control unit than if loop signaling were employed. Occasional difficulty may be experienced due to difficulty in obtaining satisfactory grounds where a speaker location may be in a rock-shelf area.

Use Ground Return

By J. A. Parkinson
General Superintendent
Communications & Signals
Santa Fe Railway System
Chicago, Ill.

We use ground return signal circuits on yard loudspeaker installations. Most of the speakers are located some distance from the control point, and it is more economical to install a ground rod at the speaker than to run a metallic circuit back to the control point. The disadvantage is that, in some locations where the yard is built on rock or certain other types of fill, it is difficult to secure a satisfactory ground return path In the isolated instances where is is difficult to secure a satisfactory ground, the metallic circuits would, of course, be an advantage and might be the more economical.

Basic Requirements

By Howard Alford
Assistant Communications Engineer
Chesapeake & Ohio
Richmond, Va.

A signaling circuit, regardless of its method or application, must meet certain well-defined specifications. A system using a ground return or metallic return circuit (reference to the metallic return circuit is understood to mean a grounded bare conductor connecting all loudspeaker points and returned to a central control point) must take into consideration that the electrode used must itself be a good electrical conductor, must be able to resist corrosion while in contact with various types of soil, must be capable of withstanding mechanical abrasion of foreign objects, and above all, must provide sufficient area in contact with the soil so that the resistance of the current path into, and through the earth, will be within the allowable limits for the particular application.

A necessary requirement of a ground return circuit is that the resistance of the earth path remain reasonably constant throughout the various seasons of the year. The choice of the type of signal system for any particular application is determined to a great extent by local conditions. In general, if the subsoil can be penetrated and is of reasonably low resistivity, the ground return system will perform satisfactorily in the majority of applications. An advantage of a ground return system is its low installation and maintenance cost. A disadvantage is that its use is limited to areas of low resistivity of soil.

An advantage of a metallic return system is that installations may be planned and installed in any locality without soil resistive tests or consideration of soil composition; gravel, sand, clay, loam. The disadvantage is the high cost and the precautions that must be taken to protect the conductor against chemical action and high resistive connections.

One Metallic System

By Richard W. Neill
President
R. W. Neill Co., Inc.
Chicago, Ill.

The advantage in using the ground-return method in contrast to the metallic circuit would be the savings in labor and cost of wire in providing the additional circuit. The only yard loudspeaker system in our experience that required a metallic ground-return was installed in Soo Line yard at Duluth, Minn. The yard was built on rock shelf terrain making it impossible to obtain a ground connection at the speaker locations or bury speaker wiring or cable. The ground-return from each speaker was connected to the messenger wire supporting the speaker line cable on a pole line.

Our method of circuitry consists of two conductors from the control console connecting to a line matching transformer in each speaker unit. The signaling push-button at the speaker unit is connected between a center tap on the line side of the transformer and ground. To obtain an adequate ground at the speaker location it is only necessary to bury 10 to 15 ft. of bare wire in the trench provided for the line wiring. Both conductors to each speaker are tied at the selector switch in the control unit to act as one conductor carrying a 24-volt d.c. potential for signaling purposes. This arrangement allows for operating speakers at approximately four times the distance from the control unit than if a loop signaling method were employed. When the speaker signal push-button is depressed to originate a call, the lamp relay in the control unit is actuated and holds through its own local circuit. If a loop signal circuit were used, the relay would hold through the speaker line loop causing a voltage drop and dimming of the indicating lamps if a number of calls were originated at one time.

Our method of connecting the speaker signal push-button between a center-tap on the transformer and ground, is to prevent interference when the call is answered by the control console operator in the event the person at the speaker location holds the push-button depressed it would not interfere with the conversation. If the push-button were connected between one side of the line and ground for signaling, it would short circuit the line in the event the push-button became defective or was held depressed. The signaling circuit employed in our yard loudspeaker systems operates very satisfactorily with a maximum of 375 ohms d.c. resistance path between the control unit and two-way speaker.

CTC Locking

In centralized traffic control territory, do you use approach or time locking? If you use approach locking, do you apply it throughout the territory or only at specific locations, such as passing tracks near important towns, interlockings, or on heavy grades?

Approach Locking

By C. L. Summers
Assistant to General Superintendent
Communications & Signals
St. Louis—San Francisco
Springfield, Mo.

On the Frisco, we use approach locking throughout centralized traffic control territory for main track moves. Our standard practice is to use non-coded d.c. track circuits, and four wire polarized line circuits with APB controls. Approach locking circuits are selected through the neutral contacts of opposing line relays at controlled signal locations, and locking is effective when a train enters a block between control points, or when the opposing line relay is de-energized by the APB tumbledown feature. This scheme has most of the advantages of separate approach locking circuits, and is much more economical in that separate line circuits are not required.

A disadvantage is that when the control operator has cleared more than one signal, and it is desired to

change the route, to avoid going in time, the signals must be returned to "Stop" in the order in which they would be approached by a train moving through the route. This feature, however, is not too objectionable, as the operators are aware of its presence, and the very rarely clear signals far enough in advance to result in a time delay, in event it becomes necessary to change a route. Time locking is used on all signals governing moves from siding to main tracks.

Approach and Time

By W. J. Pearson
Office and Estimating Engineer
Western Pacific
San Francisco, Calif.

The Western Pacific uses approach locking at interlockings and time locking for all other controlled signals in centralized traffic control territory. As non-coding track circuits and line circuits for approach check at interlockings were already in service at the time CTC was installed, a change to coded track could not be economically justified. The delays we have experienced, where only time locking is used, have been negligible.

Our opinion is that approach locking in CTC territory should be used only where the savings in train time can justify the expenditure. At interlockings where it is necessary to install approach circuits to indicate the approach of a train to an operator, or to approach clear signals at an automatic interlocking, the small added cost for approach locking is justified.

Time With One Exception

By M. R. Roberts
Principal Assistant Signal Engineer
Burlington Lines
Chicago, Ill.

For several years we have used time locking in our centralized traffic control, except in multiple-track, high-density traffic territory, on which we use approach locking. We do not use coded track circuits in this territory.

The reason for using time locking, instead of approach locking, is that it is more economical to install and maintain than approach locking, in that in most cases the use of approach locking would require an additional line circuit, and our practice is to use a thermal relay on the approach circuit to prevent momentary loss of shunt when approach locking is used. We feel that there is no particular advantage in approach locking over time locking in single track CTC in expediting the movement of trains. We have over 1,100 miles of single track CTC in service on which time locking is used, and we find that is has worked out very satisfactorily.

In multiple-track, high-density traffic territory where a number of crossover points and fleeting of movements are used, approach locking is justified to expedite the train movements and to permit last minute changes of line up.

Approach and Time

By W. E. Prince, Jr.
Signal Engineer
Clinchfield
Erwin, Tenn.

In our centralized traffic control territory, we use approach locking in every case where sufficient approach distance is available and relay control is feasible. Our reason for this is to permit immediate release of signal circuits when there is no possibility that a train has accepted the approach signal. At points where trains may leave a non-signaled track as from a yard to the main line or from a passing siding to the main line, we use straight time locking. It is possible that a location can have both time and approach locking, depending on the route selected. The time-element relay is set for the maximum length of time as determined by field observation of movements and distance to be traveled in approach to home signals. We do not make use of coded track circuits, but use approach relays or track repeater relays in approach locking.

Cost Favors Time

By A. C. Krout
Principal Assistant Signal Engineer
Southern Pacific
San Francisco, Calif.

Originally, we used approach locking on all of our CTC installations. However, on some of the more recent installations in more or less remote territory, we have deleted the approach locking and substituted time locking in lieu thereof. The chief reason was economic. However, at important junction points and switching locations in which considerable delay might occur if time locking only was used, we continue to use the approach locking. Furthermore, at such locations approach locking is of material benefit in reducing delays when signal department personnel are making tests involving approach locking. We do not use any coded track circuits in our approach locking circuits in CTC territory.

Straight Time

By A. C. McMahan
Chief Signal Draftsman
Union Pacific
Omaha, Neb.

The Union Pacific uses straight time locking throughout in centralized traffic control territory. Approach locking is used at some of our interlocking plants, where delay might result in pre-clearing of signals and it is desirable to change the route before a train occupies its approach. We see no other particular advantage in approach locking except for testing purposes.

Where approach locking is used, care must be taken to provide double wire, double break control, of the approach relays to prevent any possibility of losing the time. This often results in a number of additional wires on the pole line. Straight time locking is simple, safer, and requires less circuiting to install.

GEORGE WESTINGHOUSE, founder of the Union Switch & Signal Company, was enshrined, December 1, in the Hall of Fame for Great Americans at New York University. The presentation of the bust of George Westinghouse was made by William F. Ryan, president, American Society of Mechanical Engineers; and was unveiled by Walter J. Barrett, president, American Institute of Electrical Engineers. Herbert Hoover made the official address honoring Mr. Westinghouse. Only 86 persons have been elected to the Hall of Fame since it was founded in 1906.