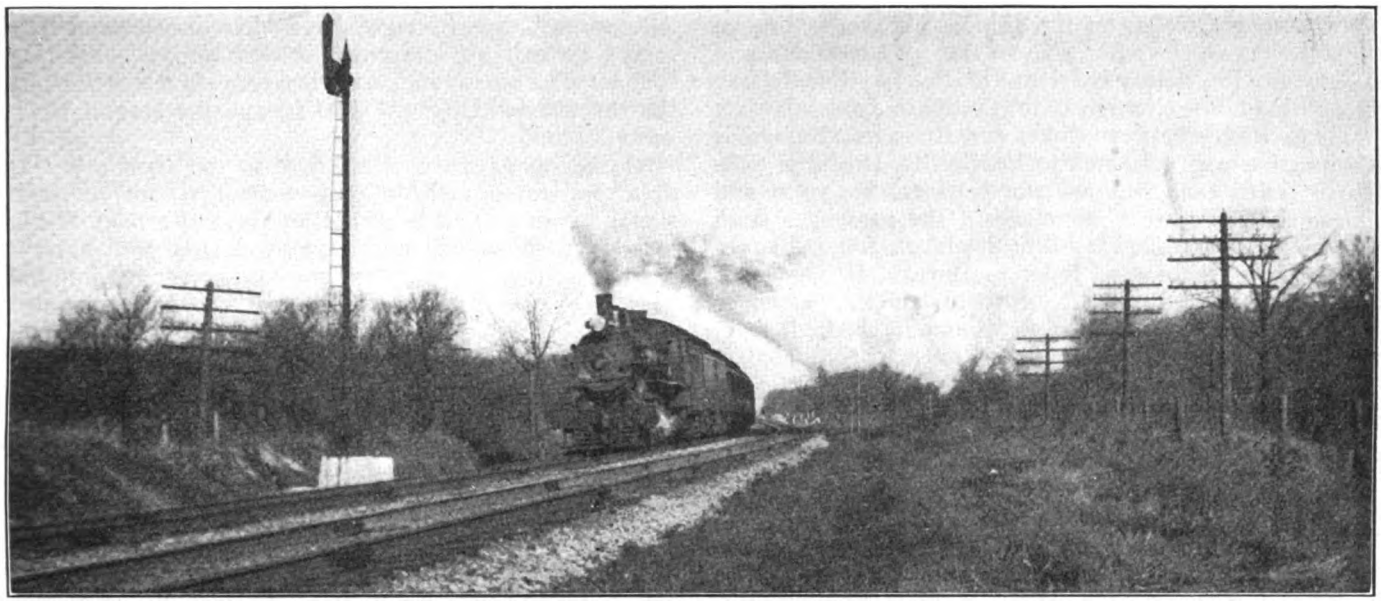


Locomotive Passing Over Clear Ramp

Rock Island Installs Train Control

This 156 Miles Double Track Installation Is the First to Be Inspected Officially by the I. C. C. Under the Order

THE Chicago, Rock Island & Pacific, in compliance with the Interstate Commerce Commission's Order No. 13413, has installed automatic train control on 165 miles of its double track main line between Blue Island (Chicago), Ill., and Rock Island. The automatic train control system of the Regan Safety Devices Company, Inc., as used on this installation, is the intermittent ramp contact type, with speed control. The roadside equipment consisting of the ramp and circuits connecting the train control and automatic (visual) signal system, was completed on November 1. There are 89 road engines assigned regularly to the Illinois division, of which 38 are for passenger and the rest for freight service.

An official inspection of this train control installation was made by W. H. Harland, chief of the division of signals and train control of the I. C. C., and his staff, during the latter part of November and it was pronounced complete and in full compliance with the requirements of the commission, as was announced by the railroad on December 4. Therefore, the Rock Island is the first road to receive an official inspection and approval of an automatic train control installation on a full engine district, as specified in the order.

Record of Tests Made

The inspection and test of the roadside apparatus was made by parties, each consisting of two inspectors of the Interstate Commerce Commission, accompanied by representatives from the Rock Island and the Regan Company. One of these parties started from Blue Island on November 19, and one from Rock Island on November 20. The inspection and test at each location consisted of measurements of gage and height of ramps, check of potential and polarity, and a general examination of the construction at each location. A check was also made of switch protection, overlaps, grade, etc. All ramp locations throughout the installation were examined in detail by the government inspectors.

An inspection and test was made of each equipped locomotive to determine the integrity of the apparatus, including operation under the several conditions of train control, such as unlimited speed, limited speed and stop, with tests of the integrity of the circuits, grounds, elevation and gage of shoe mechanism, etc., including the seals applied to the air cocks. These tests were also to determine whether the installation was made in accordance with the plans. Observations of the automatic train control apparatus in regular train service were made, with a record of date, engine number, train number, signal indications, speed of train, reduction in pounds of brake pipe pressure, and whether the apparatus operated as intended.

At the request of the Interstate Commerce Commission a special train was run from Blue Island on November 30, for the purpose of demonstrating the flexibility of the system. The train consisted of engine 1328 with five cars, including a business car which was fitted with a speed recorder and train-line gages. Tests were made at unlimited speed, at prescribed medium speed and at stop, corresponding to the signal indications—Proceed, Proceed with Caution, and Stop. The purpose of these tests was to demonstrate that the apparatus operated as intended and at the prescribed speeds at which it was set. On the return trip the train was operated with the locomotive running backwards and the various indications were received the same as when the locomotive was running forward.

Territory Included and Traffic Handled

Blue Island, Ill., is 15.7 miles from the La Salle street station, Chicago, and is considered as the end of the Chicago terminal district, as the majority of the sub-

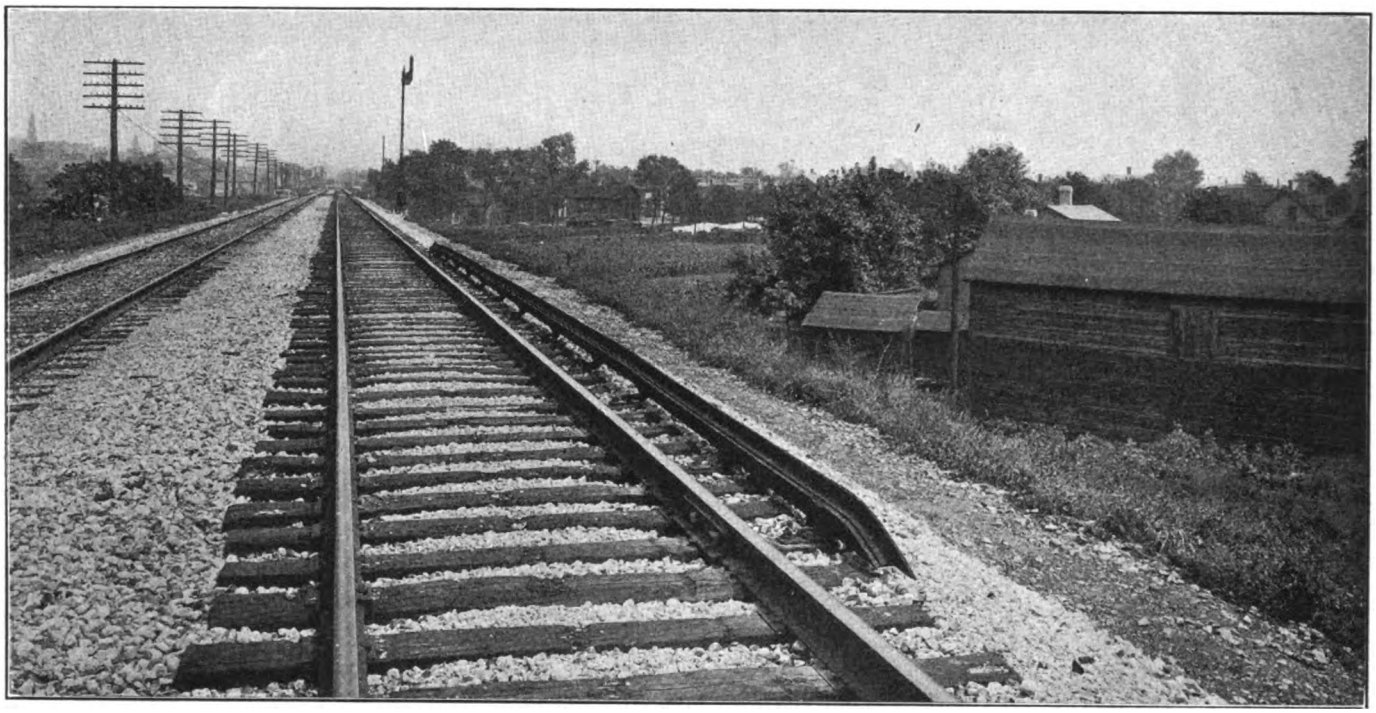
urban trains from the city terminate at Blue Island. The passenger traffic on the Illinois division is broken up at Joliet, which is 24.5 miles west of Blue Island and at Bureau, Ill., which is 98 miles west of Blue Island. In addition to the through trains there are eight suburban trains each way between Joliet and Chicago. Bureau is the junction with a branch to Peoria, Ill., and three passenger trains each way are run between this point and Chicago. Therefore a summary of the passenger train movements is as follows: Blue Island to Joliet, 18 passenger trains each way, Joliet to Bureau, 10 passenger trains each way, Bureau to Rock Island, 7 passenger trains each way. The Rocky Mountain Limited, train No. 7, westbound, traverses the 165 miles of train control territory in 3 hr. 40 min., at an average scheduled speed of 43.5 m.p.h. One of the Joliet suburban trains runs at an average speed of 40.2 m.p.h.

For the six months' period from June to November, 1923, inclusive, there was an average of 13 eastbound and 12 westbound freight trains on the Illinois division for each 24-hr period. The freight train speeds average between 13.1 m.p.h. and 17 m.p.h. The ruling grade of 0.62 per cent for approximately six miles east of Joliet limits the eastbound tonnage of the larger freight engines to 3,370 tons as an adjusted rating between Morris, Ill., and Blue Island. At Tiskilwa, nine miles west of Bureau, the line leaves the Illinois river valley and climbs 154 ft. within a distance of 14 miles, with a maximum westbound grade of 0.6 per cent. This ruling grade establishes an adjusted rating westbound of 3,470 tons, between Bureau and Sheffield, requiring additional train movements between these points.

Automatic Control as Connected With the Signaling

In addition to the complete system of three-position automatic block signals in the train control territory the signaling includes two electric interlocking plants, one electro-mechanical and three mechanical interlockings, all of which are equipped with modern electric track-circuit locking. A contact ramp 80 ft. long is located approximately 65 ft. from each automatic and each home interlocking signal. The present installation includes 240 ramp locations, eight of which are intermediate ramps (which are described below) and two clearing ramps. The average distance between signals is 1.4 mi., the shortest block being 3,000 ft. and the longest block being 2.5 mi.

As the ramps are located close to the signals it was necessary to extend the line control circuit of each signal to give overlap protection into the next block. That is, a signal will now remain at stop until a train has passed through the block and also preceeded into the next block the distance of the overlap. It is intended that these overlaps shall provide protection for "train stopping distance" with the service application of the brakes at the speed regulated by the train control apparatus, taking into consideration the gradient. The term "stopping distance," as here used, is, therefore, somewhat different from the term "braking distance" which is required to stop a train at maximum speed.



Ramps Are 80 ft. Long and Located Approximately 65 ft. From the Signal

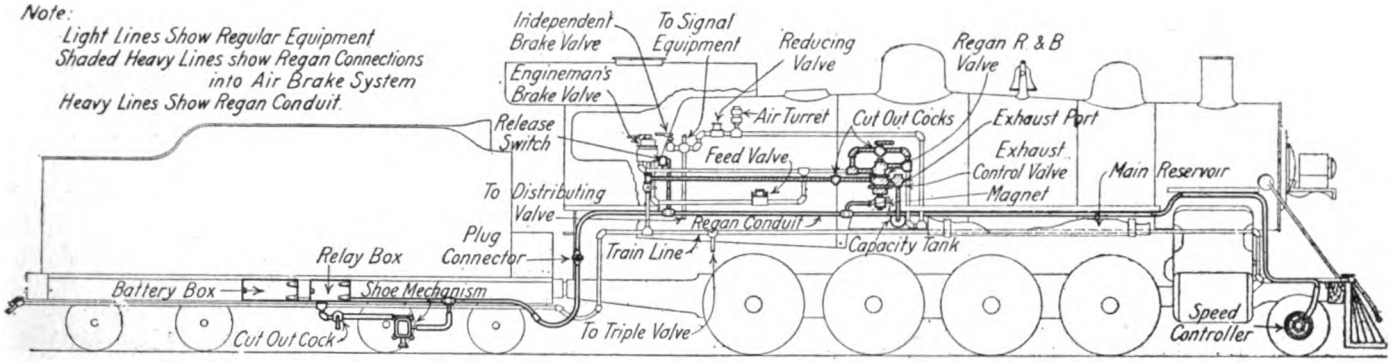
Generally the overlaps were provided by changing the wiring of the signal system so as to include the first track section of the next block, although at some locations new track sections were required. The longest overlap in automatic territory is on a 0.41 per cent ascending grade and is 3,400 ft. long and the minimum is 1,375 ft. long on a 0.4 per cent ascending grade. At the interlocking plants there are no overlaps. However, approaching an interlocking, an intermediate ramp is located between the distant signal and the home signal in order to obviate the overlapping of the distant signal within the home signal limits. At one interlocking, the ramp is 1,100 ft. from the home signal on a 0.4 per cent ascending grade. This is at a point where permanent speed restrictions are in effect. The maximum is 1,300 ft. on a 0.03 per cent ascending grade.

Ramp Circuits

A 10-volt battery is used with each ramp. At most of the locations this is a 16-cell caustic soda battery, although as a.c. power is available at Joliet, storage batteries on a.c. floating charge are used there. The feed

circuit for the ramp is carried through a contact on the line relay and through circuit contacts on the signal mechanism; and the other side of the battery is connected to the rail. The circuit is completed so as to draw current only when a locomotive shoe passes over the ramp.

A contact device is provided at the ramp for the purpose of checking the position of the ramp. If the ramp



Showing Application of the Regan Apparatus to a Typical Locomotive

should be knocked out of line 5/8 in. the control circuit of the signal in the rear is opened, causing the signal to go to stop; and consequently placing the ramp at that signal in a condition to stop trains.

Train Control Equipment on the Locomotive

The engine equipment consists primarily of a contact shoe, an electro-pneumatic graduated valve, a speed controller, an indication selector and a storage battery. Stated briefly, the system functions as follows: The shoe, in riding up a ramp, opens an air port, operating the graduated valve, unless this valve is held closed by an electric circuit that is controlled indirectly by energy from the ramp itself. The ramp circuit from the shoe is carried to an indication selector, which in turn controls the circuit which operates the graduated pneumatic valve.

While traveling between the ramp locations the indication selector is held in the last operating position by the local engine circuit, which is supplied with energy from a storage battery on the locomotive. At a signal indicating "proceed" the ramp supplies positive current consistent with that indication and no further action takes place until the next ramp is encountered. At a signal indicating "caution," negative current is supplied to the shoe, thus bringing into play the speed control features.

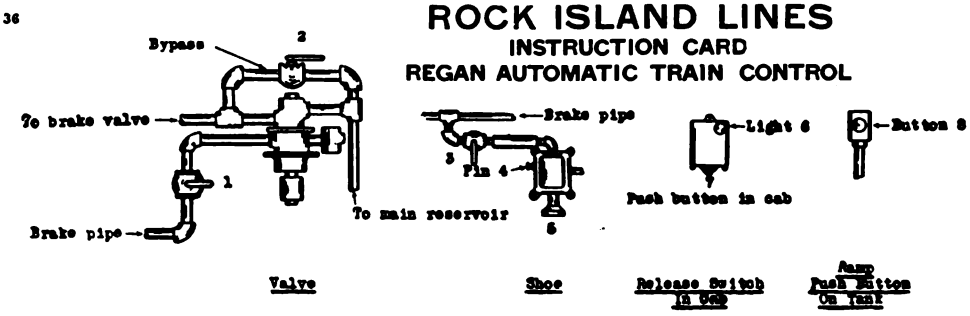
The medium speed for passenger trains is 35 m.p.h. and for freight trains 25 m.p.h. Trains are expected to enter a caution block at a rate below the prescribed rate. If this rate is in excess of the medium speed requirement then the brakes will be applied automatically, but after the speed has been reduced to a point below the medium speed, the brakes may be released and, if the engineman is alert, the train may be made to proceed through the block at or below this speed without a stop.

In case the train operates in a "caution" block to a speed above a medium speed requirement, then an auto-

FORM M. P. 36

ROCK ISLAND LINES

INSTRUCTION CARD
REGAN AUTOMATIC TRAIN CONTROL



1. TO CUT DEVICE OUT OF SERVICE: Close cock 1 so that handle is in line with pipe and open cock 2 on bypass so that handle is crosswise with pipe. In case of heavy leak of air at shoe box also close cock 3 so that handle is in line with pipe.

2. TO PLACE DEVICE IN SERVICE: Open cocks 1 and 3 so that handle is crosswise with pipe and close cock 2 on bypass so that handle is in line with pipe.

3. DOUBLE HEADING: When double heading, on rear engine Raise shoe stem 5 to full height; pull out locking pin 4, give it one-quarter turn and see that it has entered the slot full length.

4. OPERATION:

(a) The train control apparatus does not interfere with the proper observance of rules governing air brake operation.

(b) CAUTION SIGNAL will enforce speed throughout the block not to exceed 40 miles per hour for passenger trains and 30 miles per hour for freight trains. To avoid unnecessary application of the brakes, speeds should be maintained below these limits.

(c) STOP SIGNAL: At a stop block, ramp push button number 8 on tank must be pushed in before shoe engages ramp, and held in so long as shoe is on ramp. If stopped with shoe on ramp, button 8 must be pushed in and held in until shoe is off ramp.

(d) A stop signal will enforce speed not to exceed 15 miles per hour throughout the block for both passenger and freight trains. To avoid unnecessary application of the brakes, a speed should be maintained below that limit.

(e) RELEASE SWITCH IN CAB: Whenever device makes brake pipe reduction, place brake valve in lap position until train is running below prescribed speed; then when indicator light 6 is displayed, push the button 7 which will extinguish the light, and proceed to follow prescribed rules of proper air brake operation as though you had made the application yourself.

(f) IN CASE OF IMPROPER OPERATION: Should the device improperly apply the brakes, it must not be cut out of service until the ramp next ahead has been passed. The only exception to this rule will be permitted when, with the train at stop, it is impossible to release the brakes after pushing button 7.

(g) Report any improper working of the device to the Train Dispatcher and on work report.

The Instruction Card Placed in the Locomotive for the Guidance of the Engineman

matic application of the brakes will take place. The engineman must then acknowledge the speed restrictive condition and release the brakes, after the speed has been reduced to a point below the prescribed medium speed, to allow the train to proceed under the restrictive speed; otherwise the train will be brought to a stop.

At a signal indicating "stop" the ramp is de-energized; hence, as there is no current for the shoe to pick up, it functions to cause the air pressure to be reduced in the train line to give a service application of the brakes. Upon encountering this stop indication the engineman

Rocky Mountain Limited Westbound in Train Control Territory

may proceed through the block at a speed not to exceed 15 m.p.h., provided he acknowledges the condition. The system is designed not to require stopping at the signals indicating "stop" for those roads who may so elect to use the equipment.

Rock Island Train Control Installation Approved

Washington, D. C.

THE Interstate Commerce Commission on December 17 issued an order approving the installation of the automatic train control device of the Regan Safety Devices Company, Inc., on the Chicago, Rock Island & Pacific, Illinois division, between Blue Island, Ill., and Rock Island, Ill., 165.4 miles, double track, except for certain suggested changes concerning the signal system upon which the train control device is superimposed. As a result of inspection and test the Commission finds that the device itself as installed meets all the requirements of the Commission's specifications as contained in the order directed to 49 railroads on June 13, 1922. This is the first installation on one of the roads named in that order to be approved by the Commission. The order establishes certain requirements as to inspection, tests and maintenance and the railroad company will be expected promptly to carry into effect the recommendations made with respect to the signal system.

The report, which is by Division 1, Commissioners McChord, Esch and McManamy, says:

The installation consists of an automatic train-control device of the intermittent electrical contact type. This device was first placed in service in March, 1920, on the Rock Island, between Blue Island and Joliet, Ill., a distance of 22.6 miles of double track road. The installation consisted of 20 equipped locomotives with 34 roadside ramps operating in connection with 32 automatic signals. From May, 1921, to March, 1922, this installation was under continuous observation by our bureau of safety and the American Railway Association.

Under date of February 24, 1922, we were advised by the Rock Island that the device had been in service between Blue Island and Joliet, Ill., for about two years and had done what its owners claimed for it, and that, at a meeting of the directors on February 21, 1922, the officers of the road recommended and the board of directors authorized and directed, upon approval by us of plans and specifications thereof, the extension of the automatic train-control installation from Joliet to Rock Island.

Under date of May 4, 1922, the Rock Island advised us that it was ready to install automatic train-control on its Illinois division between Joliet and Rock Island and transmitted in duplicate plans of the signal system in operation on this division, together with plans of the engine and circuits of the automatic train-control device of the Regan Safety Devices Company, Inc., and other information pertaining to the extension of the installation from Joliet to Rock Island with the request that the plans and information furnished be approved.

Under date of May 10, 1922, the Commission approved the extension of this train-control system to Rock Island, a distance of 142 miles of double track. The installation was completed and placed in service on November 1, 1923, thus making a continuous installation between Blue Island and Rock Island, a distance of 165.4 miles of road, or 330.8 miles of track.

The roadside apparatus consists of a ramp located at each signal with the necessary wiring for connecting the train-control system with the automatic signal system; each ramp is provided with a ramp displacement device through which is carried the control wire for the next signal in the rear in such a manner that any displacement of a ramp is intended to open the circuit and cause the signal in the rear to assume the stop position.

The locomotive apparatus consists of the following:

1. A speed circuit controller of the centrifugal type the electrical contacts of which are set for speeds in accordance with the railroad company's requirements.

2. An electro-pneumatic brake valve with exhaust control valve and air capacity chamber which is interposed directly in the air supply line between main reservoir and the engineman's brake valve. It is also provided with a connection to the brake pipe. When the electro-magnet of this device is energized that part of the valve controlling the brake pipe vent is closed and the part controlling the main reservoir pressure is open and main reservoir pressure is free to flow to the engineman's brake valve in the usual manner. When an automatic application is made the electro-magnet is de-energized, and main reservoir supply to brake valve is cut off to prevent releasing the brakes, and the brake pipe air vented to atmosphere via the exhaust control valve.

The exhaust control valve is so designed and constructed as to permit a 30 per cent reduction of the initial brake pipe pressure, after which it automatically closes the brake pipe vent thus preventing the exhausting of the entire brake pipe system while providing for a service application of the brakes. In case it is desired to cut the train control out of service, by-pass air connections are provided, controlled by angle cocks normally sealed.

3. An electro-magnet release switch and light indicator. The function of the indicator is to advise the engineman, after an automatic application of the brakes, when the speed of his train has been reduced to the enforced lower rate of speed, after which he may, by

first operating the release switch, then release the brakes in the regular manner. The release switch is constructed so that it cannot be held closed, and its operation prior to reducing the speed of the train to the point where the indicator will be lighted will not effect a release of the brakes.

4. A push button known as the "stop ramp button." This must be operated in order to avoid an automatic brake application while going over a de-energized ramp, when passing a stop signal to enter a danger block at or below prescribed low speed. Exceeding the low speed limit will cause the brakes to be applied at any time in a danger block, irrespective of the forestalling feature.

5. A shoe mechanism, on the right hand side of the locomotive for forward running, and on the left hand side for backward running. This shoe apparatus consists of a shoe stem and a circuit controller. The contacts of the circuit controller operate with the shoe stem and are closed with the shoe down and open with the shoe up, thus selecting between locomotive and roadside energy, but overlapping in their movement sufficiently to avoid breaking the indication selector circuit. The shoe stem is held down in position for contact with the ramp by means of air pressure. The shoe stem is drilled throughout its length so as to insure an application of the brakes in case it is broken off in service.

At a clear signal.—The shoe receives energy from the ramp to cause a clear or proceed indication to be transmitted to the engine apparatus, and this indication is maintained until the shoe engages the next ramp.

At a caution signal.—When the shoe engages the ramp energy of a different polarity, actuates the engine apparatus to the caution position; and this indication is maintained throughout the caution block, and the speed circuit controller is automatically connected into the engine circuit in such a manner that it will operate an automatic service application of the brakes if the train exceeds the prescribed medium speed. When the speed has been reduced to the point at which the controller is set it operates to close a circuit to light the cab indicator, thus notifying the engineman that he may take the proper action to release the brakes. Should he for any reason be incapacitated, or fail to take advantage of this opportunity, the brakes would continue to apply and stop the train.

At a stop signal.—The shoe receives no energy from the ramp and the engine circuit is opened, thus causing an automatic application of the brakes. However, a stop signal may be passed and the train enter the danger block without receiving a brake application if two requisites are complied with, namely, "stop ramp button" must be held closed while the shoe engages the stop ramp, and the train must be operating at, or below, the prescribed low speed. The train may then proceed and is automatically restricted throughout the danger block to the low speed limit, the brakes applying automatically whenever the train exceeds that speed.

Our order in Automatic Train-Control Devices, supra, provides:

"That each installation made pursuant to this order shall, when completed, be subject to inspection by and the approval of the Commission or any division thereof to which the matter may be referred."

This device has heretofore had the Commission's approval. Therefore, the purpose of this inspection and test was to determine if the installation was made in accordance with the plans furnished and the specifications and requirements of our order. As a result of this inspection and test it has been found that the device itself as installed meets all the requirements of the Commission's specifications and order in *Automatic Train Control Devices Supra* and its installation is, therefore, approved, except as hereinafter indicated.

The Rock Island will be expected to comply at once, with the following requirements as to inspection, tests and maintenance: (1) To insure the proper and safe operation of the locomotive apparatus, arrangements should be made by the railroad for a careful inspection and tests of the train control equipment by skilled employes on the arrival of all locomotives at a terminal or roundhouse. This inspection and tests should include all parts of the apparatus; all sealed air cocks should be inspected to see that the seals are unbroken and that the apparatus is properly cut in service before leaving. A daily report as to the conditions of the apparatus should be made on a form especially provided for that purpose and forwarded by the inspectors to the proper authority. (2) The roadside apparatus should be frequently inspected and tested for crosses, grounds and polarity, the alignment of ramps and the proper adjustment of the displacement detector and a report made on a form provided for that purpose and forwarded by the inspectors to the proper authority. (3) A form should be provided for the engineman on which to report all failures of the apparatus or any irregularities in the operation of the device. (4) The shoe housing and other accessible parts of the apparatus should be padlocked or sealed.

Certain situations were noted which, in our opinion, should be corrected by the railroad company as a precautionary measure in order to secure a greater degree of safety and to prevent a possible failure properly to protect train operations, in so far as it concerns the signal system upon which this train control device is superimposed. In the following specific respects the railroad should promptly take the necessary action to carry into effect the recommendations made:

(1) Location of clearing ramp when leaving train-control territory at signal 162 should be changed so as to provide protection for a train standing in the overlap of signal 170.

(2) All cross-over switches between main tracks and sidings should, when used, be so arranged as to give maximum protection to main track traffic, through the proper signal indication.

(3) All movements leading to main tracks should be protected through the signal system.

(4) Movements by signal indication through all interlocking should be at low speed, except that where a more favorable indication is desired full train control protection should be provided through the signal system. The train control ramp indication should be made to conform to the signal indication, opposing signals should not be cleared simultaneously.

(5) Some of the signal overlaps, in our opinion, are not of sufficient length to provide braking distance at the present medium speed.

(6) The medium speed of 37 miles per hour for passenger trains is, in any event, considered too high and a lower speed is recommended.

(7) Protection should be provided against a train on siding, following a train on the main track, without restriction as to speed.

(8) Sign boards should be placed to indicate the beginning and ending of automatic train-control territory.

While these recommendations do not reflect upon the train-control device, itself, we feel that as a matter of caution the carrier's attention should be called to them and it should comply therewith in order that the greatest degree of safety may be insured. The attention of the Rock Island has been called to these matters and they indicated willingness to comply with recommendations.