drawings and tracing, therefore, are held in place on the board by using short pieces of Scotch adhesive tape. This tape is made of a heavy grade of paper, with adhesive material on one side, which does not have to be damped to make it stick on the board or to paper. Each piece can be pulled off and reused three or four times before the adhesive is worn away. The adhesive material which sticks to the board or the paper does not leave a mess, but can be rubbed off readily. The tape comes in rolls, and can be secured in widths ranging from ¼ in. to 1 in. or more. We use tape 1 in. wide, lapping about ½ in. of the width on the tracing and the other half on the board. By using pieces about 2½ in. long and spacing them at intervals of 10 to 12 in. all the way around the drawing or tracing, the work is held in place and the surface is perfectly smooth.

Make-Up-Time Chart

"How can the time required for a train to make-up time at an increased speed be determined in chart form?"

Use a Nomogram

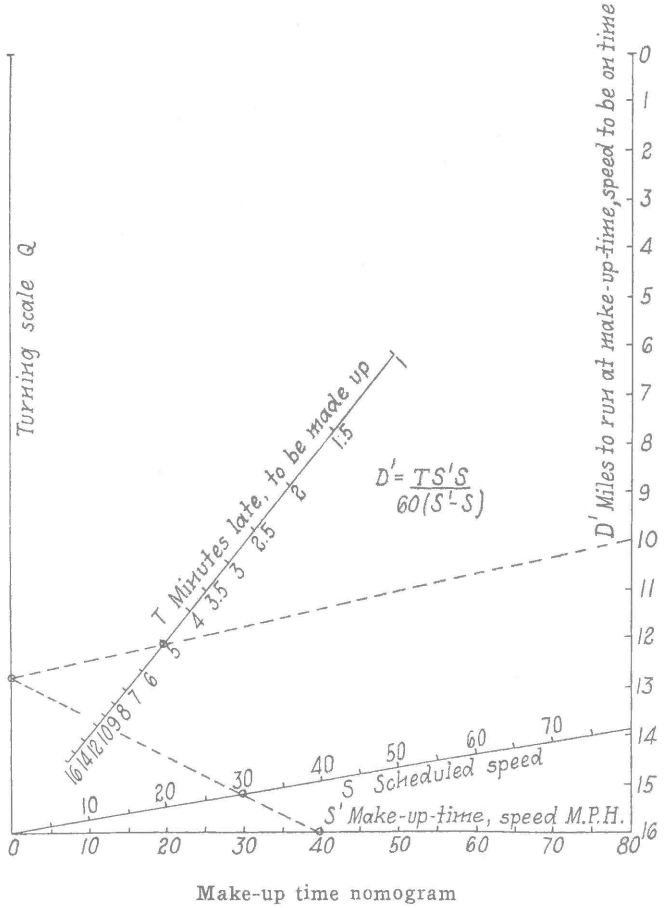
CARL P. NACHOD
Vice-President, Nachod & United States Signal Company, Louisville, Ky.

The accompanying illustration is a chart for make-up-time speed:

If a train is T minutes (5) behind time when running at scheduled speed, S m.p.h. (30), how far will it have to run on make-up-time speed of S′ m.p.h. (40) to be on time again?

Draw the secant line through 40 on scale S′ and through 30 on scale S, prolonging it to turning scale Q, whence it is to be reflected back through 5 on T, and prolonged until it cuts scale D′, which it does at 10 miles, the required distance. In short, the two dashed lines just drawn are an example of the use of this chart or nomogram, and they graphically solve the equation $D' = \frac{TS'S}{60\,(S'-S)}$ This formula is excerpted from the report of Committee 1, on the Economics of Railway Signaling, Vol. 37, No. 1, opp. p. 18.

Each secant cuts 3 scales at the intersections marked with little circles, and avoids by breaks, those intersections not significant. Any similar V line that might be drawn, each leg cutting the 3 proper scales, will cut out values from these scales that satisfy the equation. Moreover, the compactness of the nomogram is shown by the fact that the broken line gives the result of the multiplication of 4 quantities, the subtraction of two and the division of the former by the latter.



Make-up time nomogram

Testing Insulated Joints

"How do you test an insulated rail joint to determine whether current is leaking through the insulation?"

Using the Voltmeter and Ammeter

J. H. CRAIG
Atchison, Kan.

There are several types of insulated rail joints in service. The continuous insulated rail joint has been quite popular for several years, but has now been improved upon and the armored continuous insulated rail joint is being placed in service. Although each type of joint requires practically the same method of testing, the following tests apply particularly to the continuous and armored continuous insulated joint.

The insulated rail joint is installed for the purpose of dividing the track into the required length track circuits, and to insulate each track circuit from its adjoining circuit. Each track circuit has its own track battery.

The first inspection of an insulated rail joint is made visually. The bolts must be in their proper place and must be tight. All the insulation must be in its proper place, especially the bottom pieces, which occasionally on some joints have a tendency to work out lengthwise, The fibre side straps must be in place between the steel washer plate and the angle bar. The fibre washer plate should be noted carefully for breaks and cracks which are sometimes present over the bolt holes near the end of the plates. The end post will be noted to be sure it is in its place and that the rail ends are properly separated. The top pieces should be inspected for cracks and

breaks, especially at the end of the rails. Sometimes the insulation may be split or frayed just under the ball of the rail. Ballast should never be allowed to accumulate around an insulated joint in such a way that it will interfere with the inspection. Neither should ballast be allowed to prevent a joint from rendering its best service.

An insulated joint may be tested for defective insulation with a voltmeter and ammeter. The angle bar is

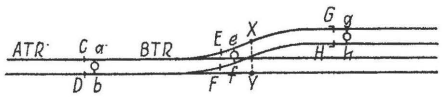


Diagram showing locations of test connections

the only part of an insulated joint that is insulated from the rail. The bolts may or may not be in contact with the rail. The bolts are also in contact with the steel washer plates. Therefore, any current that is detected on the bolts or washer plates, or armor, is legitimate. The bolts are insulated from the angle bars by bushings between the angle bars and the bolts. The steel washer plates are insulated from the angle bars by means of a small fiber washer plate. The angle bars are insulated from the rail with four pieces of insulation, two top pieces and two bottom pieces. Therefore, any battery that may be detected on the angle bar is improper.

The voltmeter is connected across the rails at *a* and *b* of B track circuit to determine the voltage of the battery. One meter lead will remain connected at *a*, the other meter lead will be connected to the angle bar, D, to determine if any battery is leaking through the insulating material. The meter lead should be attached to the angle bar at several points to insure the accuracy of the test. If the joint is properly insulated the voltmeter will not register. Any reading registered by the voltmeter is an indication of improper insulation. If the voltmeter does register it is well to connect the ammeter across the circuit in the same manner as the voltmeter to determine the amount of current that is leaking through the insulation.

The insulated joint C may now be tested by using the same method as was used to test insulated joint D.

To test the insulating properties of the end posts disconnect the battery from B track circuit then connect the voltmeter at points *a* and *b* to determine any battery that might be present. Any battery that is present is improper, and is an indication that an insulated joint at one or both ends of the track circuit is leaking. A defective end post would not necessarily be indicated by the voltmeter when the voltmeter was attached to the angle bar.

These tests are applicable to insulated joints located at BB, RB, RR, double signal, and single signal locations.

Insulated joint E may be tested by connecting the voltmeter at *e* and *f*, then move the meter lead *e* to various points on the angle bars of the insulated joint. Any registration of the voltmeter when thus connected is improper, and is an indication of faulty insulation.

Another test may be made by connecting the voltmeter across the rails at *e* and *f*, then disconnecting the fouling wire at either *x* or *y*. This test is made to determine the insulating properties of the end post in insulated joint E.

The insulated joint F can be tested only by attaching the voltmeter to the angle bars and to the opposite rail.

Insulated joints G and H can be tested to determine the leak through the insulation to the angle bars in the same manner as joints C and D were tested. A further test on joints G and H must be made by connecting the voltmeter across the rails behind the joints at *g* and *h* to determine any leak in the end posts and to serve as a check on the previous test.

Any faulty insulation should be renewed regardless of how small the leak because there is no method of determining when a complete break may occur which will cause trouble.

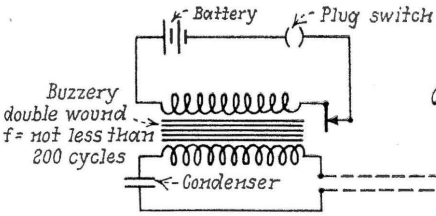
Suggests Test Circuit

S. N. Das
Assistant Tester (Special Duty)
East Indian Railway
Howrah, India

In a track circuit, under working conditions, in order to test whether an insulated joint is leaking, attention should first be given to avoid any failure or false indication of the track system itself. This can be easily obtained by a testing circuit as shown. The frequency of the buzzer should not be less than 200 cycles per second, and the headset receiver should be of a high resistance type of approximately 1,000 ohms. The condenser should be so tuned, as for buzzer frequency, that the circuit will offer the least impedance, i.e.,

$$\text{L ohms} = \frac{1}{\text{C ohms}}$$

With the headset on, the two leads with insulated handles are pressed hard against the rails, on either side of an insulated joint, and the intensity of the buzz indicates roughly the amount of current leakage.



Test circuit for testing insulated rail joints

Railroad Operation and Railway Signaling

NOTE: Answers to these questions are not solicited. If you have questions, please submit them to the What's the Answer department.

309-Q: *What general rules may be laid down for the design of track indicating relay controls at large interlockings?* A: The application of the following rules may be followed by reference to Fig. 49 which illustrates a set of track indicating relay controls for a comparatively large mechanical interlocking with position-light signals. 1.—Assign a track indicating relay for each home signal which is capable of displaying aspects requiring a check of track occupancy (in Fig. 49, note 3AN and 3AS for signals 4 and 12, opposing home signals on the same track). 2.—Prepare the stick feature for those track indicating relays which are to provide semi-automatic operation of their associated signals (in Fig. 49, signals 2, 4, 10, 12 and 16). 3.—Take battery over