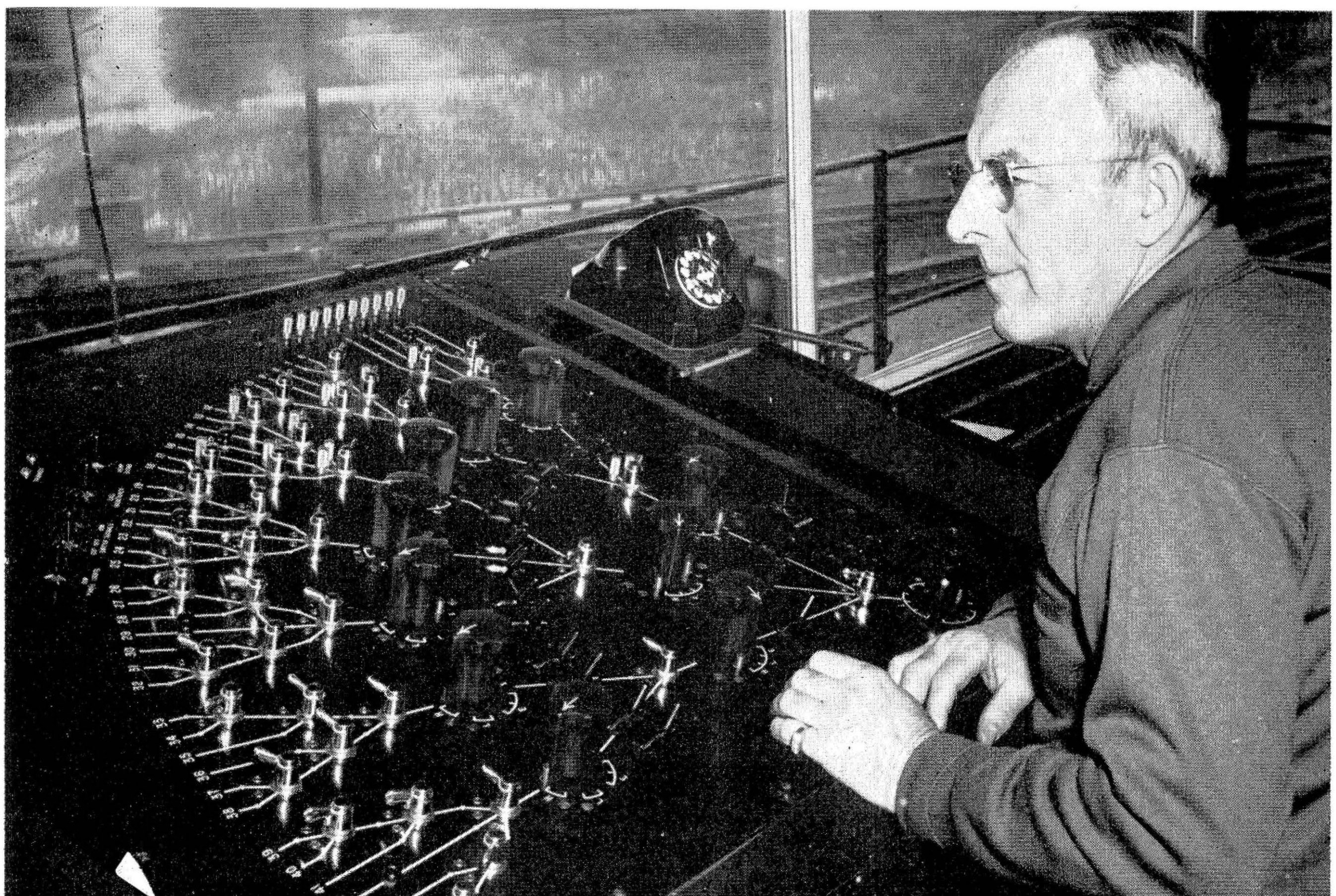
I. C. Rebuilds Classification Yard

And Installs New System of Control

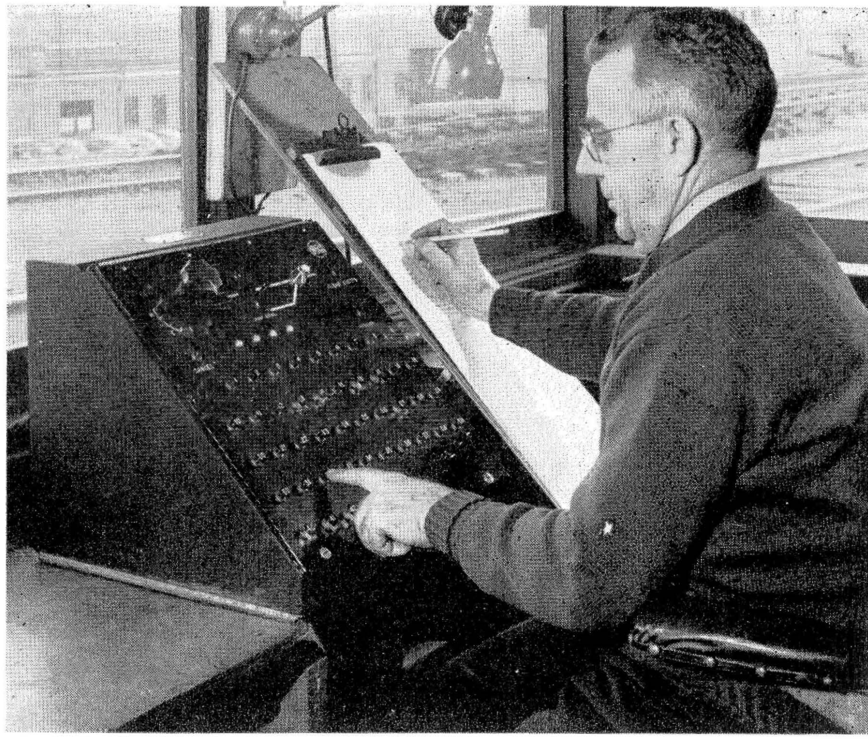
The control of switches is automatic after being initiated by push-button in panel at the crest of the hump, and all of the retarders are controlled by one man in a tower near main lead

A NEW system of control for power switches and retarders has been installed by the Illinois Central in its southbound classification yard at Markham Yards, located 20 mi. south of the passenger station at Twelfth Street in Chicago. This southbound yard, as well as the northbound yard nearby, were built in 1926, and at that time they were the first yards to be equipped with car retarders of commercial manufacture. Original installations were based on the ladder principle, with retarders down the hump and the throat leads, as well as on the upper end of each classification track. The southbound yard with its 43 classification tracks, 43 power switches, and 72 retarders was controlled from four towers each of which handled the retarders and switches in their corresponding areas. Within a few years after the original yards at Markham were placed in service, a new group arrangement of tracks was developed for use in yards being installed on other roads, the object of which was to reduce the number of retarders, because one retarder on the lead to each group serves to apply final retardation to cars routed to all of the tracks in that group.

Having rendered 23 years service, the retarders, switch machines, control machines and rail in the Illinois Central southbound yard were due for replacement. A decision was made that the replacement program should include a change from the old ladder-track layout to the more



The man in the tower controls the retarders in the entire yard modern grouping of tracks, as well as a change in grades. About that time — early in 1949 — the General Railway Signal Company, which furnished the switch machines and retarders installed in the southbound yard in 1926, announced the development of a new system of control, which was adopted for installation as a part of the improvements. The Illinois Central has the distinction of being the first road to place such a system in service. Starting in June, 1949, the change-over to the new track layout, new grades, new retarders with new system of control for power switch, has been gradually made under traffic. As of June 1, 1950, the new system was in service on 35 of the total of 45 tracks. The same system is being installed by the Canadian Pacific in its new yard at Montreal, which is scheduled to go in service in July.



At the hump a button is pushed to control switch leading to each yard track

Fewer Retarders

The yard as installed in 1926, had 78 retarders totaling 5,022 rail feet, 43 power skate machines, and four control machines in four towers. In the rearrangement, two more yard tracks were added making a total of 45 tracks, which are arranged in groups, one with five tracks, two with six, and four with seven tracks each. In the new improved yard arrangement, there are 45 power switches, 21 retarders with a total of 1,683 rail-feet of retardation, as compared with 5,022 rail-feet of retardation previously in service with two less tracks.

In the previous layout there was a power-operated skate at the lower end of each of the 43 yard tracks. These were eliminated. Also in the old yard there were two tracks up to the crest and down toward the yard so that, on either track, cars could be pushed over the hump to be classified. A portion of one of these tracks was removed. Now all cars are pushed over the crest on the one track which is equipped with a track scale. The second track with its power switch is used to route a locomotive around the scale. This switch is controlled manually from the hump office.

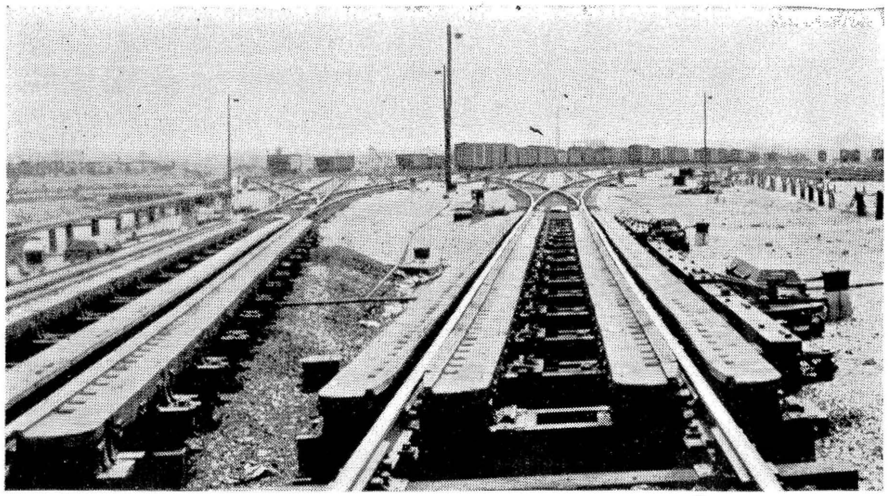
As part of the change-over to track groups, the grades down the incline and through the main leads were revised to conform with present-day practices for use with retarders as applied to this track arrangement. These grades are indicated on the plan herewith. One change was to make the grade steeper down the incline as far as the intermediate retarder, thereby increasing the rate of acceleration. The objective of this is to increase the running distance between cars or cuts of cars.

In order to minimize the length of track taken up by turnouts, lap switch layouts were used as required. In the previous yard, no track circuits were in service to prevent the operation of a switch under a car which would cause a derailment. Such accidents are prevented by detector locking, controlled by track circuits, as have been installed in practically all yards equipped with power switches during the past 20 years. Accordingly, track circuits and electric locking were incorporated in the new installation at the Illinois Central southbound yard. The old retarders, which were of the electric type, were worn beyond repair, and were, therefore, discarded. The 21 new retarders are also of the electric type of a modern design. Some of the switch machines in the new yard are of a new high-speed type. These are used where the track circuit in advance of the switch is short. All switch machines are trailable. Most of the old switch machines were rebuilt and installed in the new yard.

One Tower In Place of Four

The four old control towers were removed and one new brick control tower was constructed along the east side of the main yard lead at a location indicated on the plan. The wiring distribution for power and control circuits, as well as the control system, are all new.

With the old arrangement the men in the four towers each controlled not only the retarders, but also the switches in an assigned area of the yard. One of the features of the new system, as installed by the Illinois Central, is that the switches are normally controlled automatically after the control for the route for each car or cut of cars has been initiated by operation of a corresponding button. These push-buttons —one for each of the 45 classification tracks—are on a panel in a small office at the crest of the hump. As a car or cut of cars approaches the crest of the hump and is being cut off, a man at the hump pushes the button which is numbered for the track to which this cut is to go, as shown on the switch list. For the first car of a "train", as soon as the button is pushed, a control goes to the first switch in the route to position it as required. When the car or cut of cars enters the detector track circuit for that switch, controls are then automatically advanced to the next switch in its route. As each succeeding car or cut of cars is pushed up to the crest of the hump, the operator pushes the button numbered for the track to which it is destined. Controls for switches are set up in the same manner as for the preceding car. If the operator at the crest sees that he has pushed the wrong button for a car or cut



This retarder serves a group of six tracks

lamp immediately ahead of the car. During the time that a car is occupying the track circuit through a switch, a red lamp is lighted in the symbol representing the switch. Thus on his panel, the towerman can see the routes lined and the locations of cars.

On this control panel each of the 10 retarder locations is represented by a raised black knob which can be rotated, as indicated by a dial, to control the corresponding retarders to the open position or to any of seven closed positions each giving an increased degree of retardation. The switch list shows whether cars are empty or loaded and if loaded, the lading, so that the towerman has a fair estimate of the retardation required, and he rotates the dial to set up a retarder before a car approaches it. As the car passes into the retarder, he watches until the speed is reduced as required at that location, then he can quickly release each retarder section by throwing its corresponding key-type lever. These levers are in line with the "track" and in "approach" to the corresponding knob controllers. When he replaces this key lever to its normal position, the retarder is operated to the position called for by the setting of its knob controller. Thus that retarder is set for the next car, or the setting can be changed depending on the weight and speed of the next approaching car.

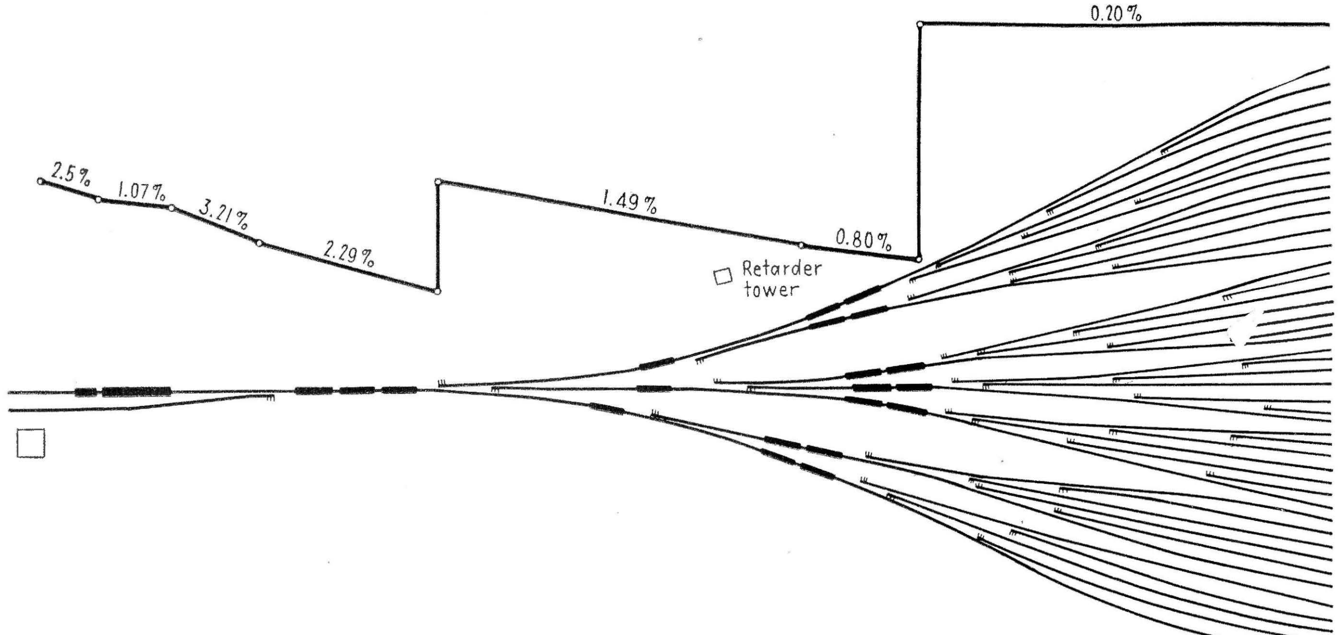
Retarders serve two purposes: (1) to retard a car or cut of cars as may be required to allow the cars to enter their respective classification tracks at a safe bumping speed of roughly about 4 to 6 m.p.h.; (2) to

approaching the crest, he can cancel controls by pushing a "cancel" button. Thus the operations of switches to route cars from the hump to their classification tracks are normally controlled by this automatic system.

Between the crest of the hump and the track scale there is a short retarder that is used when necessary to hold a car off the scale or reduce its speed when going onto the scale. This retarder is used also to hold slack as an aid in pulling a pin that is stuck. This short retarder is controlled from the hump office.

Retarders Now Controlled From One Tower

The remainder of the retarders, i.e., the 10 locations down the hump and on down the leads are all controlled by one retarder control machine which is in the new tower at the east of the main leads. This new tower is of brick construction, with control room 9 ft. by 15 ft. The dimension from rail level to the floor line on the top story is 30 ft. Glare proof plate glass windows are used on the track side and the two ends of this operating room. At this height the towerman has a good view of cars when moving down the hump and throughout the retarder area, as well as down into the classification tracks. The panel of the control machine in this tower is 40 in. by 40 in. on which is a schematic diagram of the tracks, switches and retarders. Small indicating lamps are located in the white lines which represent the tracks. When a car or cut of cars approaches a switch over which it has been routed by the push-button control, its selected route is indicated to the towerman by the progressive lighting of the indicating

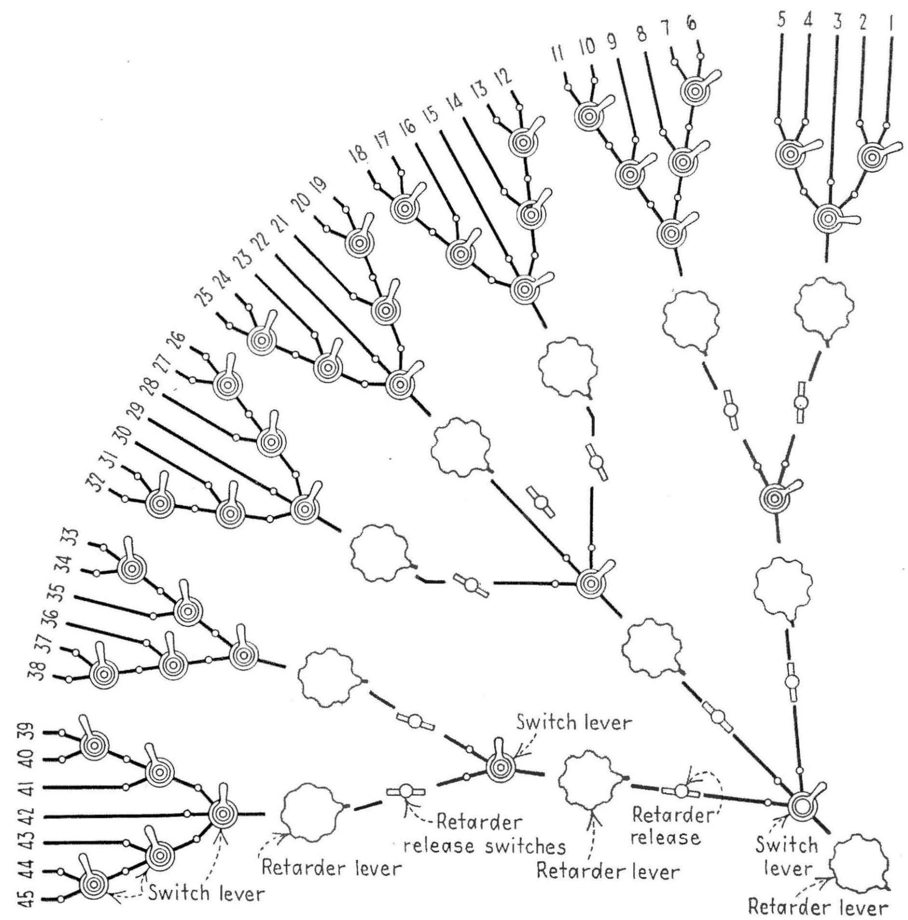


Profile and plan of tracks down the hump and through the retarders and switches control cars when passing down the hump and through the switches, so that succeeding cuts will be spaced properly. Spacing is necessary to permit time for the release of the detector locking and the operation of the switch machine. This operation is no different from that in other yards equipped with detector locking. With the automatic control as in service, each switch is controlled automatically to operate when a car enters the track circuit of the switch in advance. If a switch has started to move when a car or cut of cars enters the track circuit, the switch goes on over. Thus under normal automatic control the towerman has nothing to do with the control of switches.

The average speed of pushing cars up over the crest ranges between 3.5 to 4 m.p.h. If there is an average of three or four cars per cut, the pushing speed can be faster than if the average is 1.5 to 2 cars per cut, because running space must be allowed between the cuts. During the yard reconstruction, the traffic has been handled by one engine and yard crew to push cars from the receiving yard over the hump. This operation introduces some delay when the engine goes back to the receiving yard for more cars. Based on experience to date, the men operating the yard expressed opinions to the effect that they can classify all the traffic that may be offered, up to a range of 800 to 1000 cars in each 8-hour trick, providing engines are available to push cars over the hump continuously except when necessary to to trim the yard. It has been demonstrated that trimming is required so seldom that practically continuous humping is possible.

When the maintainer is testing or adjusting a switch, or when setting up routes for the trimmer engine, the switches are controlled individually by levers on the towerman's panel. On the schematic diagram on this panel as discussed above, each switch is represented by a small rotary type lever. These levers are turned to the "right-hand" or "off-track" position at all times when the automatic control system is in effect. When the yard is clear and a switch is to be operated individually, the corresponding lever is moved to the position over the white line representing the route to be lined.

As an over-all proposition the control of the switches in this new system is somewhat similar to "NX" entrance-exit interlocking circuits except that in this yard the "entrance" is always the same place—at the crest—and the "exit" is the classification track to which the car or cut of cars is to be routed.



Schematic diagram of panel on the retarder control in the tower

The controls for switches are set up, stored, transmitted, etc., by coding equipment, similar in operation to coding equipment used in centralized traffic control. The automatic switch control system uses Type A relays which are all located in cabinets in the ground floor of the new tower building. These cabinets have the same general appearance as those used in G.R.S. centralized traffic control. The relays used for track circuits, switch repeaters and switch controls, are the plug-in Type B, mounted on racks also in the ground floor of the tower. The controls thus center in this room. The controls and indications between this room and the crest of the hump require 22 wires. From the tower to each switch there are 11 working wires, all No. 14. These include 3 controls, 2 track circuits, 2 switch-repeater circuits, 2 for 110-volt a.c., 1 for B-24 and 1 for the switch signal lamps. From the tower to the control case near each retarder there are 5 No. 14 wires for controls. The retarder motors operate on 220-volt d.c. which is distributed from the power house to all the control cases by a 3-wire loop system made up of 350,000-cir. mil. conductors. Between each controller case and the retarder motor this 220-volts is on No. 00 conductors. The 110-volt d.c. switch machines receive power from this same system, getting proper voltage from two of the three wires. The outdoor circuits are in buried cable laid at least 24 in. below the level of the ties. This cable, made by the Okonite Company, is made up with outer covering including a layer of Okoprene, jute, two overlapping wraps of steel tape, and a layer of jute.

The detector track circuits through the switches are the single-rail, sensitive, fast-shunting type, each track circuit being about 55 ft. long. Where space is available, 25 ft. of this 55 ft. is in approach to the point of a switch, although where necessary this can be as little as 16 ft. The track circuits are fed a.c. at about 10 volts. At the "relay" end of each track circuit the a.c. feeds into a rectifier to convert the energy to d.c. which is transmitted over No. 14 wires to the tower where it operates a 28-ohm Type B quick-release relay.

The two neutral relays for the control of each switch—normal and

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advantage. The company believes the machine takes the human factor out of signal bond installation.

The machine has two rams that drive the bond terminals into place. Pressure on each ram is exactly 12,000 lb. each time it operates. The power bonder has a Briggs & Stratton gasoline engine that develops 1.3 h.p. at the 2,000 r.p.m. used in the bonding operation. Ordinarily, it's 1-gal. tank requires filling only once a day. The engine drives a seven-cylinder radial pump, built by Simplex Engineering Company. For the bonding operation, only two of the pump's seven pistons are needed. With all in use, the 10,000 pounds per square inch pressure of the pump would be developed much too quickly. As it is, only four seconds elapse from the time the operator moves the starting lever until the driving rams compress the bond in place. The excess cylinders can be used as replacements when the original cylinders and pistons become worn.

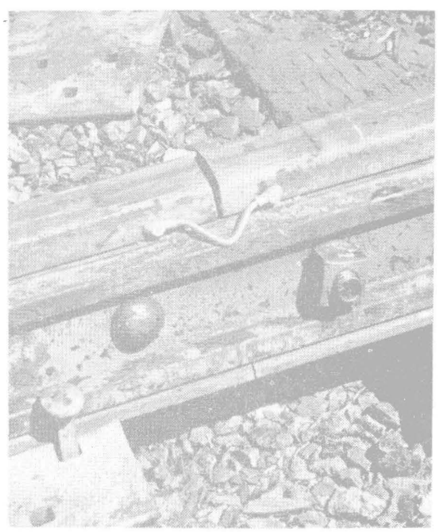
Pressure at 12,000 lb.

The driving rams, one for each terminal, are products of Blackhawk Manufacturing Company, and can be serviced with standard replacement parts. They are housed in a steel alloy body casting that has a proved safety factor of three, for withstanding the total applied pressure of 24,000 lb. that accompanies each bond installation. As soon as the maximum pressure of 12,000 lb. is applied to each bond terminal, a release valve immediately cuts off the pressure. Pressure is equalized on both rams so that there is no possibility of one terminal being driven harder than the other. The equalization of pressure also helps to align the machine on the rails. Curved guards, made of tubing, form the frame of the machine and also serve as protection for the engine and control units when emergency derailment is necessary.

Present for the test run in Kansas were T. W. Hays, general signal engineer, Omaha, D. C. Bettison, signal engineer, Omaha, and C. B. Mason, signal supervisor, Kansas City, of the Union Pacific; and W. P. Bovard, manager of the railway signal bond division, H. R. Sampson, Kansas City district manager, and C. A. Davis, development engineer, from Ohio Brass. The bonds installed by the power bonder were carefully examined for uniformity of appearance, both while still in the rail and after being extracted. It was agreed that these visual examinations indicated the machine had done its job with 100 per cent uniformity. Visual inspection of the bonds installed also showed that the rams compress the Hammerhead more closely against the rail, thus providing maximum clearance against dragging equipment. Use of the bonder permits better hole location. Centers are ⅜-in. above the lower corner of the rail head, well below the area of distortion due to traffic and well out of the way of dragging equipment.

Ohio Brass undertook the development of the hydraulic bonding machine in response to an often-repeated request for a method of bonding that would remove the influence of human error. The first machine, developed in 1941, had only one ram, and was transported by hand. It was soon discarded as being too awkward. World War II interrupted any further experimental work. The project was resumed last year. The machine used in the recent Kansas test is the first one Ohio Brass considered worthy of field testing. As a result of the successful trial, additional machines will be produced.

The development of a bonding machine completes the line of equipment that Ohio Brass describes as its "Hammerhead System" of bonding, all based on the use of Hammerhead bonds. Besides its Twindrill, the company has a Webdrill and a Headrill, light-weight, portable, hand-operated machines for emergency installation of rail bonds, and a new Dual Mobildrill which can be used for a few or for mass installation of bonds in the rail head, and can drill the rail web.



Bonds are applied uniformly

I. C. Yard

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reverse—are the Type B rated at 700 ohms. These relays for all the switches are in the tower. The switch motors operate on 110-volts d.c. The three wires from the tower to each switch are the normal control, the reverse control and the common—all 110-volts d.c.

One relay repeats the normal position of each switch and another relay repeats the reverse position. These are Type B relays rated at 190 ohms, and are quick acting—about 0.6 sec. For each switch there is a 900-ohm switch-repeater repeater relay which is picked up when either the normal or reverse repeater is up. The WPP is slow release—about 1.3 sec. The only time that a WPP is released would be when some obstruction prevents a switch from being closed. In such an instance the controls through contacts of the WPP cause the switch to return to its previous position, and a lamp is flashed in the lever handle for that switch, and a bell is sounded.

The 24-volt d.c. control circuits throughout the plant are fed from a set of 160-a.h. Gould storage batteries. The 110-volts d.c. for operating the switch motors, and the 220-volts d.c. for operating the retarder motors comes from one or the other of two motor-generator sets. Each set is operated alternate weeks. The d.c. generator of each set has adequate capacity to supply all d.c. demands, even to close a retarder for a higher degree of retardation after a car is already in the retarder. Such operation is not ordinarily necessary, but nevertheless the generator capacity can handle such requirements.

This yard reconstruction program was planned and carried to completion by railroad forces under the jurisdiction of C. H. Mottier, Vice President and Chief Engineer. The grading and track work was under the direction of J. S. Francis, Assistant Engineer. Engineering with respect to power switches, retarders and controls was under the direction of H. G. Morgan, Signal Engineer with construction work being handled by Supervisor of Signals, W. R. Hutchings. All the signaling equipment including retarders, switch machines, control apparatus and relays, were furnished by the General Railway Signal Company.