arrangement because they do not have to go on to the crossing to flag.

Need for Such Control

C. H. Tillett
Signal Engineer, Canadian National, Toronto, Ont., Canada

It is feasible to provide weather-proof switches at a crossing so that trainmen can take charge of the operation of the crossing signals, and it is sometimes desirable to make such provision.

The public, through the various regulating commissions, is becoming more insistent, and properly so, that the operation of the crossing signals shall more nearly follow the facts, as to the probable use of the crossing by a train. This means that they should not only operate when a train is coming, but that they should not operate if no danger is imminent. Where frequent switching operations are made over the crossing, it is better to have a trainman take over the control of the crossing signal. In doing so, however, he should not overlook putting it in condition for normal operation in his absence, and to insure that he does so we have provided that this is automatically done when the trainman removes his hand from the box housing the control switch. (See article on page 240, September, 1933).

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Signals at Automatic Interlockers

"What factors are of most importance in determining whether the home signals in an automatic interlocking plant should operate to three positions or only to two positions? Under what conditions should a speed limit be imposed?"

Automatic Plant Safe as Any

H. C. Lorenzen
Assistant Signal Engineer, Pere Marquette, Detroit, Mich.

We would use two-position signals in non-automatic territory and three-position signals in automatic signal territory at an automatic interlocking plant, the same as if we were installing a manually-controlled plant. At locations where the conditions will permit of the installation of an automatic interlocking plant, there should be no speed restrictions other than what is required by state law for railroad crossings at grade, as, I believe, an automatic interlocking plant is just as safe as a manually-operated plant.

No Speed Limit Needed

P. M. Gault
Signal Engineer, Missouri Pacific, St. Louis, Mo.

The purpose of the home signal is to convey information as to the use, by a train, of the track within the limits of the plant. A further purpose may be to convey information as to the condition of the signal governing the next block beyond the plant. The indications which the home signal may give should be consistent with these purposes.

For a road using three-indication signals the home signal should be capable of indicating "Stop," "Prepare to Stop at Next Signal," and "Proceed." When located outside of automatic block signal territory the "Approach" indication should be eliminated and only two indications used.

An automatic interlocking is as safe as any other kind of interlocking and, in my opinion, no speed limit should be imposed on account of the automatic feature.

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Moving Interlocking Machines

"What experience have you had in moving an interlocking machine from one tower to another? How can this be done without interfering seriously with train movements?"

Machine Moved with Plant in Service

LeRoy Cone
Chicago & North Western, Chicago

Several years ago a tower at an electric interlocking was badly damaged by a derailment, and it was necessary to remove the machine (which contained 28 levers) from the tower before a box car, which was leaning heavily against the side of the tower, could be pulled away by a wrecker. Of course, there was no time to make any special arrangements to keep the plant working. Therefore, the wires were disconnected; the machine was moved out promptly, and was set up in a flagman's shanty on the ground, about 30 ft. east of the old tower.

In due time, the tower, which was of brick construction, was rebuilt and then came the time to replace the machine in the tower and, as this was a "hot spot," we were told that we could not put the plant out of service. Therefore, arrangements were made to move the interlocking machine without interruption of train service.

Although the tower was of brick construction, there was a large double window in the east end, and the center portion of the window was removed to give ample opening for the machine to go into the tower. All of the wires were terminated in a junction box in front of the tower, these wires having been extended to the temporary quarters, and were spliced out long enough to go up through the window and to the proper position for the machine in the tower.

Machine Mounted on Skid

This done, a skid or platform was made of oak lumber large enough to allow a man to stand on it close to the machine and operate the levers. The machine was securely bolted to this skid. By sliding the skid along the ground the machine was moved close to the tower. The machine had to be lifted about 20 ft. and to accomplish this, we made a large pile of ties, setting them across each other. This pile was started all around the machine, then the machine was lifted one end at a time up one tie height, and then another layer of ties was placed and the machine was lifted up another tie height. This was repeated until we were level with the window sill. Then a few ties were placed in the tower to the level of the machine outside, and the machine was moved through the double window on to the ties in the tower. One tie at a time, the ties were taken out until the

machine rested on the tower floor. It was a simple matter to connect the wires from the conduit to replace the ones coming in through the window. Although a number of trains were handled when the machine was part way up to the tower, there were no delays to train movements.

Two Machines Moved

E. Hanson
Signal Engineer, Gulf, Colorado & Santa Fe, Galveston, Tex.

When the Galveston causeway was constructed across the Galveston bay, as a connecting link between Galveston island and the mainland in 1912, the causeway consisted of two tracks to be used by steam lines, one track to be used by the Galveston-Houston Electric Company, which operates an electric line between Houston and Galveston, and a 20-ft. paved highway for vehicular traffic.

In order to handle the rail traffic for the steam and interurban lines, three interlocking towers were erected, one at Virginia Point, which is on the mainland end of the causeway, one at Island, which is on the island end of the causeway, and one at Lift Bridge, which is in the center of the causeway. All steam lines converge at Virginia Point and use the two tracks across the causeway and at Island they branch off to their individual yards. The steam lines using the causeway are the Gulf, Colorado & Santa Fe, the Missouri-Kansas-Texas, the Missouri Pacific, the Southern Pacific, the Burlington and the Rock Island. This causeway is two miles in length and trains are handled by signal indication, the two tracks being used as two single tracks and the trains handled in either direction on both tracks.

It was decided that the operation of the causeway could be accomplished by one set of towermen and, to accomplish this, it was necessary to move the Virginia Point and Island machines into the Lift Bridge tower. These machines were set end to end in this tower and are operated as three separate machines; the Virginia Point machine at the north end, Lift Bridge machine in the center and the Island machine at the south end. These machines are the Union Switch & Signal Company's electro-pneumatic type.

The Virginia Point machine consists of 41 levers, 30 working levers and 11 spare. The 30 working levers operate 11 derails, 13 switches, 2 movable point frogs, one double slip, 14 signals and 2 traffic levers. The Island machine consists of 35 levers, 21 working levers and 14 spare. The 21 working levers operate the following equipment at Island: Seven derails, 7 switches, 2 double slips, 2 movable point frogs, 11 signals and 2 traffic levers.

Making the Change

When the machine was in operation at Virginia Point, track indicators were used instead of a track diagram. Neutral relays were used for SS control. In making the change to the Lift Bridge, the track indicators were discarded, and relays were used to select all circuits at that point and a track model diagram was substituted. The SS control was changed to use polar relays.

In making this change, on account of the length of time the outside wiring had been in service, it was necessary to entirely rewire the outside equipment. A sufficient number of wires were run from the Lift Bridge to Virginia Point in lead-covered 37-conductor cable through the clay ducts provided in the arches of the causeway. These 37-conductor cables were run to central locations of the plant and then distributed to each machine, by using insulated wire placed in trunking under the ground and wires properly pitched in the trunking.

All relays at the new location at Lift Bridge were wired. The track diagram was wired, battery placed and wired and wires run to the location where the machine was to be placed in the Lift Bridge tower, properly tested out and properly tagged. All new wires in the field were run to their proper places in the switch machines, derail machines, movable point frogs, and slip switches, signals, relay boxes and transformer locations. These wires were all properly tagged before the machine was moved.

On the day the Virginia Point machine was moved to its new location, the windows of the upper story and the window sills were removed from the tower on the side next to the track, proper skids were constructed to skid the machine from the upper story down to the track and landed on two push cars. (The move was started at 10:00 a. m. after all of the morning passenger trains had arrived and departed.) The outside case was removed from the machine and the machine was moved without taking it apart and was raised up so it could be skidded from the upper story of the tower to the push cars on the track below. The machine was then trucked one mile to the Lift Bridge and was skidded in the same manner to the upper story and placed in its proper location in the Lift Bridge tower. At 10:00 a. m. when the moving was started at Virginia Point, four wiremen were sent out with four helpers to disconnect all of the old wires to all switch machines, signals, relay boxes and transformer locations and connected the new wires. When they completed this work, the machine was in place at the Lift Bridge and the four wiremen and their helpers connected all of the wires to the machine in the Lift Bridge tower and at 4:00 p. m., on the same day, all switches, etc., were working from the new location from the levers in the machine which was now located in the Lift Bridge tower. The crew performing this work consisted of a foreman and eight men, four wiremen with four helpers, to move the machine, and two men in the field to operate the switches at Virginia Point by hand between 10:00 a. m. and 4:00 p. m. There were no train delays. Trains were handled by hand signals by telephone directions from the towerman at Island.

The Island machine was moved to the Lift Bridge in the same manner in about the same length of time, a few days after the Virginia Point machine was moved.

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Battery Carrier

(Continued from page 204)

wire is inserted through these holes and is bent up on each side to make a bale-like handle. Then take a piece of No. 12 wire and bend it around one end of the cell and solder on each side so that it will clamp just below the top of the cell. The grip can be made out of a piece of galvanized iron about 4 in. long, bent as shown, so that when the battery is in place and the handles are closed up and hooked at the top, the battery is held firmly in the carrier. Two blocks, ½ in. by ½ in. by 4½ in., will hold the cell from slipping out of place.

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A. G. Turner,, signal maintainer, Oregon Short Line, offers the following method of determining the speed of a motor car: Where 33-ft. rails are used, count the number of rails passed in 19 seconds. Where 39-ft. rails are used, count the number passed in 23 seconds. In either instance, the number of rails so counted in the specified time is the speed of the car in miles per hour.