THE Southern Illinois farmer squinted at the visitor. "Parker Earle?" he said. "Oh, sure. He has the place about two miles down the road. Kind of a queer man, they say. Doesn't farm corn and wheat like other folks. He's always foolin' around with fruit and berry growin'."

If the farmer could have seen Parker Earle, he would have thought Earle was surely "tetched." Earle was building some queer-looking chests. In one part of each chest he put ice. In the other part, he put strawberries. The chests were shipped by railroad to Chicago. Strawberries in the Chicago area hadn't ripened that early. Thus, Earle's strawberries brought high prices.

Freight Service Grows With the Nation

Parker Earle tried his experiment in 1866. He was one of many pioneers in sending refrigerated products to market. His experiments with the chests later included tests with carloads of fruit carried in refrigerator cars invented by other pioneers.

In the 1880's, the ammonia compression machine made it possible to manufacture ice in great amounts. Railroads quickly expanded and improved their refrigerator service.

Today, we practically "live out of" freight cars. Refrigerator cars bring us fresh fruits, vegetables, meats, fish, and dairy products. Other freight cars bring us clothing, fuel, and supplies of all kinds.

Freight cars are of many shapes and sizes. The boxcar carries almost anything needing protection from theft or the weather. Gondola cars and hopper cars may carry coal, coke, ores, phosphates, sand, gravel, sulphur, and many other "bulk" products.

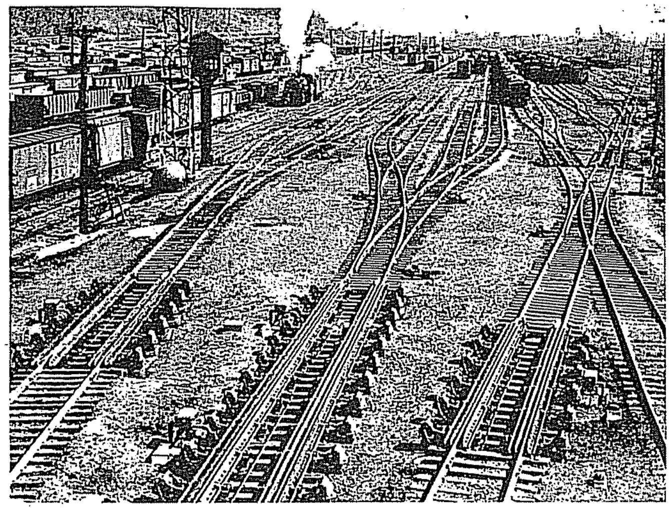
Flatcars may carry such products as lumber, heavy machinery, and military equipment. Flatcars with lowered floors (wells) are used for extra large shipments. Railroads also use livestock cars, poultry cars, milk tank cars, helium cars, tank cars for certain chemicals, and many others.

By far the most active of these cars is the boxcar. If a boxcar could talk, it would probably heave a big sigh and say, "Boy, am I tired! I've been all over this country in the last few months. But, brother, hard work is my middle name!"

Let's check back on this boxcar's record.

The car had been given an overhauling and a new coat of paint in Atlanta, Ga. There, it was loaded with packages of mixed freight. When all its space was filled, the door was sealed shut. Somebody made out a ticket for the car. This ticket, or "waybill," showed the car number, what was inside, and where the freight was to go.

A switching locomotive coupled onto the car and



Freight cars roll off the "hump" and are switched to the proper tracks. Retarders "squeeze" wheels to slow cars.

pulled it to the freight yard. There, the car was joined with other cars. A caboose was added.

Now a complete train was made up. A huge freight locomotive hooked on. The whole string of cars was soon on its way to New York City.

The car arrived in New York and was unloaded. It was loaded immediately with printing machinery for Bangor, Maine. The car traveled empty from Bangor to Millinocket, Maine. At Millinocket, it picked up a load of newsprint paper for Boston. From Boston, the car went to Haverhill, Mass., to take on shoes for Dayton, Ohio. From Dayton, it carried electric refrigerators to St. Louis, Mo.

But this was only a start. Here's what its waybills would show us about the rest of its work:

Packaged freight, St. Louis to Houston, Texas; *empty,* Houston to Galveston; *chemicals,* Galveston to Chicago; *telephones and parts,* Chicago to Los Angeles, Calif.; *ship machinery,* Los Angeles to Portland, Oreg.; *canned salmon,* Portland to Minneapolis, Minn.; *flour,* Minneapolis to Baltimore, Md.; *empty,* Baltimore to Lancaster, Pa.; *linoleum,* Lancaster to Green Bay, Wis.

The car took a rest from Green Bay to Appleton, Wis. Then, it started to work again:

Paper, Appleton to Hamilton, Ohio; *empty,* Hamilton to Cincinnati; *soap,* Cincinnati to Detroit, Mich.; *automobile parts,* Detroit to New Orleans, La.; *coffee,* New Orleans to Nashville, Tenn.

By this time, the car needed some repairs. It was sent home to Atlanta.

These Little Cars Stayed Home

Early freight cars were stay-at-homes. Each railroad kept its cars on its own rails. When a freight car reached the end of its own road, it was unloaded.

Its freight was loaded into a connecting road's car. On long-distance hauls, transfers took place many times. Freight shipments were slow and costly.

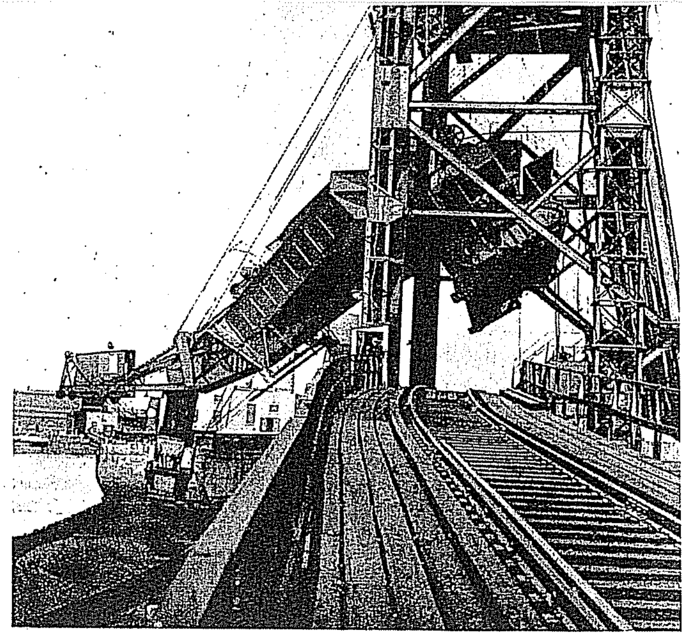
Working together, the railroads developed an interchange system. Today, any freight car of any American railroad may be sent anywhere in the United States, Canada, Mexico, and Cuba. A car from a western road may be coupled to a car from Maine, or any other place in America. All cars couple together, brake together, and run together. Even the ladders, steps, and hand brakes are always in the same places. Thus, freight can be shipped all over the North American continent.

As part of the interchange plan, each railroad charges other railroads for the use of its cars. For each day that a car spends on a "foreign" road, the car's owner receives a rental fee—called a "per diem." Effective August, 1953, the per diem became $2.40, the estimated average daily cost of owning a freight car.

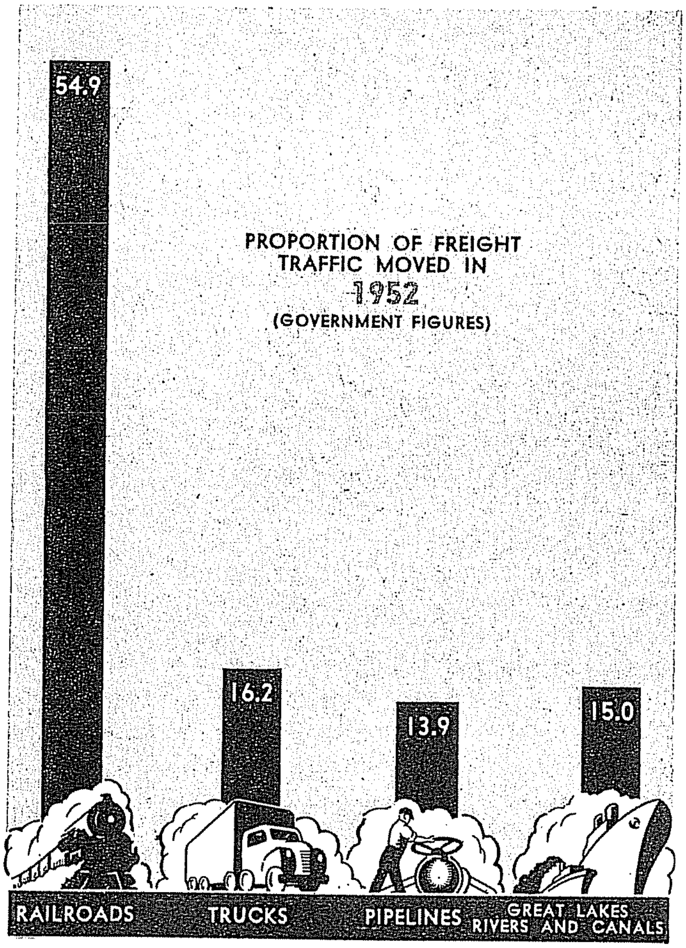
The railroads also work together in repairing cars. Methods and parts are standardized.

Railroad Car Record Offices keep a record of each car through telegraphic and written reports. Through these offices and a car's waybills, a car can be located at any time.

This great system is due, again, to American

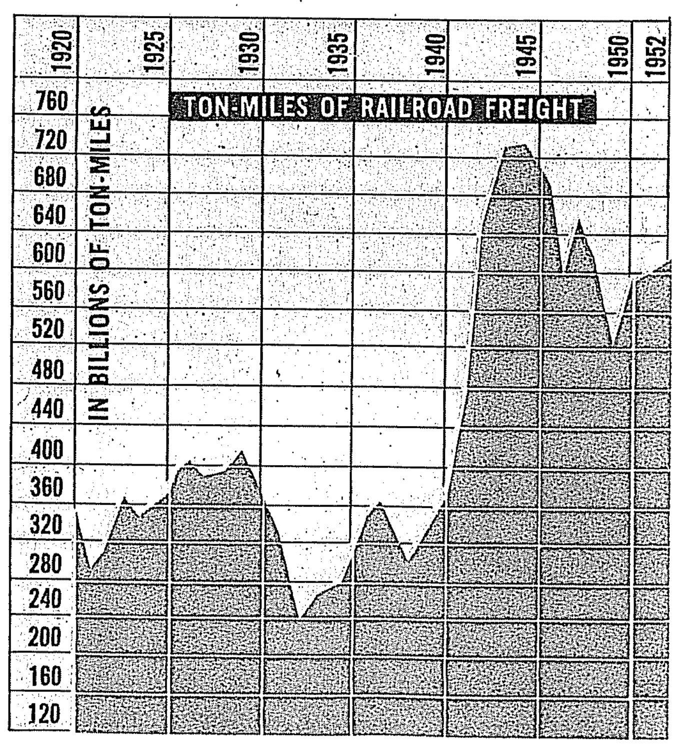


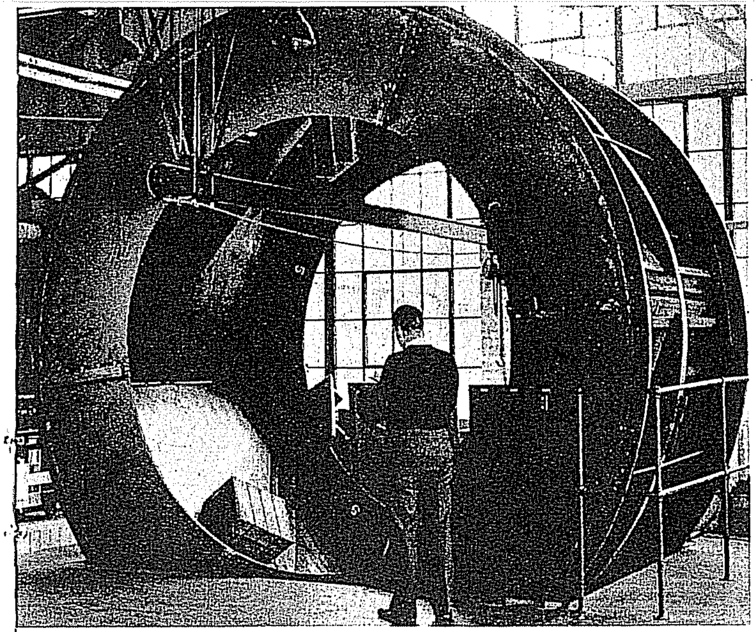
Huge coal dumpers pick up loaded cars and empty them.



HOW FREIGHT TRAFFIC IS HAULED

There are two ways of measuring the freight traffic of the nation. One counts only tons moved, ignoring the equally important factor of distance. The other counts tons moved one mile, or ton-miles. The latter, of course, is the accurate way to measure. By that measurement, railroads handle more than half of all freight traffic moving to, from, and between towns and cities. In fact, railroads handle more inter-city freight traffic than is handled by all other forms of transportation combined.





Packaging and loading have been improved by research.

Research cars have helped to improve railroad service.

"know how"—in track building, car design, communications, and accounting. Finally, it depends upon people. That is why railroad people have to be alert, accurate, and dependable.

Science Speeds Freight on Its Way

Packages which must travel in a special hurry are handled differently from regular freight. Specially built express cars travel at passenger train speeds. In fact, express cars are moved only on passenger trains or in separate express and mail trains.

The United States mails are handled in about the same way. Specially built Railway Post Office cars carry the mails. In these cars, railway mail clerks sort letters and packages on the road.

Freight trains begin and end their runs in freight yards. These yards are made up of groups or sets of tracks, connected by switches. There are receiving tracks for incoming trains, classification tracks on which cars are sorted out for other trains, and departure tracks where outgoing trains are made up. There are also storage tracks to hold cars, and "rip tracks," where the cars are repaired. There may be "house tracks" or "transfer tracks," where freight is loaded and unloaded at stations, and "team tracks," where drays or trucks are used in handling freight. There are also roundhouses, where locomotives come in for cleaning or light repairs.

In the classification yards, cars are sorted and distributed. A switch engine pushes the cars slowly to the top of an elevation, or "hump," between the receiving tracks and the classification tracks. There, the cars are uncoupled and allowed to run down the slope. An operator in a control tower checks the number of each car against his "switching list." He sets the switches so that the car goes to the right track. To slow down or stop the car, he presses a button or moves a lever which causes retarders in the tracks to "squeeze" the sides of the car wheels.

Electricity and compressed air operate yard devices from control towers. Pneumatic tubes speed messages and waybills in many freight yards. Loudspeakers, two-way radios, teletypewriters, and telephones carry information and orders designed to keep cars and trains moving on schedule.

On the road, modern science is making it possible to carry greater amounts of freight at higher speeds. Some late-type boxcars, for example, are built of aluminum and alloys which reduce the weight of each car by several tons.

Adjustable shelves and walls in some of the new cars prevent shifting and damage. Improved couplers, brakes, shock absorbers, and other devices allow freight cars to travel at higher speeds with greater safety.

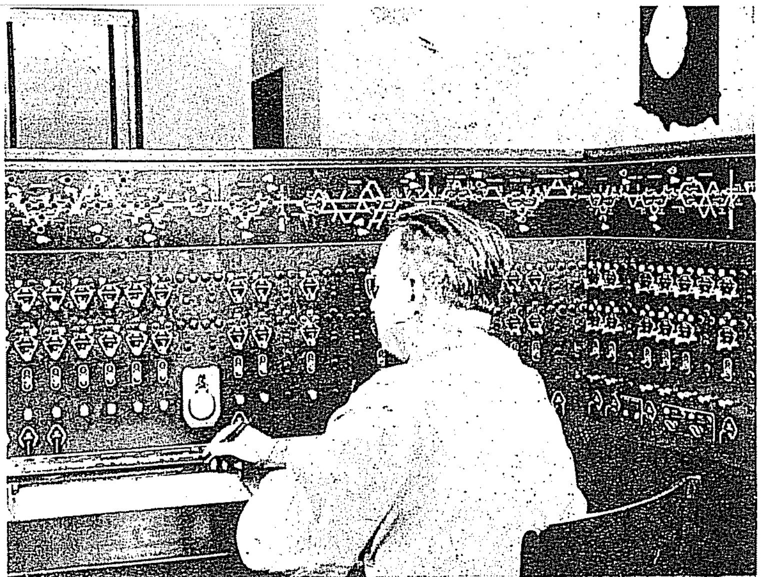
Steady improvements in equipment and the freight-handling system have increased freight service greatly since World War I. For example:

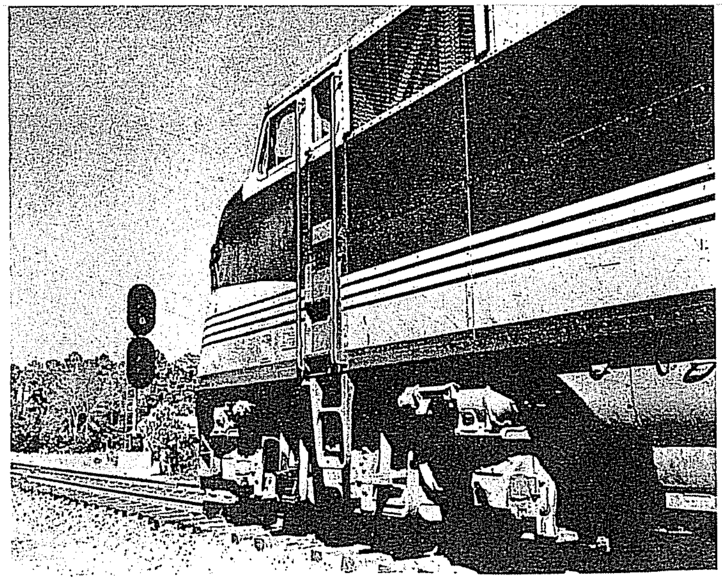
The transportation output of the average freight car per day has almost doubled.

The net freight load of the average train has been increased from 700 tons to nearly 1,300 tons.

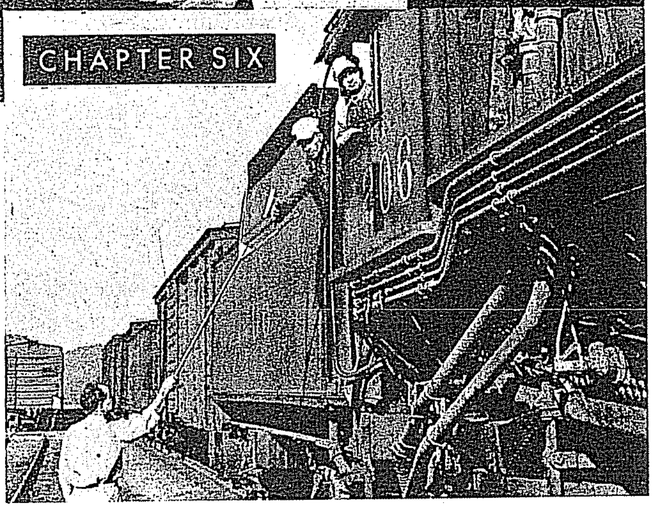
The average speed of freight trains has been increased by 77 per cent.

The transportation output of the average train, on the road, has been increased from about 7,300 ton-miles to nearly 23,000 ton-miles per hour. (A ton-mile is one ton of freight carried one mile.)





CHAPTER SIX



The operator of a Centralized Traffic Control machine (top left) can change signals and switches for trains many miles away (above). On other lines, orders may be "handed up" to the crew (left) by a station agent.

THE EYES AND EARS OF THE RAILROAD

Signals and Communications Speed Our Trains with Safety.

CENTRALIZED Traffic Control was something new to engineer Ernie Martin. This trip was his first through the CTC. The next 150 miles of track were controlled by an operator who could "see" the track on a board in front of him.

Ernie had seen the CTC machine. "Don't know how anyone could ever make a machine that would do all that one does," he had said. But he knew that CTC was supposed to save a lot of time. "We'll find out on this trip, for sure," he told his fireman.

Ernie was nursing the throttle of a hotshot—a fast freight train. Behind him stretched a mile-long train of "reefers" (refrigerator cars) filled with fruit and vegetables.

Ernie's powerful locomotive pounded along the single track. The miles went by quickly. Ernie thought about the stretch of track ahead.

"Somewhere up there," he said to himself, "Number Seven is really pouring it on. Joe Johnson likes to make up time on this stretch. I suppose I'd do the same if I had a passenger train like his. Well, we'll see where the CTC gives us a meet."

To a non-railroader, the picture of a 50-mile-an-hour freight train and a 75-mile-an-hour passenger train approaching each other on a single track might have been terrifying. But Ernie wasn't worried.

He watched the signal lights carefully, as he always did. "Yellow," called the fireman from the other side of the cab. But Ernie was already applying the brakes and easing back the throttle.

"This must be our meet coming up," called the fireman.

"Yep," said Ernie. He applied the air brakes until the train was down to 10 miles an hour. The target on the switch and the signal into the passing track showed clearly

The locomotive and the long train snaked their way into the passing track. The brakeman craned his neck to see the caboose. "We're in," he called.

"Okay," said Ernie. "Now, if that dispatcher is really workin' that machine, we can pull right on through here."

Three minutes later, while Ernie's train was still rolling, Number Seven roared past with a bleating honk from her horn. "By golly," said Ernie. "That CTC is gonna be all right.'

Railroads Are Safety Pioneers

From the very earliest days of railroading, various kinds of signals have been used to keep trains from running into each other. One early type was called a block-board. At each station a board, painted red, was put upon a high post. It was the station agent's duty to set the board for each train. When the board stood out straight, trains had to stop. At night a red lantern was hung on each end of the board.

Timetables next governed the movements of trains. At certain times, a train was supposed to pull onto a siding to let another train pass. If the second train was late, the first train simply waited —sometimes for hours.

Telegraphic train orders solved these problems and helped to make railroad travel safer. Then came the block signal system—first hand operated and then automatic. A block is a section of track with a signal at each end. By watching the signals, trainmen know whether or not another train is in the block.

Science Gives the Signals

The basis of today's block system is an electric current flowing through the rails. So long as all switches are closed, and no train or other obstruction is in the block, the signal shows "clear." When a train enters the block, its wheels and axles short-circuit the current. The signal changes to "stop." Usually, the signal circuits are arranged so that a "caution" signal shows when a train is in the *second* block ahead.

As the trains move along the tracks, changes in the electric circuits in the rails automatically cause the signals to change their positions or their colors. These positions and colors tell the engineer of an approaching train what's ahead of him, and what he should do.

The *semaphore* (pictured at right) is a *position signal* by day, but gives its messages by colored lights at night. The *position light signal* gives its messages by the direction of a line of three lights—vertical, horizontal, or slanting. *Color position signals* use different colored lights in different positions. In some systems, these signals are repeated in miniature inside the cab, right in front of the engineer. On some lines, automatic train control stops the train if the engineer does not obey a stop signal.

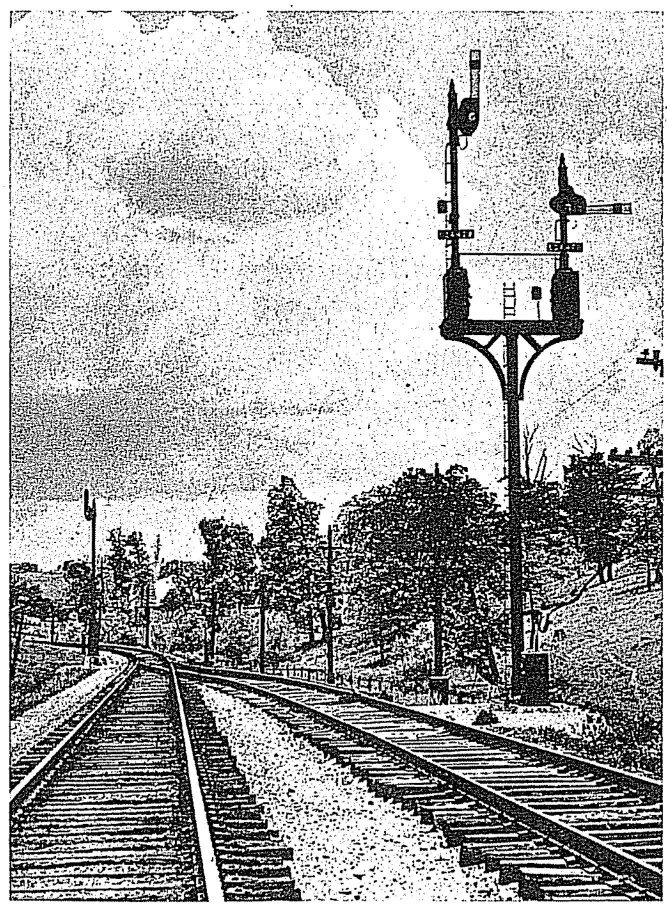
Horizontal position of the semaphore arm, or a red light, means "stop." *Diagonal* position, or a yellow light, means "caution." *Vertical* position, or a green light, means "clear—go ahead at authorized speed."

People Run the Machines

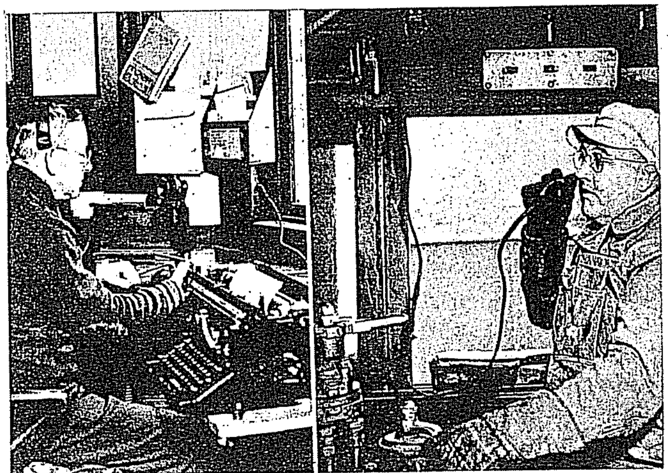
The dispatcher is the man responsible for the proper movement of the trains. He sits at a table in a central office with a large train sheet before him. On this sheet, he notes the position of every train operating over the line.

As the train leaves the station, he notes the time, the number of cars, the names of the crew, and the number of the locomotive. As the train passes each station, the time is telephoned to the dispatcher. Thus, he knows the location of every train.

In case of delays the dispatcher may make up special orders. These orders are telephoned or telegraphed to a station ahead of the train. The station



Railroads use semaphores, lights, and many other signals.



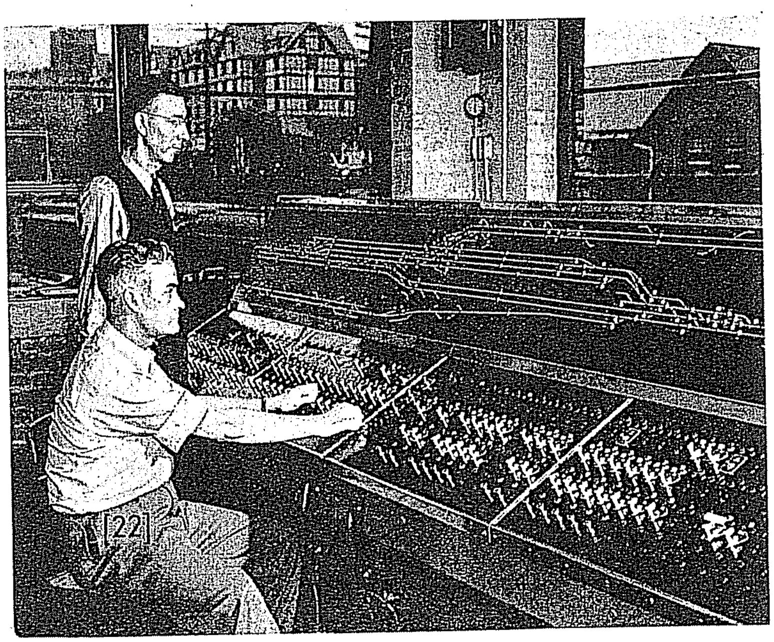
Engineers on some roads get messages by radiotelephone.

agent attaches copies of the orders to large hoops. As the train passes, he stands beside the track and "hands up" one hoop to the locomotive and another to the caboose. Members of the crew catch the hoops on their arms as the train goes by. Sometimes the hoops are placed one above the other on a metal frame called a "train order standard." Orders for the engine crew are on the upper hoop, and for the train crew on the hoop below.

CTC Is a Long Distance Traffic Cop

With Centralized Traffic Control, the operator of the machine has the control of a section of the line at his finger tips. Electric lights on his board tell him the position of each train. These lights are placed along a "map" of that part of the line. He controls both signals and switches. By turning levers and pressing a button, he may throw a switch and direct a train into a passing track sometimes as far as 300 miles away.

Operators in busy terminals control many switches.



Present-day CTC equipment is designed so th switches cannot be thrown one way and signals s another. Neither can signals to proceed be show for opposing or conflicting movements.

Centralized Traffic Control has many advantage It reduces costly delays. It saves many stops, mal ing it possible to increase the train load as well average train speeds. It makes close or non-stc train meetings possible. It increases the track c pacity, or volume of traffic.

The kinds of railroad signals and controls va because different railroads have differing kinds problems. On roads with light traffic, simpler sign systems are satisfactory. Thus, one railroad may u many kinds of signals on different parts of its line

Railroads Find New Uses for Electronics

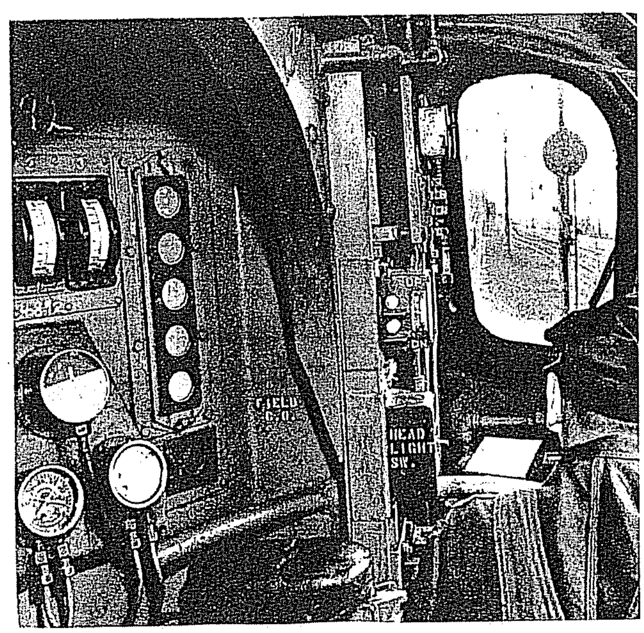
The science of electronics has also gone to wo for the railroads. With the radiotelephone, the en neer can talk to the conductor, or to station agen along the line.

In freight yards, radio helps to run switching a "hump" activities more efficiently. In harbors, rad gives the dispatcher better control of railway-ope ated tugboats and ferries. On some of these boa radar, too, is used. Radar permits the pilot to "se through fog.

New developments in wire communications all many different messages to be sent along the sa wire. These "multiple channel carrier systems" a used for telephone, telegraph, or teleprinter m sages. Loud-speakers are used widely in yards a stations, too. Small loud-speaker or inter-office s tems are used in many central offices.

The eyes and ears of the railroads are nev closed. They become better with each passing ye

On some lines, road signals also appear in the c



THE ROADWAY

Engineering, Research, and Modern Tools and Materials Make the Tracks Safe and Strong.

It isn't often that anyone can walk up to a river and say, "Move over. You're in my way!" Railroad track builders, however, will tackle anything—even this. And they have.

Railroad builders have sliced away hills and bored through mountains. They have tunneled under water and beneath cities. They have bridged rivers and lakes, and have even laid their tracks out over the sea. And if they can't bore under, or bridge over, they may even move a river itself to get their tracks built.

A big river-moving project was completed in the fall of 1947. On a busy four-track main line, the tracks had followed a sharp curve in the Mohawk River at the town of Little Falls, New York. For years, crack passenger and freight trains had been forced to cut down their top speeds to 45 miles an hour at this curve.

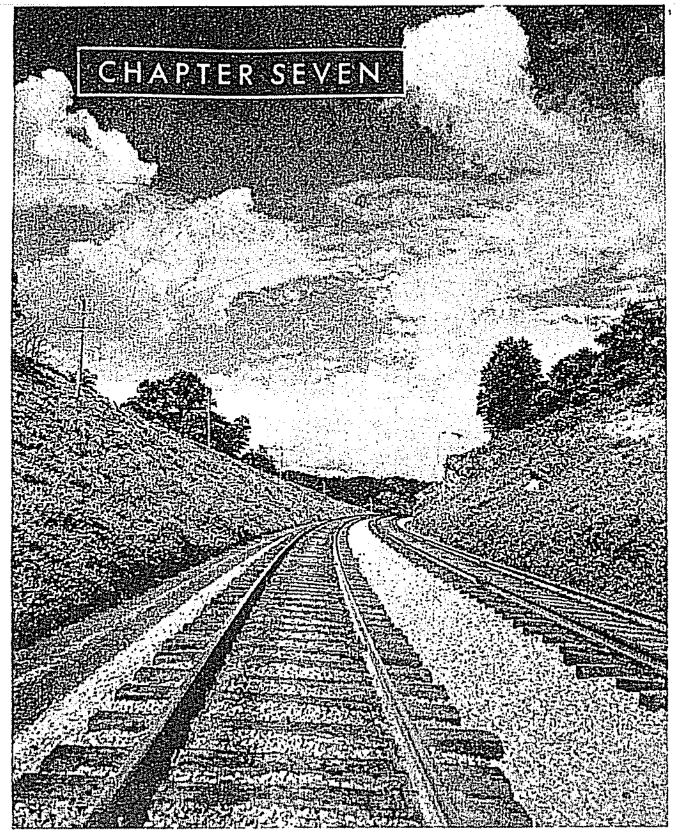
Finally, at the end of World War II, the track engineers went to work. They blasted a new channel for the river. The loose rock from the new channel was used to fill the old one. The engineers added more and more rock to this "fill" until they were 12 feet above the average water level. Then, with gravel, cinders, and more rock, they built an embankment 30 feet high.

When the engineers were through laying track, they had spent $2,500,000. But they had cut out a sharp curve. Trains can now run at regular speeds.

The Tracks Come First

In these days of shiny streamlined passenger trains and fast freights, we sometimes forget that the track comes first. But railroad men don't forget that fact. Take a ride along any stretch of railroad track. Sooner or later, you'll see crews of men working on the tracks and roadbed.

Railroad men call this work "maintenance of way." In most cases, all this work is done by "Roadway and Structures" departments of the railroad companies. Tracks and roadbeds, bridges, tunnels, docks and piers, and buildings are the responsibility of this department employing many specialists.



Tracks and roadbed are the basis of rail transportation.

Add up the more than 400,000 miles of track, the more than 190,000 bridges, more than 1,500 tunnels, 655 large railway shop plants and hundreds of small shops, 59,000 passenger stations, and 61,262 freight stations. You begin to get an idea of the great size of just one part of the railroad industry.

Always, however, the basis of railroad operation is the track and the roadbed beneath it. Millions of dollars are spent on those two items alone each year.

Early track rails were made of wood, capped with thin strips of iron. By 1845 or 1850, most rails were made entirely of iron. Steel rails were first made in the United States in 1865. By the late 1890's, steel had almost completely replaced iron.

Today's steel rail is the result of many years of scientific research and experience. To most people, the rail of today might appear to be the same as the rail of years ago. But it is heavier, longer, and many, many times stronger.

The first iron rails weighed about 50 pounds per yard. Today, the weight of steel rails ranges up to 155 pounds per yard. About 141,000 miles of main-line railroad are equipped with rail weighing 100 pounds or more per yard. The present standard length of rail is 39 feet. However, some railroads use rails 60 feet long in special locations. In fact, some railroads are now using "continuous rail."

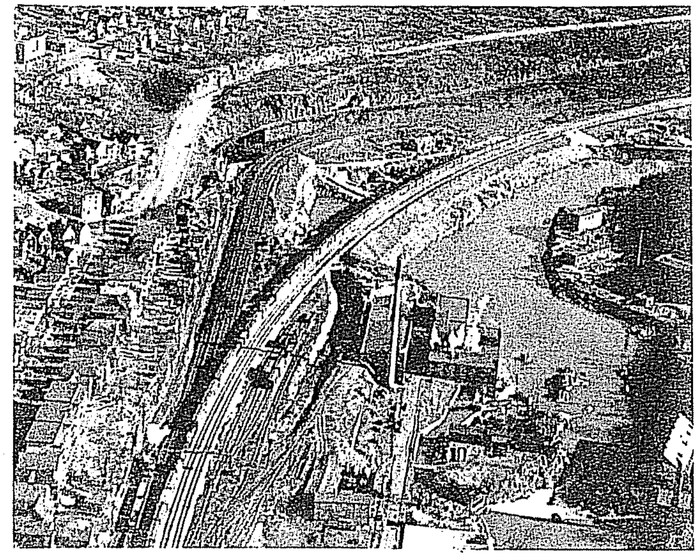
Continuous rail has its joints welded together into lengths sometimes of a mile or more. Continuous rail is expected to give a smoother track, longer service life, and lower cost of upkeep.

The Tracks Are Cushioned

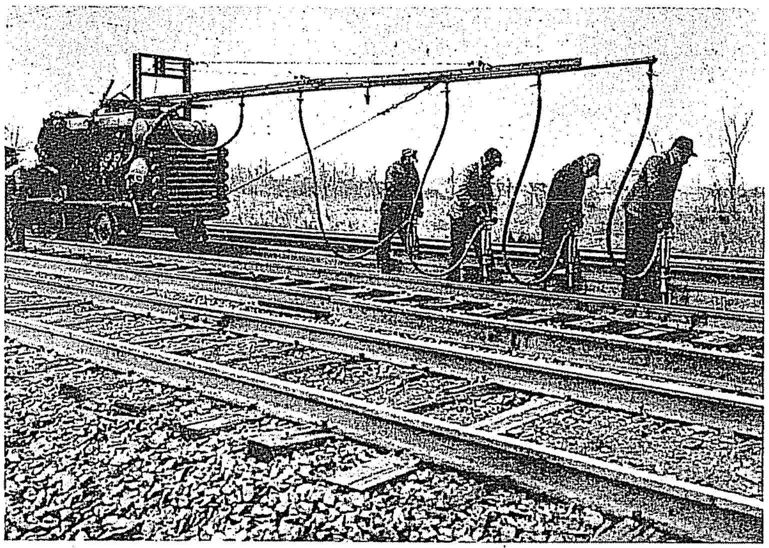
To make the train ride smoothly, the track must have a cushion under it. The rails are fastened with spikes to wooden crossties. Many materials have been tested for use as ties. Nothing better than wood, however, has ever been found.

Nearly a billion crossties are in use under railroad rails in the United States. The railroads put down about 35 million crossties each year during track repairs or rebuilding. About 95 per cent of these ties are treated with creosote, zinc chloride, or other chemicals to make them last longer. This treatment nearly trebles the life of the ties.

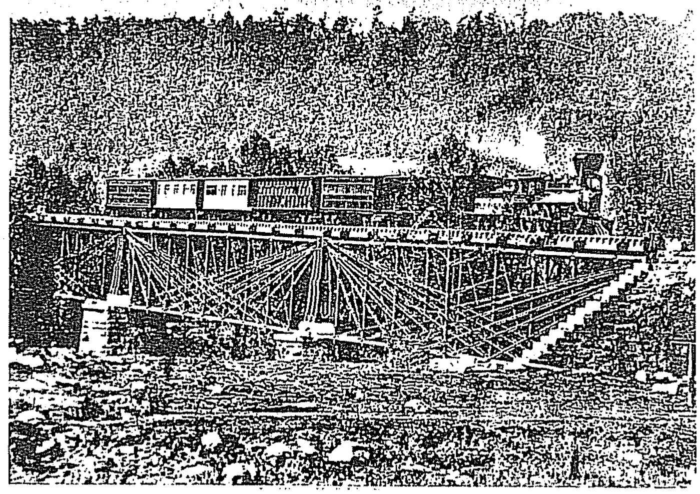
The ties are placed in crushed rock, gravel, or cinders, called "ballast." Ballast drains water from the ties and spreads the load evenly over the roadbed. It also holds the ties firmly in place and checks the growth of grass and weeds. Ballast is an important part of the cushion under the tracks.



Engineers moved a river to straighten a sharp curve.



These modern spike drivers are run by compressed air.



Early bridges were built of stone, wood, and some iron.

The Tracks Run Straight

Road engineers lay out the roadbed as straight as possible, of course. Curves are described, or expressed, in degrees, minutes, and seconds. The Mohawk River project, for example, reduced the curve there from nearly seven and one-half degrees to about one and one-half degrees.

Most railroad curves are from one degree, or less, to about three degrees. Curves in mountainous country range up to 10 or 11 degrees.

Sometimes, engineers must bore through hills and mountains to make their tracks run straight. The Cascade Tunnel, in the State of Washington, is 7.79 miles long. It is the longest tunnel in the Western Hemisphere. Boring of this tunnel was started from the eastern and western ends at the same time. When the construction crews met in the middle, they found that they were only a few inches out of line. This small error was easily corrected, of course.

Bridges help the railroads to run straight, too. Today, there is a railroad bridge for every two miles of railway track in the United States. These bridge structures range in size from small spans over streams to the Nation's longest—the Lucin Cut-off over Great Salt Lake in Utah. The Lucin Cut-off is over 12 miles long.

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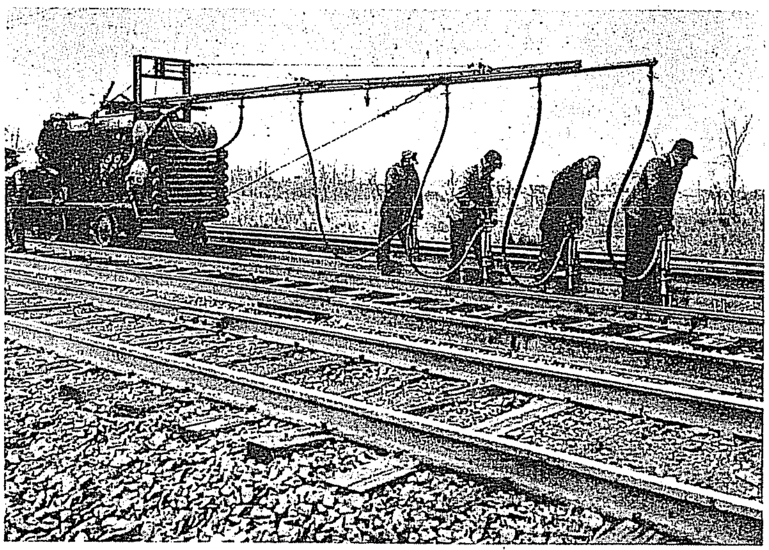

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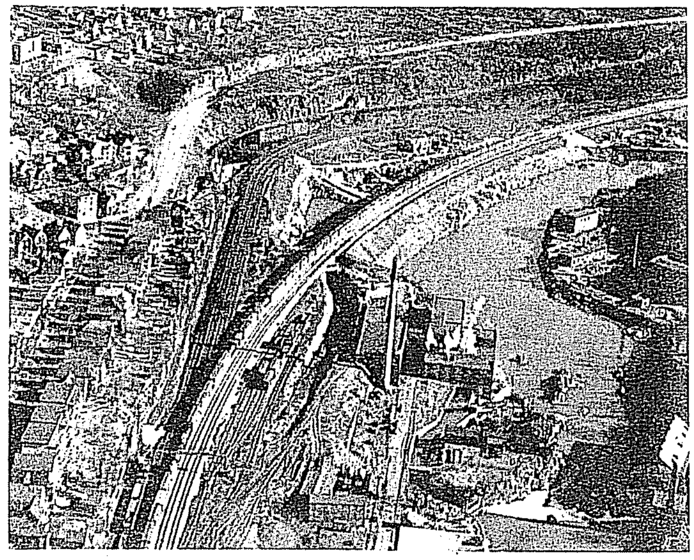

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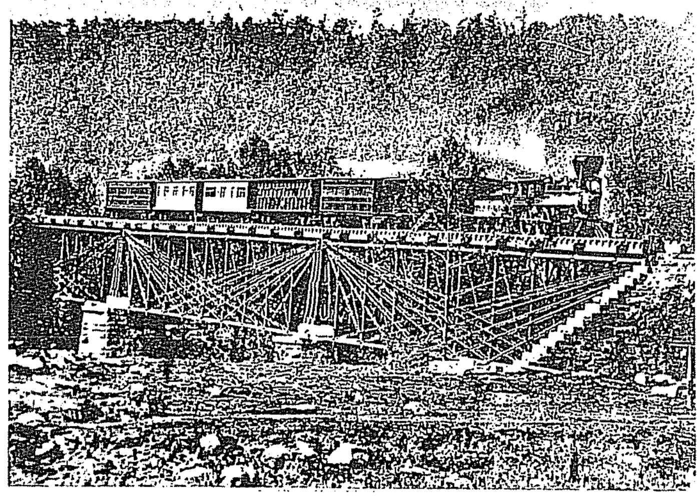

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