Editorial Comment

Progress in the Use of Coded Track Circuits

As has been explained in articles published in these columns from time to time, coded track circuits have been in process of development for more than five years, and are now in service extensively on eight railroads. Therefore an analysis of their characteristics and their further application as compared with conventional circuits of the type used for many years, is in order.

The conventional practice, since the invention of the track circuit by William Robinson in 1872, has been to feed each track circuit by a constant flow of energy, as for example from a battery, and for this energy to hold the relay in the energized position except when a train shunts the rails, thereby causing the relay to be released. On the other hand, in a coded track circuit, the energy is fed intermittently as impulses, spaced at intervals of 75 per minute, for example, and the relay is, therefore, energized and released with corresponding frequency. Thus a shunt on the rails which reduces the current in the relay coil to less than the working value will prevent operation of the relay, whereas, in a conventional track circuit, the shunt must reduce the current to the release value of the relay which may be about half of its working current. Thus, in a coded track circuit, the Stop aspect is displayed when the relay current is reduced to slightly below its minimum working current, at which point the relay no longer follows code. Furthermore, coded relays can be and are designed to operate at a higher current value than conventional track relays. For these reasons, coded track circuits have better shunting characteristics than conventional track circuits. For the same reasons, it is claimed that coded circuits afford better broken rail protection.

The maximum length of a track circuit depends on the ballast leakage, low ballast resistance being the result of various conditions, as for example wet ballast, especially when it is full of dirt and in contact with the base of the rail. Zinc-treated ties, salt brine from refrigerator cars, sediment blown off from locomotive boilers, and even unburned coal dust contribute to low ballast resistance. Under highly favorable ballast conditions, conventional d-c. track circuits up to a mile or more in length have been operated successfully, but in order to insure satisfactory year-round operation, most roads consider that 3,000 ft. is about the maximum for a conventional d-c. track circuit. On the other hand, due to the operating characteristics of coded track relays, track circuits up to two miles in length can be and are being operated successfully where ballast conditions are good. Thus where the automatic blocks are as long as two miles, one coded track circuit serves for each block whereas two or more conventional d-c. circuits would be required. (A detailed discussion of 11,000-ft. coded track circuits on the Pennsylvania was published on page 427 of the August, 1940, issue.)

The relay of a coded track circuit must be operated continuously to control the signal to display a proceed indication. If foreign current holds the relay in the energized position, the most restrictive aspect will be displayed, whereas with a conventional track circuit, if foreign current holds the relay energized, a proceed aspect may be displayed. For this reason coded track circuits eliminate the possible hazard which may result from foreign current.

A conventional track circuit using a neutral relay serves only two purposes—to detect the presence of a train, thereby controlling the signal to its most restrictive aspect, or to detect the absence of trains, thereby controlling the signal for one proceed aspect. If two or more proceed aspects are desired, line-wire circuits are required. A polar track relay can be used to control a signal to display two proceed aspects, but line circuits are required for more aspects. With coded track circuits, however, the controls can all be accomplished on the rails; for example, using 75 code to control the Approach aspect, 120 for the Advance-Approach and 180 for the Clear. Other aspects such as Approach-Medium and Advance Approach Medium can be controlled by other codes, consisting of modulations of codes at the rates mentioned above, by using polarity of codes at these rates, or by using codes at higher rates per minute. The use of modulated code on the New Haven was discussed in the January, 1943, issue, and the use of polarity code on the New York Central is discussed in this issue. A project now being planned is to include the use of codes at 75, 120, 180 and 240 times each minute, to effect control of different aspects. Thus in these various installations, the controls of all signal aspects are accomplished by coded track circuits, and line wire circuits for these purposes are eliminated, this being one of the most important advantages of the use of coded track circuits.

For the control of signals, the feed of a coded track circuit is at the exit end, and the relay is at the entrance end, this being known as the normal direction feed. In the intervals between pulsations of this normal-direction code, impulses can be sent in the opposite direction, this being known as inverse code, which is used to control approach locking and train approach annunciators, and, with certain variations, to control highway crossing protection, thus obviating the use of line wire circuits for these purposes. Where inverse code is in service for approach locking, the inverse code can be used also to control the approach lighting of signal lamps. Where inverse code is not used, approach lighting controls are accomplished by a relay, either in series or in multiple with the feed to the track circuit in approach to the signal to be lighted.

Recognizing these various advantages of coded track circuits, several roads have made rather extensive installations, as has been explained in detail in articles published in these columns. These railroads have assisted in the development of the apparatus and circuits, to the point that coded track circuits, as such, may now be considered to perform the function intended in a reliable manner, and data have been assembled to show just how coded track circuits will operate under varying conditions. Therefore, on the whole, the next problem is to determine the application of coded track circuits, as compared with conventional track circuits, in the various systems of signaling.

On account of the fact that coded track circuits can be up to two miles in length, several roads have installed such circuits to advantage on multiple track lines on which each track is signaled for train movements in one direction only, the track circuits feed normal from the exit to the entrance end at all times, and all the advantages of controlling signals to different aspects are accomplished without the use of line wires. Likewise on single track, such as on the Milwaukee, the Pennsylvania, and the Louisville & Nashville, coded track circuits, always feeding at a certain rate and always feeding in one direction, are used to detect the presence or absence of trains, the control of signals to two proceed aspects being accomplished by line circuits. In such applications, the advantage of using coded track circuits is to permit the use of only one track circuit for each automatic block.

In centralized traffic control, the line code controls from the office to the field stations afford a means for initiating controls of track circuits to feed throughout the station-to-station block in the direction opposite that of the next train movement. With this arrangement, codes at various rates such as 75, 120, and 180, can be used to control signals to three or more Proceed aspects, thereby eliminating line control circuits. So far as we know, no road has installed single-track absolute permissive block signaling including coded track circuits. However, with all the possibilities of normal direction code, inverse code, and follow up code, undoubtedly the control of A.P.B. signaling can be accomplished exclusively by coded track circuits, and perhaps this will be done before many years.

Thus, except for territories where the track circuits must be cut into short lengths on account of local conditions, the use of coded track circuits offers advantages which should lead to their extensive adoption and use within the next few years.

Signaling on N.Y.C.

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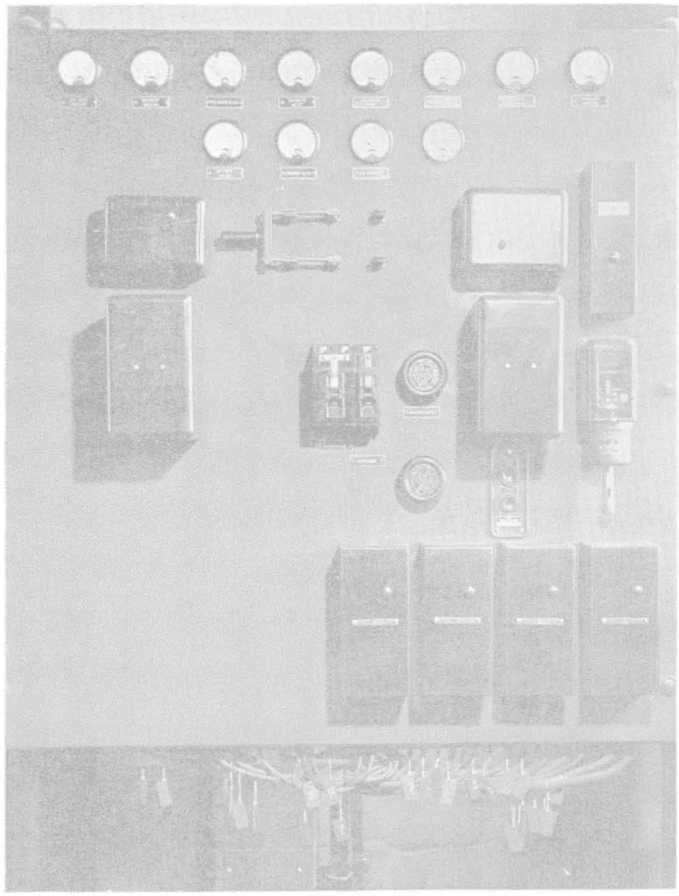
mistake when making connections. The incoming wires from the signals are connected to terminals on the top board, and the incoming wires from the rails are connected to terminals or block arresters on the bottom board. The relays are equipped with wall-type spring hangers, and the code transmitters are on spring bracket mountings.

The 550-volt arresters, fused plug cut-outs, code transmitters and part of the transformers are in one case, and a separate compartment of a case is used for the relays in connection with each of the four tracks, each compartment being 44 in. wide, 70 in. high and 16 in. deep. A door for each compartment is hinged at the top, and, when swung up, is supported by an iron rod; thus the door serves as protection from rain or snow. The cases and doors are made of 1½ in. pine, tongue and groove, and are painted two or more coats of black paint. The cases are supported at the ends on concrete posts.

A cable of aerial type construction with braided covering extends from the case to each searchlight signal unit. Each cable comes out through a separate hole in the rear of the case, and then the cables are held together by Raco straps to a stranded Copperweld messenger which goes up the signal bridge and across to the various signals. These cables are covered with Collins cable-coat, which protects the cable coverings from moisture and remains plastic so that it does not crack if the cables swing in the wind or are pushed.

The signaling reconstruction program discussed herein was planned and carried to completion by the signal forces of the New York Central, Lines East, under the direction of R. B. Elsworth, signal engineer; the new signals, coded track equipment, transformers, rectifiers, etc., being furnished by the General Railway Signal Company.



Automatic power panel at Corfu