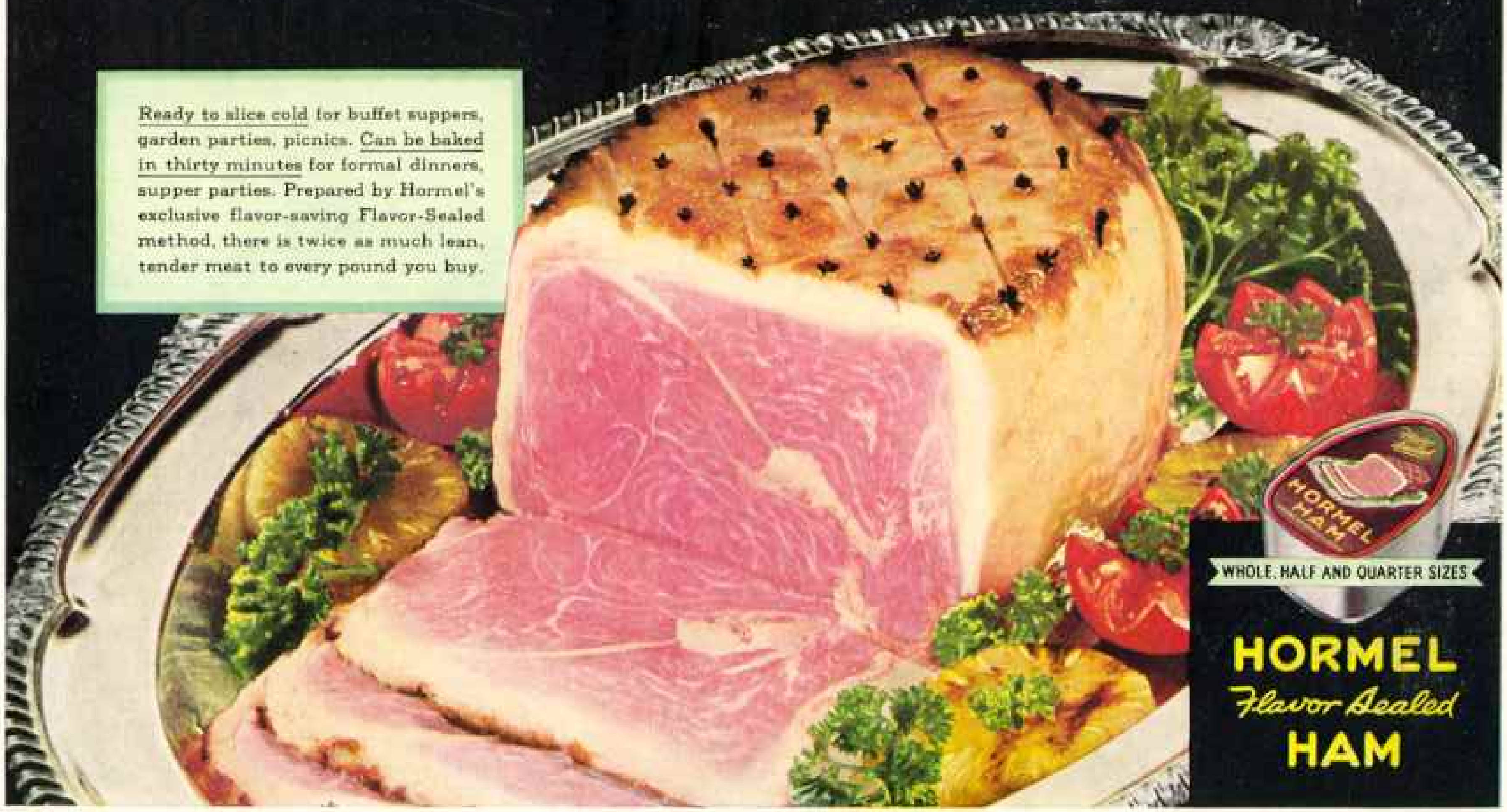


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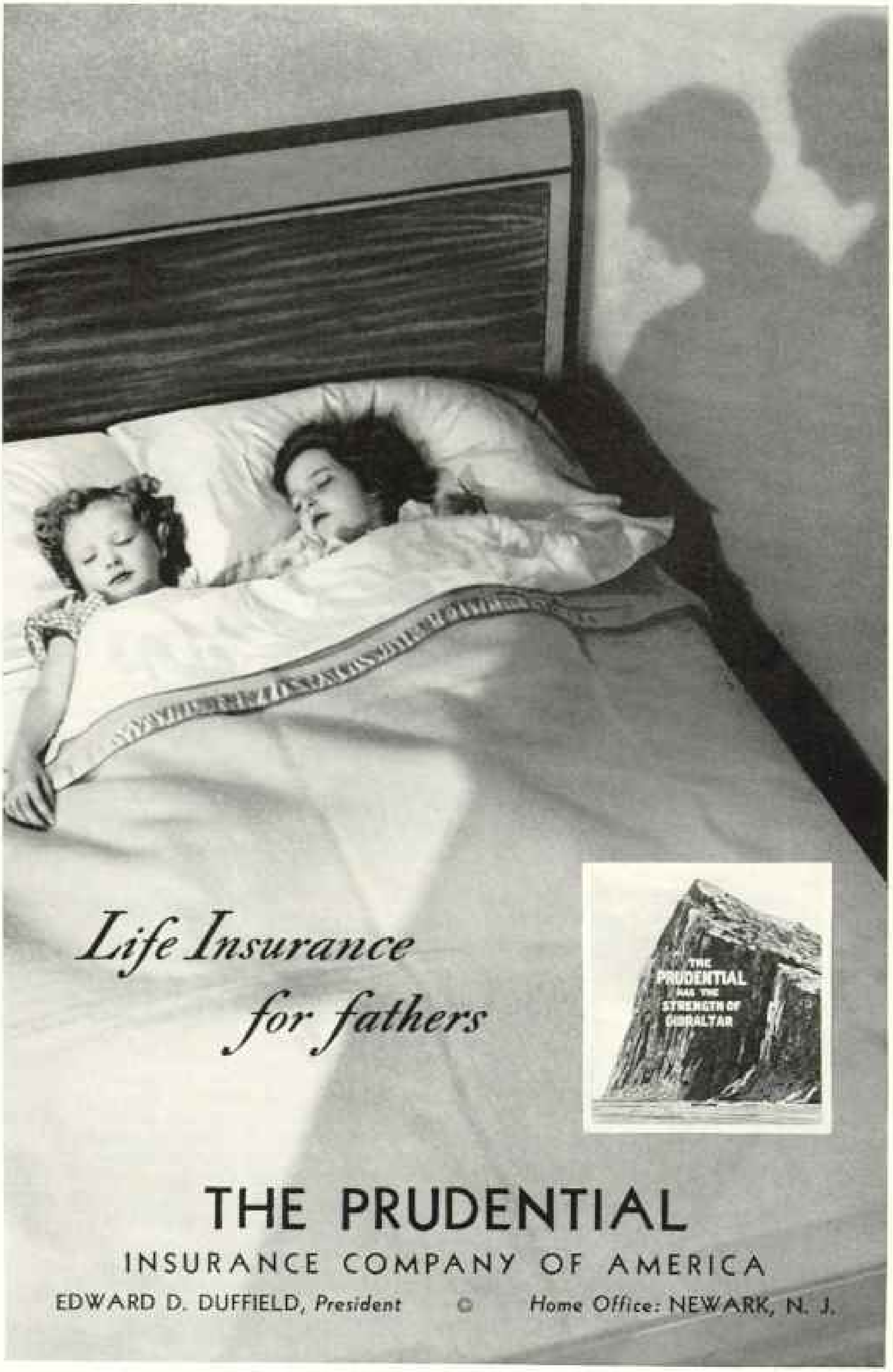
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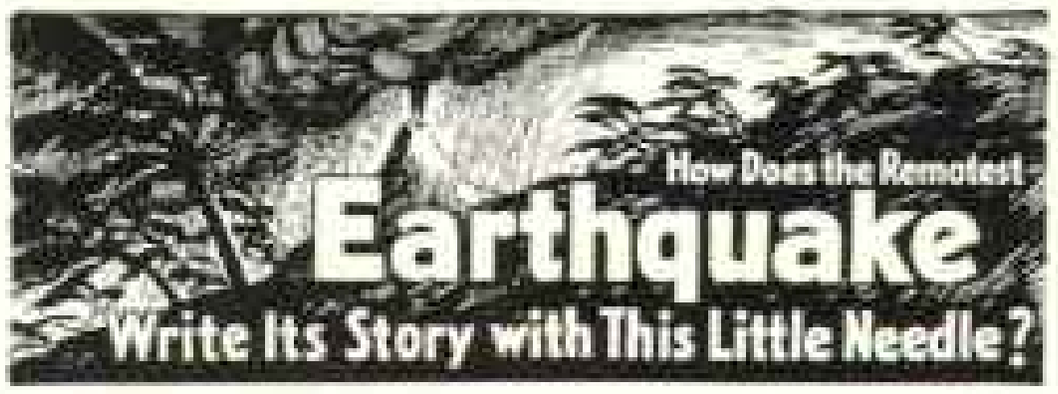


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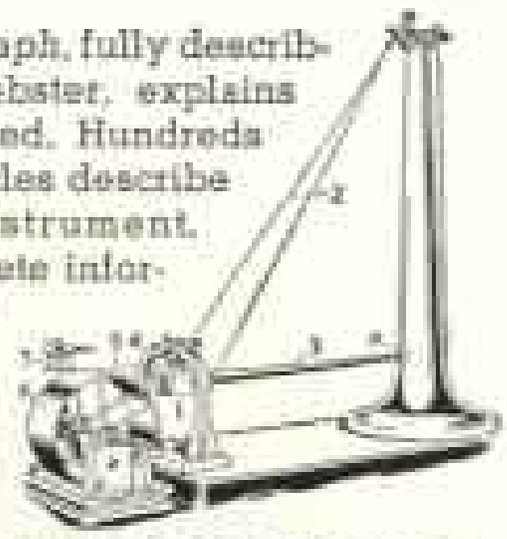

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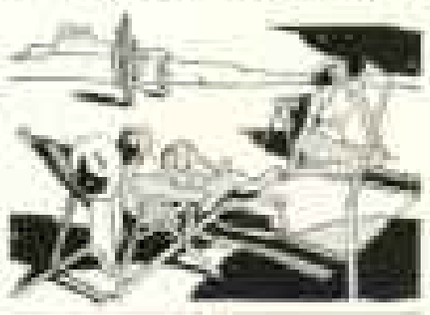

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**NEW SCENERY**...See ancient missions, Indian Picture Rocks, vast cactus deserts, strange caves, and Old Mexico.

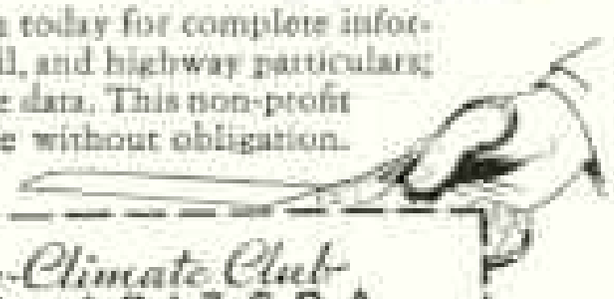
**NEW SPORTS**...Enjoy real western ranch life with broncho busting, branding, riding on bridle paths in the golden desert, barbecues at sundown—every outdoor sport at its best.

**FINE SCHOOLS, TOO**... Send the children to accredited schools—kindergarten through university.

**WITH ECONOMY**...Ample accommodations at hotels, apartments, houses, and sanatoria are scaled to every purse. A Tucson sojourn costs very little. Come and see!

# TUCSON

Write or mail coupon today for complete information including air, rail, and highway particulars; accommodation and rate data. This non-profit civic club renders service without obligation.



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Send me your new illustrated booklet "*New Life in the Land of Sunshine.*"

*Name*_____

*Address*_____


Are you among those fortunate ones who can get away for a bit of play and let-down during the fall-winter months? Then you'll find that all California and the Southwest have to offer, is *nearer* this season than ever before—

*Nearer in hours*, because of faster Santa Fe schedules; *nearer in dollars*, because of rock bottom fares, lower cost Fred Harvey meals en route, free pillows in chair cars, etc.; *nearer*, too, because new Santa Fe comforts are making the western rail trip an ever more enjoyable part of one's whole vacation.

**Via Santa Fe,** you may choose among seven fine air-conditioned trains—from solid Pullman, extra-fare fliers, to the swift new **Scout,** dedicated to finer service for chair car and tourist Pullman travelers.

This season's low winter fares are on sale earlier—October 1—with more liberal return limits.

**● May we send you picture folders, or special details of any sort?**

*Delightful in winter via Santa Fe*
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Send picture books and folders about fares
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# INDIA

## *The Taj Mahal*

### HAS A NEXT-DOOR-RIVAL

23 miles west of Agra is Fatehpur Sikri, most beautiful Moghul city in India. Visit the tomb of Saint Salim Chisti with its carved marble screens, delicate as lace. See the Pachisi Court where Emperors played human chess! First Class travel in India is inexpensive; cool, comfortable Second Class is 50% less! English spoken everywhere. Come via Europe or the Orient. Information: Delhi House, 38 E. 57th St., New York . . . or the better travel agents.

## INDIA STATE RAILWAYS

## APPLAUSE

WHEN the last ripple of applause has ended, it's time for something to eat. And whether you sit on a high stool, or in upholstered luxury, make your late snack a bowl of Kellogg's Corn Flakes.

They're delicious and satisfying. Aid sleep. And next morning your wisdom will be apparent. Sold everywhere.

**Nothing takes the place of**

*Kellogg's*

## CORN FLAKES

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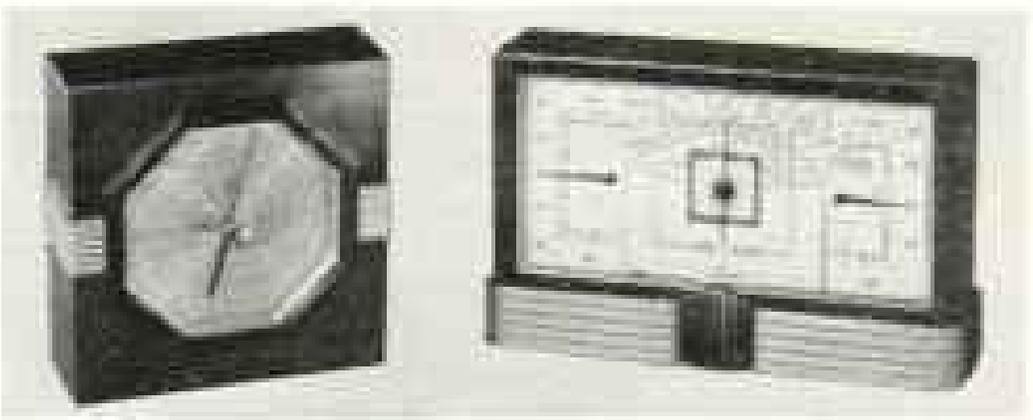
***Taylor Stormoguides give you notice 24 hours in advance***

YOU'LL save yourself a lot of grief and upset plans if you rely on a Taylor Stormoguide to predict the weather for you.

Taylor's 85 years' experience in making weather instruments for explorers and scientists the world over and for official weather bureaus from Washington to Guam, is behind every Stormoguide. That's why they are so reliable. And this same background of experience and scientific knowledge is behind all the many other types of instruments Taylor makes. Every Taylor instrument bears the Taylor name. Look for it on weather instruments and thermometers of all kinds. It's your guarantee of quality. If your dealer cannot supply you, write direct to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



**FAIRFAX STORMOGUIDE** tells *tomorrow's* weather today. Satin-black case, chrome reed trimming, altitude adjustments. Weather tendency indicator, **$10.***

**FAIRMONT COMBINATION,** Stormoguide, Humidiguide and Indoor Thermometer in one. Forecasts the weather, warns when air is too dry or room too cold, all at once. Satin-black case, chromium reed trimming. **$15.***

## Taylor INSTRUMENTS

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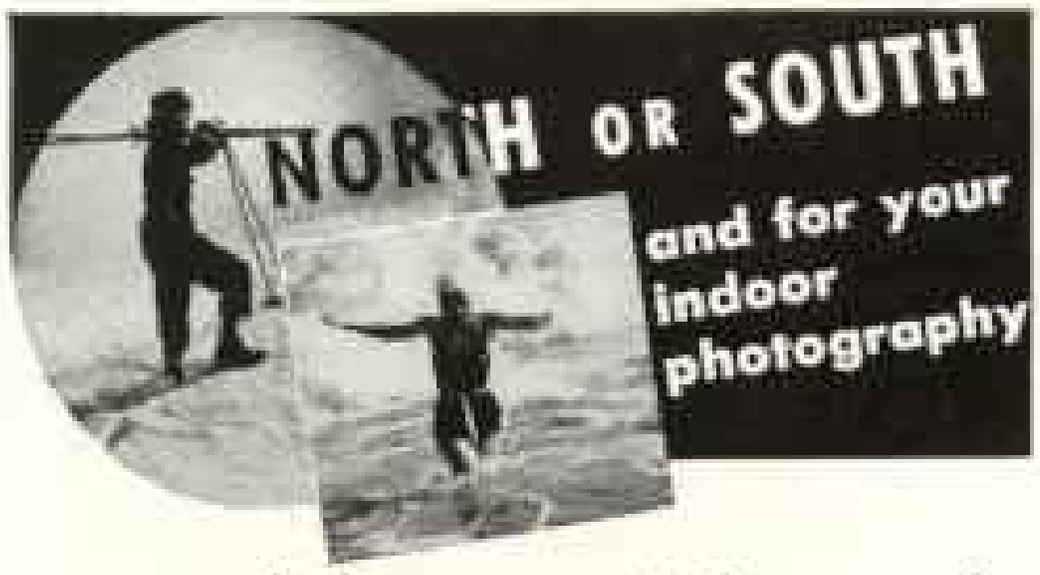
**IN INDUSTRY,** other types for indicating, recording and controlling temperature, pressure and humidity.

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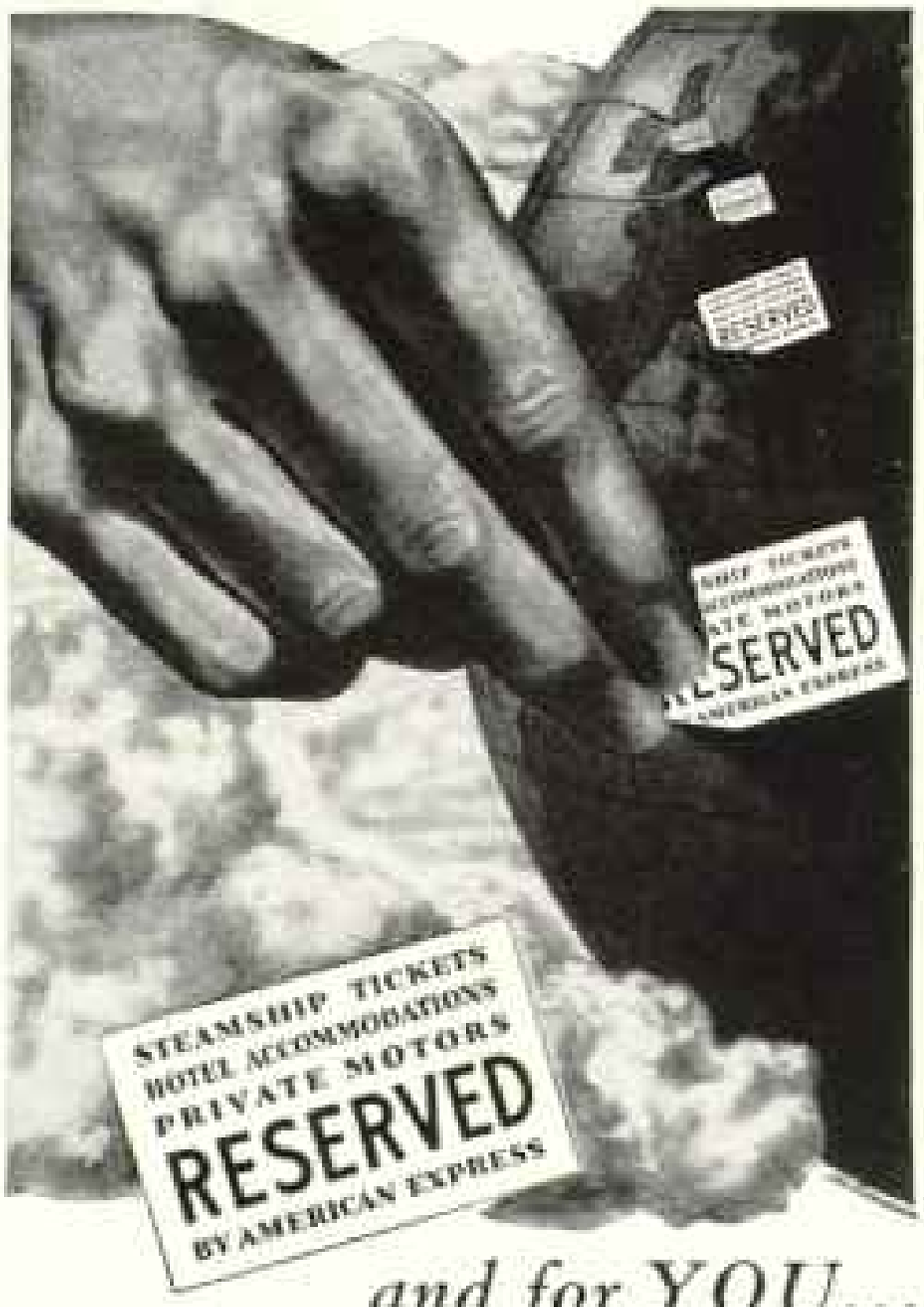
Now, you can take your camera with you and be sure every picture you shoot . . . stills or movies . . . will be correctly exposed. In any clime, indoors or out, simply point the small WESTON Meter at the scene or subject and it instantly tells you the exact camera settings to use. Every picture taken with the WESTON is sharp and full of detail . . . just as you want your pictures. Be sure you see the WESTON Meter at your dealer's, or write for full data ... Weston Electrical Instrument Corporation, 584 Frelinghuysen Ave., Newark, New Jersey.

WESTON *Exposure Meter*

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H. P. Brownell, Managing Director

# MEMBERS WILL RECEIVE

## The Society's New, Ten-color Wall Map of the Pacific Ocean . . . . A Veritable Atlas of Up-to-date Geographic Data

FIRST LANDING OF CHINA CLIPPER IN HONOLULU

TO PROVIDE members of the National Geographic Society with a comprehensive source of reference to the many island groups, isles, and harbors in the Pacific, The Society's cartographers have prepared, after months of research, a 38x31-inch Map of the Pacific Ocean, which will be issued with the December GEOGRAPHIC as a ten-color supplement. Seventy-three insets bring into large-scale visibility many land areas of special interest or importance, including the Midway and Wake islands on the transpacific route of the flying Clipper ships.

You, as a member, will receive this excellent addition to The Society's notable series of wall map supplements. But what of your friends? Wouldn't they, too, enjoy receiving THE GEOGRAPHIC and other benefits of membership, particularly now that reading months are here?

We shall be happy to invite your friends to become members if you will coöperate by nominating them. They will thank you for your thoughtful action. Your officers will likewise be grateful, for sound membership growth means new explorations and scientific researches—and a better Magazine for every member.

## Thinking Ahead to Christmas

Each year many members avail themselves of their privilege of presenting Christmas-gift memberships to relatives, friends, business associates, and employees, because each month THE GEOGRAPHIC is a constant reminder of happy personal associations.

"My membership is the ideal, year-long Christmas present," wrote a new member, "because The Magazine and its valuable map supplements never fail to interest and delight."

To give your friends this appreciated Christmas remembrance, nominate them on the form below, mark it "Christmas Gift," and return it as directed with their membership dues for 1937. Appropriate greeting cards announcing your gift will be sent to the favored recipients.

(YOU MAY NOMINATE BY LETTER IF YOU PREFER NOT TO CUT THIS PAGE)

## Nominations for Membership

_____ 1936

Secretary, National Geographic Society,
Sixteenth and M Streets, N. W., Washington, D. C.

I nominate for membership in the National Geographic Society:

(1) Name _____

Address _____

(Occupation) _____

(2) Name _____

Address _____

(Occupation) _____

(3) Name _____

Address _____

(Occupation) _____

**DUES:** Annual membership in U. S., $3.00; Canada, $3.50; abroad, $4.00; life membership, $100. Please make remittances payable to the National Geographic Society. Please remit by check, draft, postal or express order. . . . The membership fee includes annual subscription to The National Geographic Magazine.

Name and Address of Nominating Member

# "Where shall we stay?"

NATIONAL GEOGRAPHIC MAGAZINE'S HOTEL SECTION

## ARIZONA

### Litchfield Park

**The Wigwam.** Distinguished Inn and attractive bungalows in glorious desert setting near Phoenix. Golf, ride, relax. Rates from $8. Amer. Plan. Bklt.

### Tucson

**El Conquistador.** Landscaped resort hotel, with spacious bungalows, in midst of desert grandeur. Distinguished clientele. Glorious climate. All sports.

**Pioneer Hotel.** Southern Arizona's Finest. 250 Rooms with bath. Europ. Coffee Shop. Dining Room. Roof Garden. Sun Deck. Sensible Rates. Booklet.

## CALIFORNIA

### Arrowhead Springs

**Arrowhead Springs Hotel.** Famed hotel-spa where desert meets the hills. Filmdom's favorite rendezvous. 1½ hrs. from Los Angeles. H. E. Ward, Mgr.

### Beverly Hills

**Beverly Hills Hotel** and Bungalows. Mid the quiet and beauty of Beverly, twenty minutes from Los Angeles. Featuring a One, Two and Three Meal Plan.

### Los Angeles

**The Ambassador.** Twenty-two acre Playground in heart of City. All Sports, Plunge, Beach, Lido. Coconut Grove for Dancing. European, $3.00 up.

### Palm Springs

**The Desert Inn**

A distinctive winter colony annually gathers at this world famous desert resort to enjoy carefree days against the inspirational background of the desert. Sun-lazy days and star-quiet nights. Healthful, dry warmth. All sports. Luxurious accommodations. American Plan $10 up. Write for folder.

**El Mirador.** America's finest desert resort. Sunny days of healthful recreation and rest. Unexcelled cuisine. Discriminating clientele. Amer. Plan $16 up.

### Santa Barbara

**El Encanto and Villas.** On the Riviera. American Plan. Excellent Cuisine. Separate Diet Kitchen. Beach Club. Golf. Charles B. Harvey, Proprietor.

## DISTRICT OF COLUMBIA

### Washington

**The Dodge Hotel** on Capitol Hill. Men and women travellers enjoy the "No Tipping" service in all departments. Noted cuisine. $2-$3, single; $4-$5, double.

**Hay-Adams House.** Across from the White House at 16th and H. The best in accommodations amid smart surroundings. European, $3.50 up.

**Hotel Martinique**—16th Street at M. Directly across from National Geographic Society. New and Modern. Every room with bath. European. From $3.

**The Raleigh Hotel.** Across Penn. Ave. from new Govt. Bldgs. Dining rooms air conditioned. Rooms with tub and shower, $3-$5 one, $4.50-$8 two. E. P.

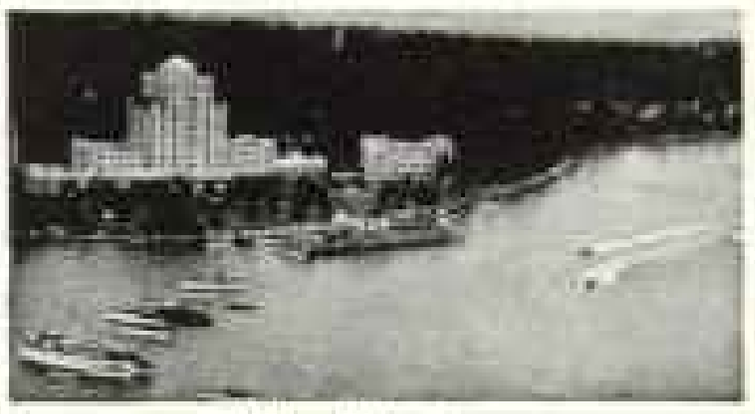
## FLORIDA

### Miami

**The Columbus**

Miami's finest hotel. Seventeen floors of solid comfort. Facing Park and Bay. In the social and geographical center of Miami. Convenient to everything. Two floors of public rooms. Individualized decorations and furnishings. soft water plant, steam heat—every possible service to enhance your stay. Booklet on request.

### Miami Beach



**The Flamingo**

Merry Christmas! Enjoy it at this famous hotel. Your sons and daughters at school or college will thrill at the idea of spending their holidays under sunny skies enjoying health-giving sports: Golf, Bathing, Tennis, Polo, Dancing and other social activities. Write C. A. Krom, Mgr., for full information and special Christmas Holiday rates.

**The Hotel Pancoast**

Most exclusive resort hotel in America. Located in an exotic tropical setting directly on the Ocean front. Private bathing beach and cabaña club. Restful atmosphere, yet close to all seasonal activities. Outdoor sports all winter. Open all year, American plan during winter season. Write or wire to Arthur Pancoast, Pres.; Norman Pancoast, Mgr.

### St. Petersburg

**Deermont Hotel.** Overlooking Williams Park. Close to Tampa Bay and all points of interest. Steam heat, elevators. Amer. plan. Angus C. Craft, Mgr.

**The Huntington.** A resort hotel of merit in beautiful and exclusive surroundings. Close to all activities. American Plan. Booklet. Paul Barnes, Mgr.

**Jungle Hotel.** Country Club atmosphere. Golf at the door. Riding, Fishing, Tennis. Famed for food, service and fair rates. John F. Hynes, Mgr.

**Princess Martha Hotel.** In the heart of St. Petersburg. Modern, fireproof, 250 rooms, each with bath. European plan. A. L. Manning, Manager.

### St. Petersburg (continued)

**Serene Hotel.** On Tampa Bay. Modern, fireproof. 310 rooms each with bath. Finest service and cuisine. American plan. Every sport attraction. Booklet.

## ILLINOIS

### Chicago

**LaSalle Hotel.** *Fireproof in Friendliness.* Near everything—LaSalle at Madison St. You'll like the clean, bright rooms—good food—reasonable rates.

## MARYLAND

### Baltimore

**The Belvedere.** Outside the business district, yet convenient to all the city's activities. Every modern comfort and luxury. Rates begin at $4.00.

## MASSACHUSETTS

### Boston

**The Copley-Plaza** faces beautiful Copley Square. Single rooms from $4.00; double from $6.00; Suites from $10.00. Arthur L. Race, Managing Director.

## MINNESOTA

### Minneapolis

**Curtis Hotel.** Contiguous to Minnesota's 10,000 Lakes region. Largest Hotel in the Northwest. Soft-water baths throughout. Rates $2 to $5.

## NEW JERSEY

### Atlantic City

**Chalfonte-Haddon Hall.** On the Atlantic City Boardwalk. 1000 rooms. Ocean Decks. Modern health baths. American and European plans.

### Princeton

**The Princeton Inn.** Facing golf course and Graduate College. Amer. plan. 100 rms. Fireproof. "Hospitality as in days of old." J. Howard Sheetz, Mgr.

## NEW MEXICO

### Santa Fe

**La Fonda**—Old world charm, city sophistication, the End of the Trail in Old Santa Fe. Cool summers, mild winters. Harvey Management.

## NEW YORK

### Albany

**De Witt Clinton.** A Knott Hotel. New, well appointed. Faces Capitol Park. Splendid meals; attentive service. Come, we'll make you happy.

### New York City

**Barbizon-Plaza.** New skyscraper hotel overlooking Central Park at 6th Ave. Tower rooms from $3 single, $5 double. Continental breakfast included.

**The Plaza.** New York. Fifth Avenue, facing Central Park. Single Rooms from $6; Double from $8; Suites from $12. Henry A. Rost, President.

**The Waldorf-Astoria**

Famous scene of New York social and business activities . . . convenient to the City's important and interesting centers. Various restaurants with comprehensive range of prices and types of service. Park Avenue, 49th to 50th Street, New York.

## NORTH CAROLINA

### Southern Pines—Pinehurst

**Pine Needles Inn.** Only completely fireproof resort hotel in central Carolinas. 18 hole Donald Ross golf course. For rates apply Emmett E. Boone, Mgr.

CONTINUED ON NEXT PAGE

# "Where shall we stay?"

## OREGON

### Portland

**Multnomah**—Oregon's largest. 600 rooms. From $2.50. Three to four blocks to leading stores and banks. Three cafes. Famous food.

## SOUTH CAROLINA

### Aiken

**Willcox's.** Excellent south bound stop-over. Ideal fall climate. Golf, shooting, tennis, horses. Fortieth winter. Write pre-season rate, Box 457.

### Camden

**Hobkirk Inn.** Traditionally Famous. Located in heart of Southern Horse Country. Emphasizing Golf and Quail Hunting. Cottages. Season—Nov. to May.

### Charleston

**Villa Margherita.** Stately mansion on the famous Battery. Gathering place of cultured, traveled people. Booklet on application.

## TEXAS

### El Paso

**Hotel Paso Del Norte.** A friendly, cordial host offering travelers unexcelled accommodations, cuisine, service. Ideal climate. Rates from $2.50. Hkit.

## WEST VIRGINIA

### White Sulphur Springs

**The Greenbrier and Cottages.** America's world-famous spa and resort. Open all the year 'round. For rates and information apply L. E. Johnston.

• • •

## BERMUDA

**The Princess Hotel & Cottages.** Largest hotel. Every recreational facility. Established clientele. Consult your local travel agent or write direct.

## MEXICO

### Guaymas

**Hotel Playa de Cortés.** Southern Pacific's new beach resort. Finest deep-sea fishing. Overnight from border. Write manager or S. P. agents.

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THE ROYAL GUARDS

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This is what the perfection of Victor Higher Fidelity Recording has done for you: When you listen to Victor Records, the musicians come to life exactly as you hear them at an actual concert! For the first time, every sound of the music is heard when it's reproduced by a Victor Higher Fidelity Phonograph from Victor Higher Fidelity Records.

How wonderful it would have been for us if there had been Victor Higher Fidelity Recording in the days of Liszt and Jenny Lind! Equally priceless, though, are the living records we can own and preserve of the music of Toscanini, Stokowski, Heifetz, Rachmaninoff, Tibbett, and all the musical titans of our day.

Why don't you stop in at your Victor dealer's soon, to hear a Victor concert?

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Symphonic Poems—Night-Ride and Sunrise and The Oceanides (Sibelius). The British Broadcasting Company Symphony Orchestra. Album M-311 (11933-11935), AM-311 (11936-11938). . . . . Price **$5.00**

Symphony No. 7 in A Major (Beethoven). Arturo Toscanini — Philharmonic-Symphony Orchestra of New York. Album M-317 (14097-14101), AM-317 (14102-14106). Price **$10.00**

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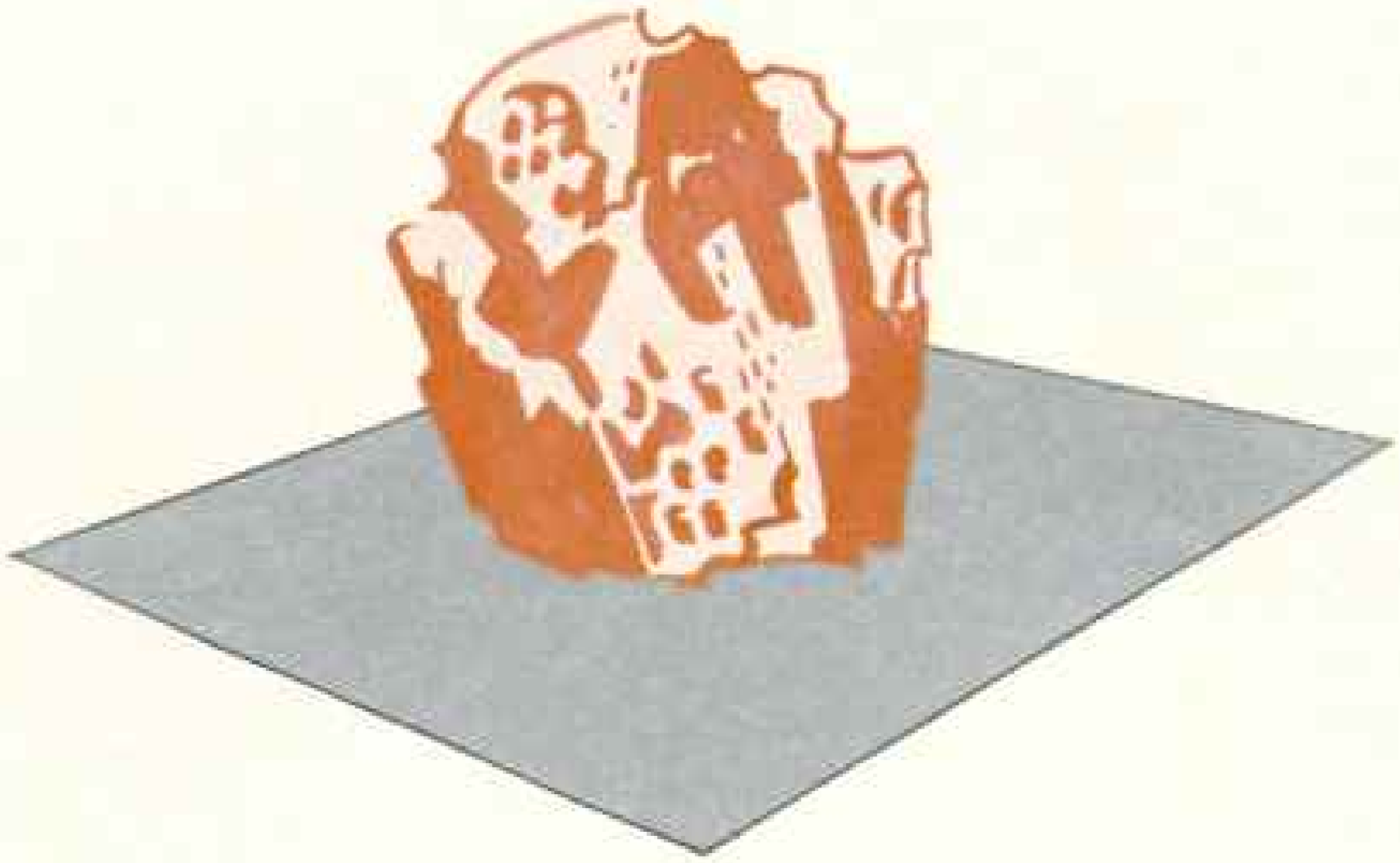

# "There's so much Aluminum in the earth it ought to be Dirt Cheap"

Whenever we hear a statement like that, we are reminded of another familiar metal, which offers an interesting comparison with aluminum.

Did you ever hear anybody say, "Gold is so easy to extract, *it* ought to be dirt cheap"?

Gold *is* easy to produce, because it is usually found as free, metallic gold. A pan and some water in the hands of a solitary prospector is a complete gold factory. But the difficulty with gold is to *find* it.

The difficulty with aluminum is to *extract* it.

You don't have to search for aluminum. It is the most abundant metal in the earth's crust. There is aluminum in every claybank. But not *metallic* aluminum. Always, it is in some form of chemical compound. If it did occur as free metal, as does gold, such abundance would make aluminum cheap enough for paving blocks.

Even when rich deposits are found, the job of unscrambling the aluminum compounds concocted by nature is complex, tedious, and costly. Scientists worked for sixty years to find *any* economically practicable way of doing it, before young Charles Martin Hall hit upon the present electrolytic method.

It requires 9 tons of raw materials to make 1 ton of aluminum. These materials include bauxite (the most commonly used ore of aluminum), coal, soda ash, limestone, fluorspar, cryolite, petroleum coke, and pitch, to name only the principal ones.

To complete the process there are used, also, 22,000 cubic feet of gas, and 24,000 kilowatt-hours of electrical energy.

Fifty years of scientific research and practical experimentation have gone into finding ways and means of putting these essentials together more efficiently, in order to reduce the price of aluminum. In those fifty years the price of ingot aluminum has been lowered from $8 a pound to its 20 cent level of today.

The comparative cheapness of aluminum is emphasized by the fact that, because of natural lightness, one pound of aluminum is 3 times as big as one pound of almost any other common metal.

Obviously we want to see more aluminum used. We recognize that there are just two fundamental ways to do this: by working hard in laboratory and factory to make aluminum lower in price; by working hard in laboratory and factory to make aluminum more useful.

Such is our basic program. We believe it is intelligent self-interest, because its foundation is a profit earned by benefiting the public generally.

ALUMINUM COMPANY OF AMERICA