be replaced before cold weather starts, thus avoiding failures from this source. The switch-operating battery should not be overlooked; it should be kept charged to full capacity. Snow-melting devices should be kept in good working order for immediate use. A well organized force should be made available at call to clean snow away from the low-voltage machines as fast as it falls. Track forces should be warned not to use salt or picks in removing ice and snow from the switch, otherwise the wires and metal parts of the switch-machine might be damaged.

Experience on the Great Northern in Montana

F. J. Murphy,
Signal Maintainer, Great Northern, Pacific Junction, Mont.

To keep frost off commutators of switch-machine motors, we make commutator bands from old felt hats and fasten them in place with snap fasteners. The reason for using this material is that there is no danger of pieces of wool escaping from the band and getting under the brushes. By using such bands I have never had a switch fail by reason of frost on the commutator.

We keep the proper tension on circuit-breaker contacts and check the contacts weekly. The machines are lubricated with an oil having a low cold test, and we find that such oil provides good lubrication under extreme weather conditions. In the late Fall the section forces clean all gravel from between the ties and down to a point one inch below the bottom of the ties throughout the full length of the points. This prevents snow or ice from collecting under the switch points during light storms and makes it easier to keep the snow clear of the points during heavy storms.

The switch-adjusting bracket is entirely enclosed; this prevents snow or ice from collecting on it. At the heel of the switch we use an offset angle-bar, with a piece of pipe fitted between the angle-bar and the heel block, thus permitting the point to move freely. We also use tie plates that are approximately one inch thick.

By keeping our switch machines in good mechanical condition, and observing the other precautions which I have stated, we do not experience any trouble in operating low-voltage switch machines under severe weather conditions.

A Maintainer's Viewpoint

P. C. Smith
Signal Maintainer, Chesapeake & Ohio, Huntington, W. Va.

In order to insure the successful operation of low-voltage switch machines in severe winter weather, the following rules should be followed: The clutch should be thoroughly cleaned of all grease and oil, and should be adjusted to the maximum tightness, care being exercised to insure that the current-carrying capacity of the controlling relay, and of the motor itself, is not exceeded if the switch should be stalled on account of an obstruction. The gears should be lubricated with the recommended quality and quantity of grease. The gaskets on the gear case should be absolutely weatherproof to prevent water from entering and freezing. In either the full-normal or full-reverse position the switch point should fit evenly against the stock rail throughout the entire portion of the beveled part of the point; however, no lateral pressure should exist between stock rail and switch point except from head-rod to point of switch. The switch should be equipped with heel blocks provided with thimbles or bushings, in order to eliminate friction at this point and also to prevent creepage of the points relative to the stock rail. The nuts on the cuff-bolts on all insulated back rods should never be drawn tighter than necessary to allow the bolts to be cottered; the bolts should also be oiled, as there is slight movement at these points when the switch is in transit, and tightening them simply makes a rigid unyielding switch, causing an unnecessary amount of power to be required for its operation. Rail braces should be drawn tight, forcing the stock rail against the riser plates sufficiently to hold the machine ties to the rail in order to prevent creeping; therefore, when the rail moves, due to contraction and expansion, the machine moves with the rail, keeping the lock rod and switch circuit controller rod in alinement. In addition to the lubrication of the switch, there should be a film of oil on the inside base of the stock rail, from the point of the switch to as far back as the point rests on the base, to prevent the adhesion of ice to the point and stock rails. The motor circuit should be of as low resistance as possible; this can be accomplished by keeping all connections tight. The commutator and the contacts should be kept clean. The battery should be tested frequently enough to insure proper capacity, and should, if possible, be housed underground to insure more uniform temperature and, consequently, greater capacity.

A. Vallee, supervisor of signal construction on the Delaware & Hudson, replies briefly, "Our experience has shown that if the proper voltage is maintained and if proper lubricant is used, low-voltage switch machines will operate properly in severe cold weather. During snow storms the same precautions are taken at low-voltage installations as at interlocking plants."

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Graphic Recorders

"A graphic recording instrument is to be installed in an automatic interlocking system at a railroad crossing. What indications should it record? That is, through what functions should the various elements be controlled in order that the records will show all the vital information required?"

Chart Speed Not Less Than 6 In. An Hour

H. L. Englehardt
Safety Engineer, California Railroad Commission, San Francisco, Cal.

The Safety Division of the California Railroad Commission has recently given considerable thought to the possibility of more effectively safeguarding the operation of automatic interlocking plants.

In this connection it is felt that records should be provided which would be of particular advantage in bringing promptly to the maintainer's attention any temporary improper functioning of the plant which might not otherwise be discovered.

Permanent records should be made of the signal tests and efficiency tests that are made at the interlocking plant. Such records furnish a positive check against any conflicting evidence which might be given as to signal indications in connection with any necessary investigation.

In order to accomplish these results, the essential regulations referred to below have been promulgated as requirements to be observed in the installation and

operation of automatic interlocking plants in the State of California, unless rescinded where good and sufficient cause is shown:

A reliable graphic time recorder must be provided to record accurately the movement of engines, cars or trains through automatic interlocking plants. This recorder shall: (a) Record the date and time of day any train enters and leaves each approach circuit; this can be accomplished by controlling the recording-pen magnet over a back contact of the "AR", or approach track circuit repeating, relay, (b) record the date and time of day any train enters and leaves the interlocking limits; this can be accomplished by controlling the recording pen magnet over a back contact of the track relay of the track circuit between home-signal limits, (c) record separately for each home signal the date, time of day and duration of time that each home signal indicates Proceed; this can be accomplished by controlling the recording-pen magnet over a back contact of the "GP," or home-signal repeating, relay, and (d) operate at a chart speed of not less than six inches an hour.

Eight-Pen Arrangement Being Tried on T. & N. O.

R. M. Meek
Signal Engineer, Texas and New Orleans, Houston, Tex.

Our experience with recorders in automatic interlocking service is quite limited. Only two installations have been made to date, both of which are serving single-line crossings. Eight pens are used, four pens operated by the approach relays, two operated by the track relays between home signals, and two by the traffic stick relays. With this arrangement, information is provided regarding the time of arrival and departure of trains, speed of trains, and whether or not the route was secured. The charts from these recorders are being given careful consideration with a view of determining whether the right information is being furnished. Additional pens may be required, or we may find that fewer pens will afford the necessary information.

Suggests Use of Portable Recorder for Operating Tests

L. B. Porter
Signal Engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

Although the Chicago, Milwaukee, St. Paul & Pacific has not as yet used any recording instruments at railroad crossings protected by automatic signals, we plan to include such instruments in future installations. It is felt that the following information should be given: Occupancy of the approach and inside track circuits, and clearing of the home signals on each road. At an ordinary single-track crossing, this would mean that an instrument with 10 recording pins would be required, that is, six for track circuits and four for home signals.

With this information furnished, it should be possible to determine the following: The exact time of day any train entered any zone of the interlocking plant; the length of time any zone is held by the train; the length of time any train occupies the approach circuit before the governing signal clears; the speed of the train through any zone; the number of trains per day per road; the direction of the trains on each road; and whether or not the governing signal was in the Proceed position when the train passed.

A portable type of instrument giving the above information could be used at different points from time to time, and would probably be of considerable benefit in checking train operation.

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Tie-Wire Practice

"What is your tie-wire practice, particularly in regard to No. 10, 8 and 6 A. W. G. line wire? State kind of material, and length and gage of tie wire. Is soft-drawn or annealed wire used? Insulated or bare?"

Several Lengths in P. R. R. Standards

W. M. Post
Assistant Chief Signal Engineer, Pennsylvania, Philadelphia, Pa.

It is our general practice to use bare line wire for our signal control circuits, although some exceptions are made on single-track lines. We use annealed copper tie wires of the same gage as the line wire. Tie wires 26 to 32 in. long are used for No. 6 A. W. G. line; 24 to 30 in. long for No. 8; and 22 to 28 in. for No. 10 line. The longer wires are for use where the strain is severe, so that an extra turn can be made around the insulator.

Where weatherproof insulated line is used we generally use insulated tie wires 30 in. long, of the same gage as the line, up to No. 8 A. W. G. Tie wires are of the same material as the line wire. Where insulated line heavier than No. 8 A. W. G. is used, the insulated tie wires are two gages smaller than the line.

On the New York Central

R. B. Elsworth
Assistant Signal Engineer, New York Central, Albany, N. Y.

Tie wires for signal line wires should have a life expectancy equal to that of the through wires, should be strong, and should be of a material readily available without special expense for purchasing, stocking and handling.

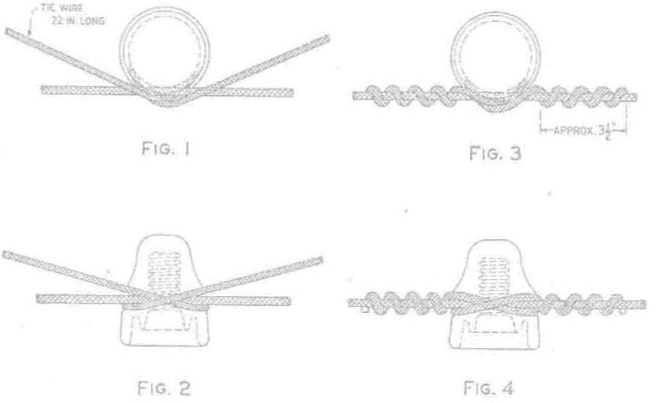

FIG. 1 FIG. 3

FIG. 2 FIG. 4

Plan and elevation views of ties about to be made and of completed ties

The above qualifications are provided by tying line wires of sizes No. 8 A. W. G. and smaller with a tie of the same size, same material and same covering as the through wire. The wire may be of hard-drawn