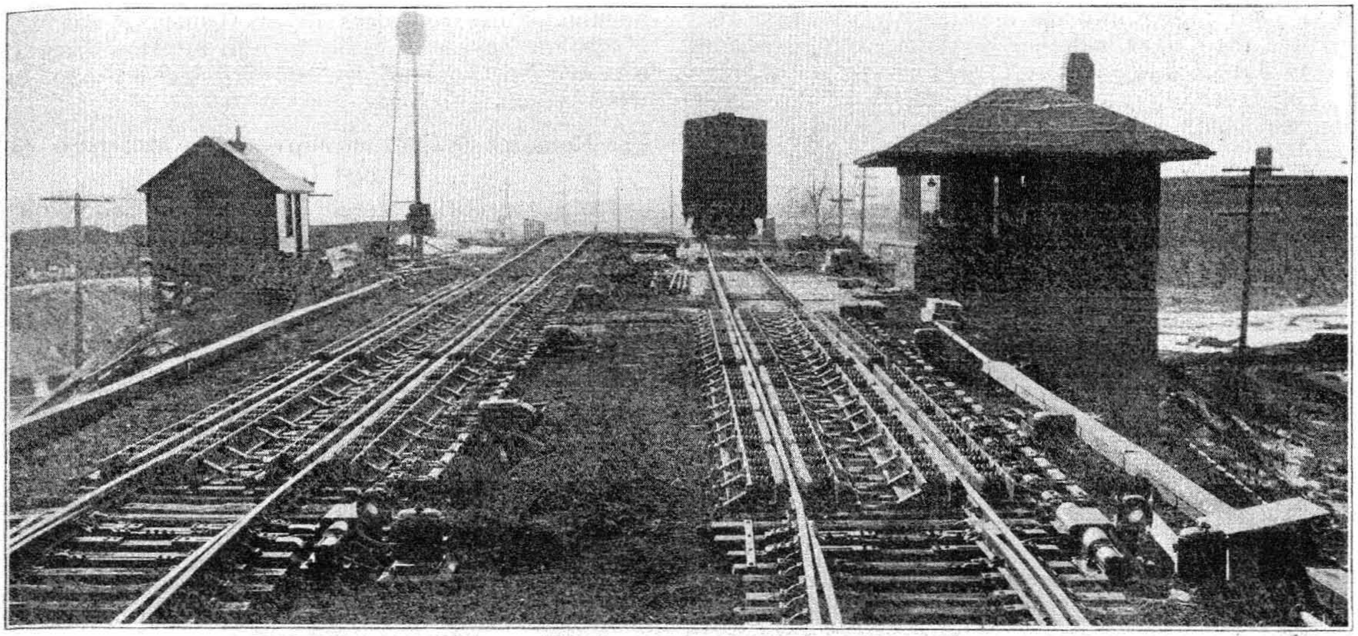


View Looking Up the Hump Showing the Retarders on the Two Tracks and the Signal at the Left

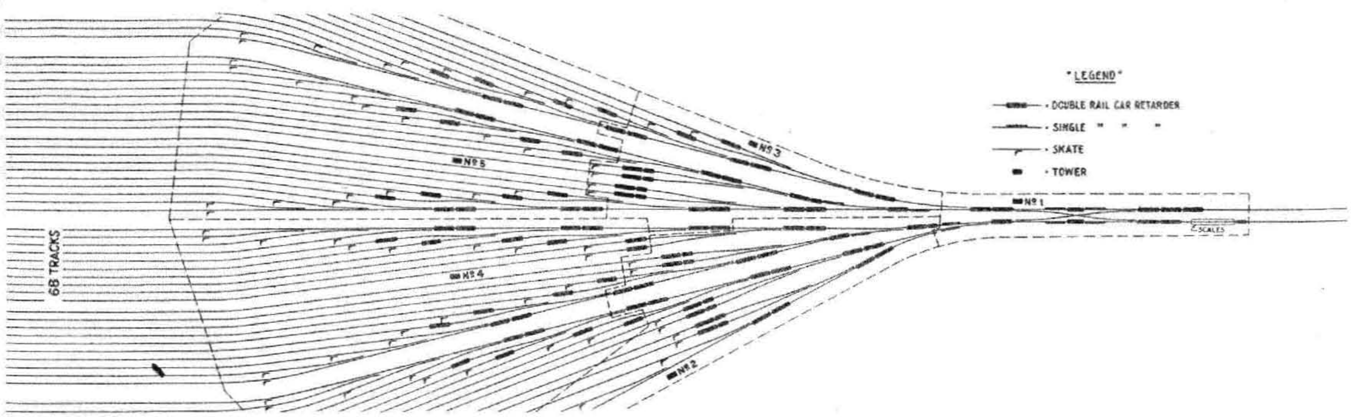
Electro-Pneumatic Car Retarders in Service on Illinois Central

Installation of Union Switch & Signal Co. Equipment on Northbound Classification Yard at Markham Largest in World

WHEN railroading was in its infancy, freight was simply handled from one point to another by being picked up by one freight train and set off by the same or another freight train. Then yards were built and the freight cars classified by flat switching, as is still done where the traffic density is low. Next, hump and gravity yards were built where gravity did the work formerly done by the switch engine. As an improved operating device, the power operated switch then came into use, where one operator took the place of a number of switchmen. And now we have another improved operating device, the car retarder, where a few operators take the place of a large number of car riders. The Illinois Central, following its usual policy of planning for the present and future needs of the Chicago Terminal district, built a complete classification yard at Hazelcrest, Ill., near Chicago. It was decided to call this yard "Markham Yard" in honor of C. H. Markham, president of the Illinois Central. It is the northbound portion of this yard that is the particular concern of this article.

General Layout and Capacity of Yard

The northbound Markham Yard was laid out on what might be called the tandem principle of operation, that is, the movement of a car through the yard is in one direction only—north. The yard is made up of a receiving yard, classification yard and departure yard. The road freight locomotive delivers its train on one of the tracks of the receiving yard. The hump engine then pushes this train over the hump and scales at which time the train is broken up and classified. This movement is controlled by signal indication. From the classification yard the cars are pulled



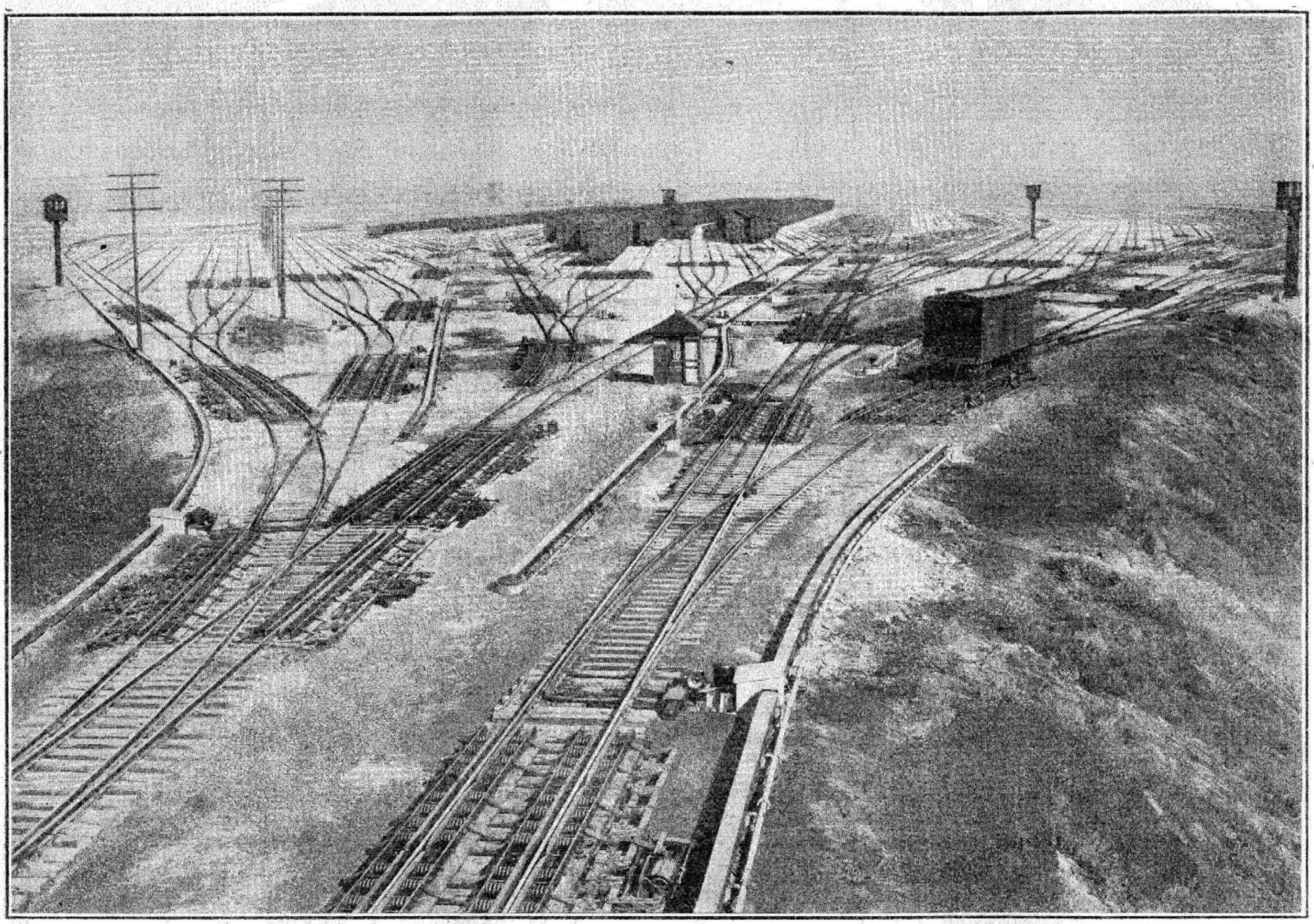
Track Layout of the Northbound Classification Yard Showing the Location of the Control Towers, Retarders and Skates by a yard engine into the departure yard where they receive their final make-up as trains, are tested, and taken out of this yard by a road freight locomotive.

The receiving yard is composed of 12 tracks, the longest holding 110 cars, the total capacity of this yard being 1,040 cars. The classification yard consists of 79 tracks, 60 of which are being used for classification. The longest track has a capacity of 40 cars, and the entire classification yard of 2,570 cars. The departure yard consists of 10 tracks, with a total capacity of 800 cars, each track holding 80 cars.

Plate fulcrum scales of the latest type, including an automatic recording device, are provided at the hump. The height of the hump may be varied by means of a five-section hydraulically operated mechanical hump, so that compensation is provided for varying weather conditions. Markham Yard is lighted by batteries of flood lights placed on steel towers from 90 ft. to 120 ft. high, there being 10 of these towers. The general result is such that night is no handicap to operation.

At the time this yard was decided upon, the most modern practice for classification yards was power operated switches, controlled from one tower for the whole yard. Accordingly, the necessary apparatus was ordered, consisting of electro-pneumatically operated switches and the usual push-button machine, air lines, etc., associated with such an installation.

Prior to the completion of the classification yard, however, George Hannauer, vice-president of the Indiana Harbor Belt, had most successfully demonstrated the advantages and practicability of the electro-pneumatic car retarders in his Gibson Yard.* As Markham Yard was to be modern in every respect it was decided to install car retarders and arrangements were made accordingly.



General View of Northbound Classification Yard Looking North Down the Hump, Four Control Towers Being Shown

Car Retarder System on Northbound Markham Yard Largest In World

The car retarder system includes the retarders themselves, the power operated switches, power operated skate placing mechanisms, control machines, located in five elevated towers located at various points in the yard, power supply, and compressed air.

The number of retarders, their locations, and the grades that should be provided were worked out by the Illinois Central engineers. The grades are such that a car, under most free running conditions, will not accelerate after leaving the last retarder. The apparatus was furnished by the Union Switch & Signal Company and installed by them and the signal department of the Illinois Central.

The electro-pneumatic retarder system at this Northbound Markham Yard consists of 121 car retarder units containing 7,072 rail ft. of retarders, 69 power operated switches, and 65 power operated skates, making this the largest car retarder installation in the world.

Control Machine of New and Unique Design

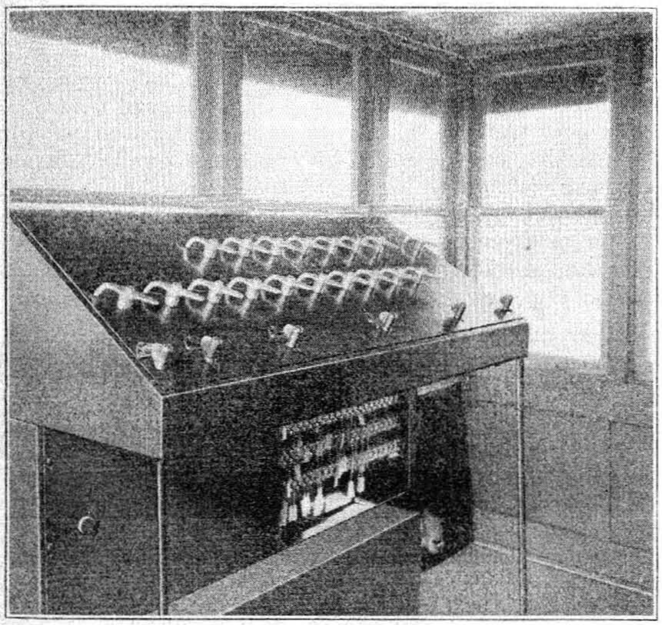
The electro-pneumatic car retarder system control machine controls all the retarders, switches, and skates within the control limits of its particular tower. It is so constructed that the operator may either stand or sit before it, and still have an unimpaired view of all

* For description of car retarder system on Indiana Harbor Belt see *Railway Signaling* for July, 1925.

cars moving down the yard. The top row of controls (a switch somewhat like a telephone switch) governs the skate placing mechanisms. The two middle rows of controls govern the retarders. These controls have six positions—off, exhaust, and one for each of the four pressures used to obtain various degrees of retardation. The control unit is so arranged that each of these positions is positive.

The bottom row of controllers governs the track switches. These controls are a two-position switch, one position for switch normal, and one for switch reversed. A track diagram is mounted in each tower which shows not only the track arrangement controlled by that tower, but also the location of the retarders, switches and skates, showing the normal position of the switches.

As each retarder, switch and skate bears a number, both on the diagram and operating machine, it is easy for the operator to associate his controls with the units on the ground, and thus operate the proper apparatus.



Control Board in Tower No. 1 Near the Hump

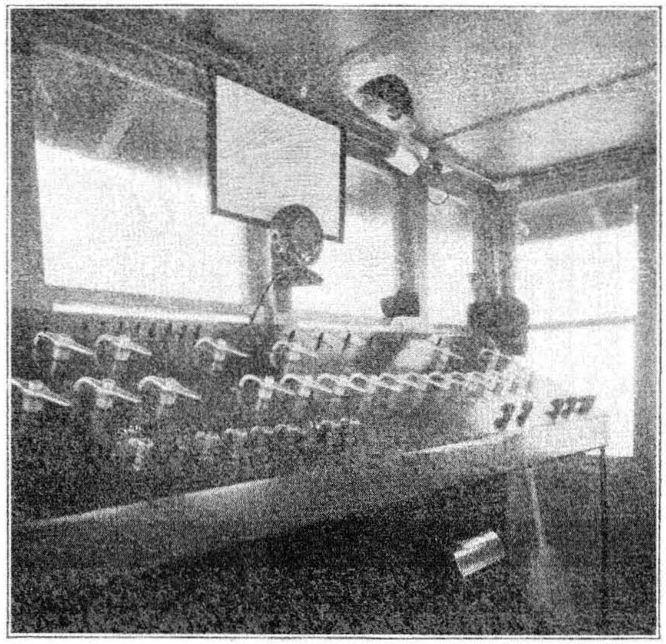
Removable panels permit of easy access to the control units, and other removable panels do the same for the terminal board located beneath the machine.

The control machine in the tower at the foot of the hump is the same as those in the other four towers, but has some additional features. Incorporated in this machine is the master signal controller already referred to and indication lights that repeat the indication of the hump and trimmer signals. A switch—the same as used for controlling the skates—controls a Strombose whistle, used in emergencies, and another switch—the same as used to control the switches—controls the lights in the pot signals.

Construction and Operation of the Car Retarder

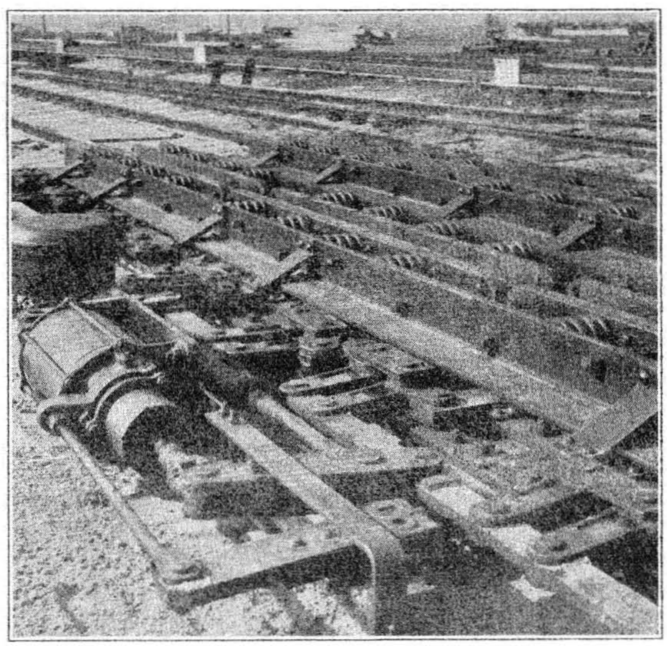
The car retarder itself is, in effect, a car brake, and, at its location, performs the same functions. It is an arrangement of brake shoes located along and parallel to the track rails, which shoes are forced against the inside and outside faces of the car wheels by compressed air acting on a piston, which, through levers, transmits the force to the brake shoes. The effect on the car is the same as if either the hand brake or the air brake had been applied; that is, the retarder, as its name indicates, reduces the speed of the car.

The cylinder and leverage arrangement for operating the retarders is simply the "live lever," "dead lever" arrangement of the foundation brake gear of a



Control Board in Tower No. 4. Notice the Switches for Controlling Skate Machines at the Top of the Panel

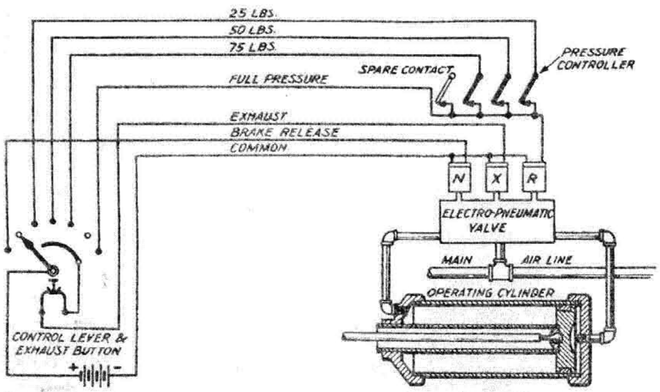
freight car, and by means of which the forces of reaction against the cylinder are completely balanced, and there is no tendency of the cylinder to move. Release is accomplished pneumatically (instead of by a spring as in the car brake cylinder) but, due to the trunk piston construction used, requires only half the



Car Retarder Layout Showing the Construction of the Lever Mechanism and Operating Cylinder

amount of air that is required for application.

The admission and release of the air in the retarder cylinder is controlled electrically, the circuits being shown in the diagram. At Markham Yard four retarding pressures are used, 25 lb., 50 lb., 75 lb., and full pressure, about 90 lb. The moving of the control lever in the operating machine to any one of the four operating pressure positions completes the control circuit, thus energizing the admission magnet *R*, which operates a valve that establishes communication between the air supply and the operating cylinder, thus forcing its piston out and the retarder shoes then exert pressure against the car wheels. This pressure in the operating cylinder builds up almost instantaneously until it reaches the pressure corresponding to the contact made by the



Control Circuits for the Car Retarder Mechanism

control lever when the pressure controller contact opens, thus breaking the circuit and de-energizing the admission magnet *R*, whose valve then closes, cutting off the supply of air to the cylinder.

If the operator finds that he is not using sufficient pressure, he simply moves the control lever to the contact corresponding to a higher pressure, when the above operation is immediately repeated, except that the pressure builds up from the pressure formerly obtained, instead of from zero. It is to be noted that this change in pressure, and hence change in retardation effect, is obtained without necessity of further movement of the brake shoes.

The movement of the control lever that resulted in the admission magnet *R* being energized, also energized exhaust magnet *X*. This, through its valves, closes communication between the operating cylinder and atmosphere, and the circuit is so arranged that whenever the control lever is in position to establish pressure in the operating cylinder the exhaust magnet *X* is energized, thus assuring no loss of pressure.

If the operator finds that he is using too much pressure, he can entirely release the apparatus by moving the control lever entirely to the left, which de-energizes the exhaust magnet, thus re-establishing communication between the operating cylinder and atmosphere and exhausting the air from the operating cylinder, and also energizes release magnet *N*, which, through its valve, establishes communication between the air supply and the release side of the piston, forcing the piston back, and bringing the retarder shoes to the open position.

Or, if the operator does not desire to release the apparatus entirely, he can push the button in the control lever which de-energizes the control magnet and exhausts the air from the operating cylinder, but only for as long a period as he holds the exhaust button open. When he releases the exhaust button, the air immediately builds up again in the operating cylinder to the pressure corresponding to the contact made by the control lever. In the normal position—retarder open—all magnets are de-energized.

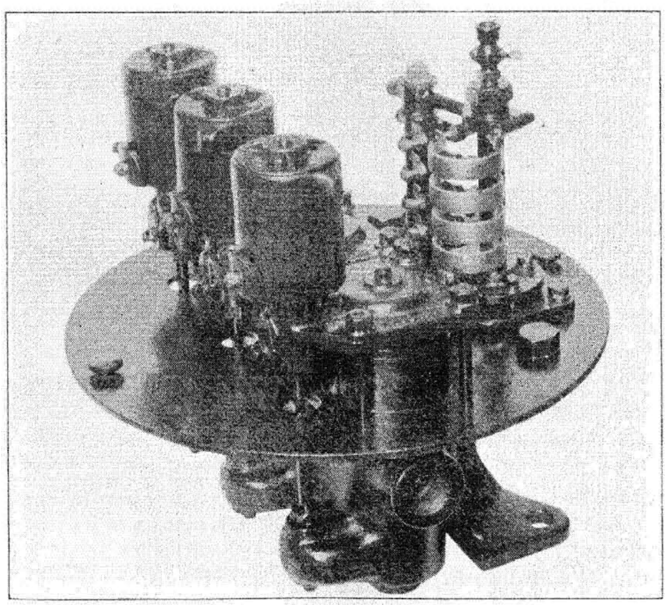
The pressure controller, by which the air supply to the operating cylinder is cut off when the desired pressure has been obtained, is shown in one of the views. It is an arrangement of contacts mounted on air gage springs, one spring for each pressure required. These springs are always subjected to operating cylinder pressure. As the pressure in the operating cylinder, and hence in the springs, increases, the springs tend to straighten out. The contacts are adjustable, so it is simply a matter of setting the contacts to give the pressure desired.

The switches leading to the various classification tracks are operated by electro-pneumatic mechanisms that are equipped with the Style C cut-off valve, which gives the maximum economy of air consumption consistent with proper and positive operation.

Skate Machines Prevent Cars From Running Away

On each classification track, about 50 ft. beyond the last retarder, a skate placing mechanism is installed. A skate, or skid, as is well known, is merely a device for stopping a car in an emergency. It is a casting, or forging, which is placed on the rail in front of a car. The car runs onto the skate and the skate then slides along the rail, but sliding friction being so much greater than rolling friction, the car soon comes to rest.

The skate placing mechanism is a simple arrangement of levers by which the movement of a piston in a small cylinder places the skate on the rail when the piston moves out and removes it from the rail when the piston goes back. The admission and release of air for this cylinder are controlled by one magnet, which, when energized, admits air to the cylinder, forcing its piston out and thus placing the skate on the rail. When this magnet is de-energized, the cylinder is open to atmosphere and a spring forces the piston back. In spite of the fact that this mechanism will remove the skate from



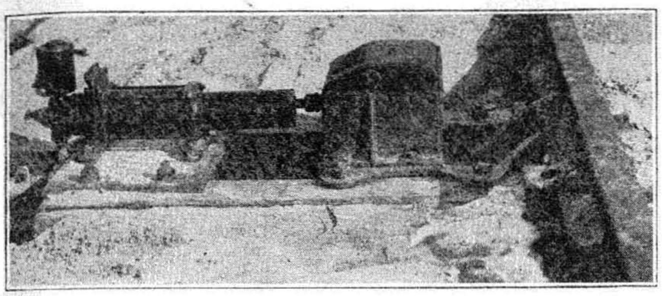
Pressure Regulator and Control Valves of a Car Retarder Mechanism

the rail, it is so constructed that the skate is perfectly free to move out of the mechanism without damage.

Signals Direct Train Movements

Movement from the receiving yard over the hump is controlled by signal indication. At approximately the crest of the hump a three-light color-light signal is located, controlled from a special controller located at the yardmaster's office at the crest of the hump. This signal gives four indications—green, hump fast; yellow, hump slow; red, stop; and red and yellow, back up. There is another controller—a so-called master controller—located in the retarder tower at the foot of the hump, that must be in the "clear" position for the signal to give any indication other than "stop." Repeater signals are located in the receiving yard so that the crew of the hump engine can always observe the signal indication.

Mounted on the same mast as the signal at the hump, is a two-light color-light signal facing the classification yard. This signal displays two indications—green, trim; and red, stop; and governs such engines as may be



Skate Placing Mechanism With Skate Off the Rail

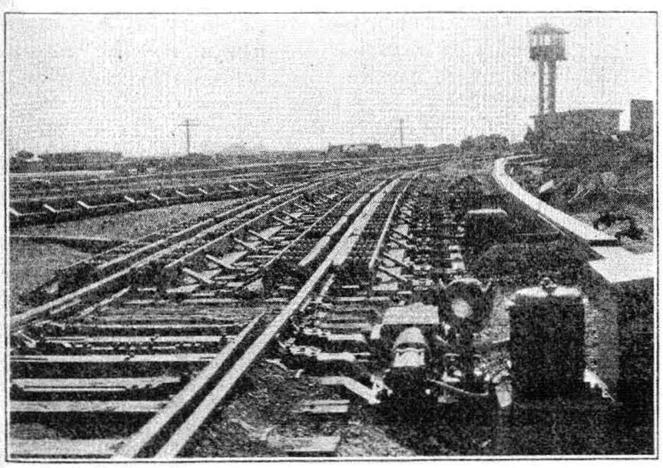
working in the yard and desire to go south over the hump. It is also hooked up with the master controller, its regular control being at the yardmaster's office in conjunction with that of the hump signal.

Air Compressors and Battery Chargers

The power house contains the compressors for obtaining the compressed air, the battery for providing the electrical energy for control of the operation of the retarders, switches and skates, battery charging outfit with necessary meters, etc. The two 675 cu. ft. capacity air compressors are motor driven from 440-volt, three-phase, 60-cycle current supply, and are equipped with full automatic pressure control so that they float on the line, and automatically start and stop, depending on the pressure in the line. One compressor will take care of all demands of the entire retarder system, the second being in reserve.

Operation of the Yard

The operation of the retarder system is simple. Switching lists are prepared in the usual manner from the bills handed in by the conductor when his train pulls into the

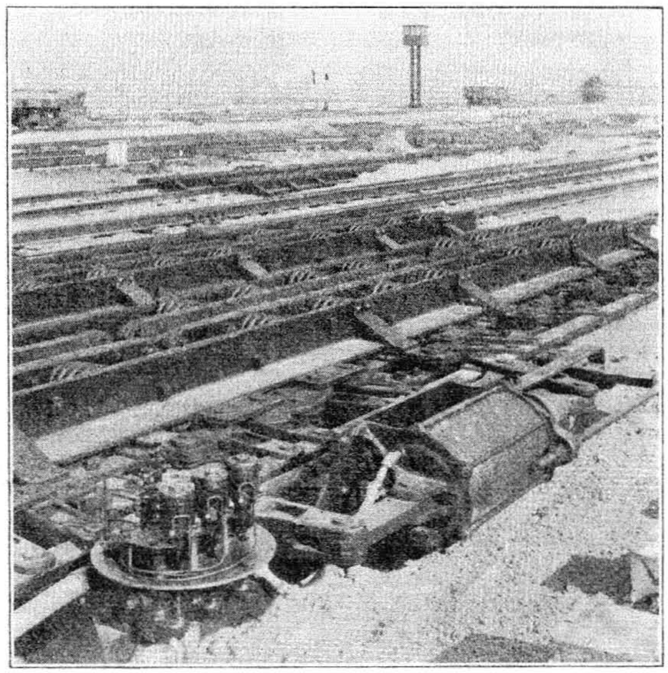


Electro-Pneumatic Switch Machine

receiving yard. A copy is furnished to the yardmaster at the hump, and to the retarder operators who are located in the five operating towers. This switching list shows the car initials and numbers—in the order in which they will be pushed over the hump—and the track to which they should go. This list also shows whether the car is empty or loaded, and, if loaded, either the approximate weight or the kind of load, such as sand, brick, lumber, coal, etc. With this list in front of him, it is an easy matter for the operator to direct each car into its proper track, and by means of the retarders, to control its speed so that it couples to the cars already on that track at just the proper speed—that is, a speed to insure the coupling being made, but a speed not great enough to cause damage to either car or lading.

Loud speakers and microphones are located in each tower and at the yardmaster's office, so that changes to be made in the switching list due to bad order cars, changes in destination, etc., may be communicated promptly. By means of these loud speakers, any unusual condition can also be immediately communicated to such towers as may be concerned.

Northbound Markham Yard was opened officially on March 8, 1926, and is working two tricks every day.



Detailed View of a Retarder Valve and Pressure Regulator

The anticipated business can be easily handled in two tricks as the capacity of the system is about 1,200 cars per trick, with a possible maximum capacity of about 1,600 cars per trick.

Locomotive Enginemen in Great Britain run 138,960,000 miles, on the average, to each error causing a collision. This is the estimate made by W. J. Thorrowgood, signal superintendent of the Southern Railway, in a paper read by him before the Institute of Locomotive Engineers on February 26. Calculating on the records of the year 1924, he finds that there were three collisions due to enginemen passing signals set against them or one to every 12,727 enginemen in service. He adds eight other collisions which possibly may have been chargeable to the engineman's negligence and still arrives at the remarkably small percentage previously noted. He assumes that each engineman travels 130 miles a day for 326 days in the year. This high degree of efficiency, says Mr. Thorrowgood, leads to the conclusion that to effect any further degree of safety, we must have, "a perfect system of automatic train control." With the multiplicity of apparatus, liable to accidents, which would be required for automatic control, the number of failures, due to additional apparatus, might easily decrease instead of increase the factor of safety.