ENGINEERING

Railroad Rails Are Twisted, In Tests to Aid Safety

Over 700 Different Kinds of Rails Have Been Frozen, Bent and Punished Beyond Any Strains of Actual Service

By ROBERT D. POTTER

SPRAWLING through the nation in an intricate web of steel are the slim ribbons that carry the country's railroad transportation. Around a great metropolis like New York are hundreds of miles of track that are part of the total 400,000 miles of railroad track in the United States. But beyond the freight, storage and switching yards of any large city extend the mainlines with rails that are husky fellows, weighing from 131 to 152 pounds for every yard of their 39-foot length.

These are the rails in the "big time"; that stand the batter and pounding of the through fast freight, mail and passenger traffic. And each one bears its history stamped in its side; the year and month of its making, the steel mill that made it, the kind of steel used, the heat number and the ingot number.

After from 10 to 12 years of service on the mainline these rails, like baseball players, are no longer fit for the big leagues but they see years of added service on secondary lines, in yards and in spur tracks. But wherever they are, until finally returned to the steel mills for a rebirth as scrap steel, their identity goes with them. About the only thing lacking is a set of ferrous fingerprints.

Now, however, scientists are taking even rail fingerprints in a research to bring even greater safety to the world's safest form of fast transportation. The Association of American Railroads and the rail manufacturers have just tossed another $50,000 chip into the research pot on rail testing for the coming year. An additional $250,000 has already gone the same way into the laboratories of the University of Illinois where Prof. H. F. Moore directs and coordinates the experiments.

So far over 700 different kinds of rails have been studied and punished beyond all possible injury that could be attained in actual service. They have been cooled to frigid temperatures of a northern winter in the cold room of the Army's Wright Field at Dayton, Ohio. They have been bent and twisted in special machines in Professor Moore's laboratory. And for days and months a standard car wheel rolls back and forth over steel rail joints, carrying a load that can be as great as 75,000 pounds, to see what loads can cause fissures. Actually the rail goes to and fro beneath the wheel but the effect is the same.

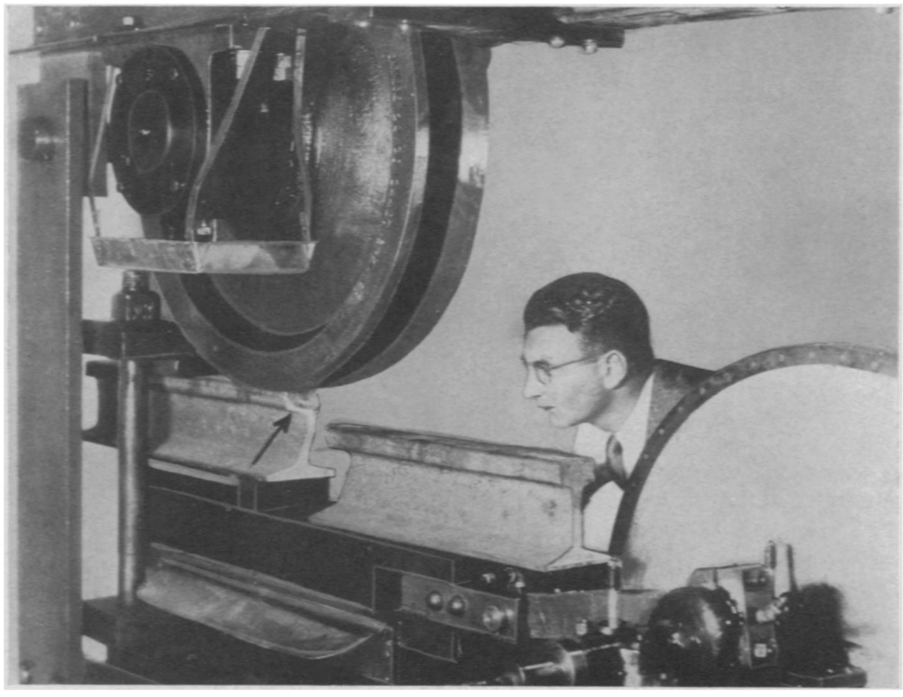
If a steel rail can have fingerprints, the so-called "shatter cracks" of the railroad technologist would take that designation. Some rails have these microscopically small cracks and some do not. One hundred thousand of them side-by-side would equal only one inch in length. Some are so small that they must be etched with acid to make them visible even in a microscope. Yet they must be watched and caught while young for they may develop into transverse fissures which, in a rail, may be compared to cancer in the human body.

Some years ago Elmer Sperry developed the odd-looking rail car which, with underslung electro-magnetic feelers, detected the fissures in an early stage and shot a dab of paint on them so that they could be spotted and removed. Ten thousand defective rails a year are found in this fashion.

But why not find out what causes the shatter cracks in the first place and prevent their formation at all? That is the question the railroads asked themselves and Professor Moore's job is to find out.

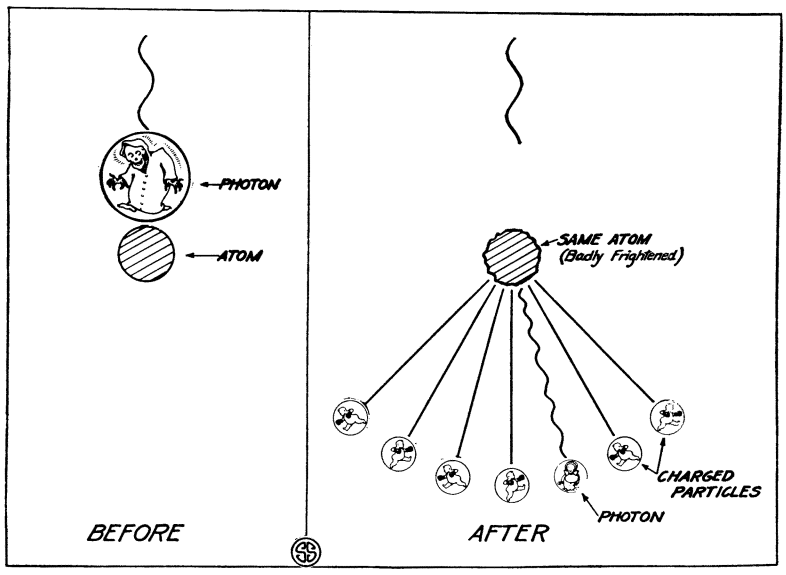
One way to cause the unseeable shatter cracks Professor Moore has found is to heat a piece of rail in hydrogen and then let it cool in open air. But it was also shown that by controlling the temperatures of the cooling rails the shatter cracks are prevented.

The rolled rails, at a temperature of from 2,000 to 2,100 degrees Fahrenheit, are allowed to cool rapidly to about 1000 degrees. Then they go into a "cooler box" and take from 20 to 30 hours to come down the rest of the way to room (*Turn to page* 61)



TESTING RAILS

This machine in the laboratories in the University of Illinois batters rails until cracks are artificially created to gain knowledge for increasing railroad safety. At the top may be seen the car wheel which rolls over the track in these tests.



ATOMS TROUBLED BY GHOSTS

PHYSICS

Photons Called the Ghosts Of the Physical Laboratory

GHOSTS have often been suspected of being at the bottom of strange happenings on this earth. But the main claim of the modern scientist is that he has dispensed with such supernatural explanations for earthly events. In the world of modern science a ghost would indeed be a lonely individual!

Nevertheless, some of those fundamental entities of which the material world is believed to be composed behave in a very, very strange way. Those "bundles of energy" called photons are perhaps the worst offenders. Even the physicist is somewhat at a loss when it comes to explaining the antics of a photon. And as far as the layman is concerned—well, perhaps a photon is as much like an old-fashioned ghost as it is like anything else.

Such seems to be—for purposes of popular explanation anyway—the view of Dr. W. F. G. Swann of the Bartol Research Foundation who, speaking informally at the Franklin Institute recently, said:

"A bullet is a kind of thing which can only be at one place at once and which strikes where it is. The electrons and protons (material particles) are like bullets. A ghost is a creepy kind of thing which can be everywhere always, which only strikes at one place at a time but which can strike anywhere." And this unpredictable, ghostly kind of behavior, Dr. Swann went on to say, is characteristic of a photon.

Carrying the analogy still further, the speaker went on to describe how these photon-ghosts terrify the inhabitants of the atomic world. Particularly potent in this respect are the high-powered ones which accompany the cosmic rays. A picture on this page is one which Dr. Swann used to illustrate his talk. It shows what happens when an especially horrendous photon-ghost meets up with an unsuspecting atom.

Except for receiving a severe "mathematical fright" the atom comes through the ordeal without serious harm. But the ghost himself may be so dreadfully annoyed that he actually materializes—comes to life—in the form of particles of matter. Newborn "particles with a punch" are formed which tear through the atmosphere, ripping the outer structure off other atoms.

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temperature. This slower method seems to give the hydrogen in the rail a better chance to escape.

Every time you hear the "click-click" of the wheels of a railroad train passing over the rail joints you are coming into audible contact with another problem being studied in Professor Moore's laboratory.

Special efforts have been made to develop methods for hardening rail ends so that the battering of the joints will be decreased. Just as parents put metal heel plates on the shoes of their active children to decrease wear, so too do the railroads try to find a means for reducing rail end batter.

Rail manufacturers are now equipped to harden the ends of rails by cooling them with an air blast immediately after rolling. They can also be hardened as they lie in place in the track. Some railroads build up battered ends by welding.

From time to time consideration has been given to very long rails, 100 feet in length, but the difficulty of manufacture and transportation have so far precluded their adoption.

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