

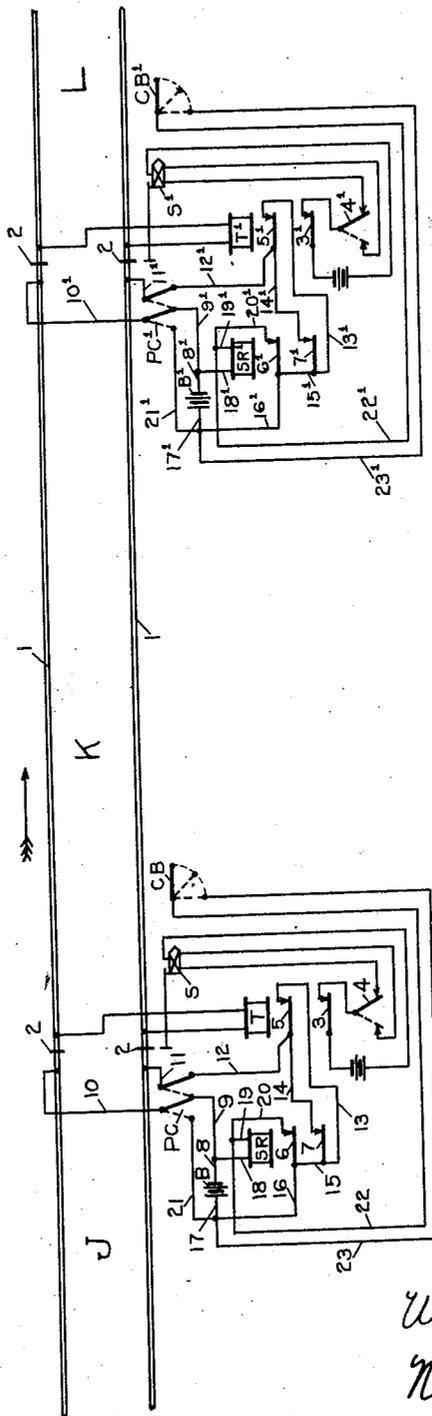
March 27, 1928.

1,664,054

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BLOCK SIGNAL SYSTEM FOR RAILROADS

Filed July 31, 1926



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BLOCK-SIGNAL SYSTEM FOR RAILROADS.

Application filed July 31, 1926. Serial No. 126,229.

This invention relates to automatic block signal systems for railroads, and more particularly to a block signal system employing semaphore signals and polarized track or line circuit control.

In the typical block signal employing polarized track or line circuit control, the reversal of polarity is obtained by a pole-changer mechanically operated by a semaphore signal; and if a signal should happen to stick for any reason and fail to assume its stop position, the pole-changer is not operated and the signal in the rear will indicate clear when it should indicate caution. Consequently, a train approaching an occupied block may fail to receive the necessary advance information and be able to stop in time. Even though some form of automatic train control system is employed, a signal stuck clear in the type of block signal system under consideration, as ordinarily installed, will fail to produce the desired caution control, since the trackway equipment of the train control system would be governed by the position of the signal, or the condition of the track or line relay, all of which would fail to reflect danger conditions ahead if the signal ahead should be stuck clear and not operate its pole-changer.

It has been proposed, as shown for example in the application of William S. Henry, Ser. No. 124,965 filed July 26, 1926, to control the supply of current to a polarized track circuit so that, if the semaphore signal fails to assume its stop position when its track relay is shunted, the track circuit current is cut off from the block in the rear and the signal in the rear assumes its stop position. In such an arrangement, however, the backing of a train into a block, or the opening of the switch in that block, will cause the track relays to be de-energized in succession, and their signals to move to the stop position, although these signals are working properly, this tumble down effect being produced because the track relays will drop one after another during the time taken for the semaphore signal to move to its stop position and operate its pole-changer.

The object of the present invention is to obviate the disadvantage just explained by organizing the control of the track circuit supply, when used as a check on the operation of the pole-changer, so that the track circuit current is cut off when a track relay

is shunted by a train running in the normal direction of traffic but not when the track relay is shunted by the opening of a switch, backing of a train into the block, or the like. More specifically, according to the present invention, a relay operated automatically by trains traveling in a normal direction of traffic is used to maintain the supply of track circuit current independently of the operation of the semaphore signal and its track relay, so that abnormal shunting of a track relay by the opening of a switch or the like, as distinctive from a normal train movement, will not cut off the supply of track circuit current during the time of the operation of the semaphore, and will not result in the tumble down action of the track relays. The invention also contemplates obtaining these desirable functions with the minimum amount of additional apparatus, and without additional line wire.

Various specific objects of the invention, its characteristic features and advantages will be in part apparent, and in part pointed out as the description progresses.

The accompanying drawing shows in a simplified and diagrammatic manner, in accordance with established convention, a typical embodiment of the invention applied to a block signal using polarized track circuits, semaphore signals, and pole-changers operated by the signals.

Referring to the drawing, the track rails 1 of the usual double track are divided by insulated joints 2 into blocks, one complete block K and the adjacent blocks J and L being shown. The direction of traffic is from left to right as shown by the arrow. Disregarding cut sections, special overlaps, and other particular conditions sometimes encountered in practice, it may be assumed that each block is equipped with the same devices and circuits; and for convenience these devices of the blocks shown are given the same reference characters with distinctive exponents.

At the entrance to each block is a semaphore signal S of any well known construction, operable to any one of three positions in the usual way. Each block is provided with a polarized track relay T. In the particular embodiment illustrated, in which it is assumed that direct current track circuits will be used, this track relay is of the well known neutral-polar type. It should be

understood, however, that the invention is applicable to alternating current block signal systems employing polarized track circuits, and is also adaptable to systems employing polarized line circuit control, as will be recognized by those skilled in the art. The track relay T controls its signals S through a neutral armature 3 and a polar armature 4 in the usual way. The track relay T has an additional neutral armature or contact finger 5 for carrying out the functions of the present invention.

Each signal S operates a pole-changer PC in the usual way, this pole-changer being mechanically connected to the signal and its mechanism and being shifted from one position to the other when the signal moves from its caution to its stop position, ordinarily at about 42 degrees. Each signal S is also provided with a circuit controller or circuit breaker CB, in accordance with well known practice, which has contacts closed only in the zero degree position of the signal, although if desired these contacts may be closed for several degrees above the horizontal or stop position.

Also associated with each signal is an auxiliary or check stick relay SR, which is of a relatively high resistance, such as 16 ohms, because it is connected across the track battery and is intended to be de-energized by the shunting action of a train entering the block. This relay has two neutral armatures or fingers 6 and 7. The track circuit is supplied from the regular track battery B, which may be a primary battery, or a storage battery; and the track circuit is assumed to be provided with the necessary limiting resistances and the like, in conformity with recognized practice.

Under clear traffic conditions, with no trains present, the parts and circuits are in the condition shown. The track battery is connected to the track rails by a circuit which, referring to the block J, may be traced as follows:—commencing with B, wires 8 and 9, pole-changer PC normal, wire 10, track rail through the track relay to the track rail, wire 11, pole-changer PC, wire 12, thence by either of two multiple paths, either through the front contact of finger 5 of track relay T and wire 13, or by wire 14 and front contact of finger 7 of relay SR, to wire 15 and thence by wires 16 and 17 back to the battery B.

The relay SR, having once been energized in the normal operation of the system, as hereinafter explained, is normally maintained energized by a stick circuit as follows:—battery B, wires 8 and 18, relay SR, wires 19 and 20, front contact and finger 6 of relay SR, and wires 16 and 17 back to the battery. It will be noted that the relay SR is in effect connected directly across the track battery B and across the track rails,

so that it is shunted by a train in the corresponding block.

To explain the operation, assume that a train enters the block J and drops the relay SR. As this train advances and enters the block K, the track relay T is shunted and cuts off the supply of track circuit current to the block J by opening its front contact 5, the relay SR being de-energized and its front contact 7 open. Assuming that the signal S is operating properly, as it drops below the caution position, the pole changer PC is shifted, establishing a supply of track circuit current to the block J of the reverse polarity, independent of the relays T and SR. The connections between the track battery B and the rails of the block J under these conditions may be traced as follows:—commencing at battery B, wires 8 and 9, pole changer PC shifted, wire 11, track rail through track relay and other track rail, wire 10, pole changer PC shifted and wires 21 and 17 back to the battery B. When the signal S reaches its stop position, the contacts of the circuit breaker CB close and establish a pick-up circuit for the relay SR as follows:—commencing at B, wires 8 and 18, relay SR, wires 19 and 22, contacts of circuit breaker CB and wires 23 and 17 back to the battery.

If at the time the train entered the block K as just explained, the semaphore signal S should, due to mechanical sticking, or for any other reason, fail to assume its stop position as it should, the supply of track circuit current to the block J in the rear is maintained cut off, so that the signal at the entrance to block J will remain in its stop position, so long as the train occupies the block K. In this way the defective operation of the signal is manifested by a more restricted indication of the signal in the rear; and this abnormal performance of the signal is ordinarily noticed by the engineers and reported.

Although the track circuit current to a block is cut off when a train enters the next block in advance during the time taken for the signal at the entrance to said next block in advance to move toward its stop position and operate its pole changer, under normal train movement, the block in the rear is ordinarily occupied by the rear end of the train, and in any event there would be merely a delay in the clearing of the signal in the rear. If, however, with the signal standing clear, the dropping of a track relay, due to the opening of a switch in a block or the like, should result in cutting off the track circuit current to the block next in the rear during the time taken for the semaphore signal to move toward its stop position, the tumble down effect, previously mentioned, would occur. This is because it takes a comparatively long time for a signal

to move to its stop position, as compared with the time for dropping of a track relay; and after a little consideration, it will be evident that, without some special provisions as contemplated by this invention, the cutting off of track circuit current to the block in the rear upon dropping of each track relay until the signal governed thereby has moved to the stop position would result in the first track relay dropping the next in the rear, the second track relay the third, and so on, there being time for several track relays to drop before the track circuit current to the first block is re-established by the completion of the movement of the semaphore. Such successive de-energization of track relays, in a tumble down fashion, with the accompanying movement of the signals toward their stop positions, is objectionable, it being evident that such abnormal operation of the signals would be confusing to engineers and tend to produce unexpected and unnecessary brake applications if train control were used.

The objectionable characteristic just explained is obviated in the present invention by virtue of the stick relay SR. This relay is automatically de-energized by trains traveling in the normal direction of traffic and breaks the shunt around the front contact 5 of the track relay T, so that this track relay is able to cut off the supply of track circuit current to the block next in the rear. In case the track relay T of the block K, for example, is shunted by the opening of a switch or the backing of a train into the block K, the dropping of said track relay T does not cut off the track circuit current to the block J in the rear, since the relay SR is at that time energized, not having been deenergized by a train moving in the normal direction of traffic into the block K. Consequently, abnormal shunting of the track circuit, by opening the switch or the like, does not produce a tumble down effect.

The specific embodiment of the invention shown and described is merely illustrative; and I desire to have it understood that various adaptations, additions, and modifications of the particular construction and arrangement of parts and circuits shown may be made in accordance with recognized practice without departing from the invention.

What I claim is:—

1. A block signal system for railroads comprising, a track divided into blocks each having a polarized track circuit, a semaphore signal at the entrance to each block governed by the track relay for that block, a pole-changer operated by each signal for controlling the polarity of the track circuit of the block next in the rear, means for interrupting the supply of track circuit current to each block when the block next in advance is occupied and the pole-changer

of the signal of said next block in advance is in its normal position but not if said pole-changer is in the reverse position, and means responsive to trains in a block for maintaining the supply of track circuit current to that block independently of said other means.

2. In a block system of the type described, the combination with polarized track circuits each having a track relay and a source of track circuit current, a pole-changer directly connecting said source of current to the track rails when the pole-changer is in one position, and a partial circuit connecting said source of current to the track rails of a given block with the pole-changer in the other position, said partial circuit including a front contact of the track relay of the block next in advance.

3. In a railway signalling system, the combination with blocks provided with polarized track circuits, a source of current and a pole-changer supplying current to each track circuit, a stick relay de-energized by the presence of a train in each block, and means governed by said stick relay of a given block and the track relay of the next block in advance for governing the supply of track circuit current to said given block.

4. In a block signal system for railroads having tracks divided into blocks each provided with a track relay, a semaphore signal at the entrance to each block, a circuit controller operated by each signal and closed only if that signal is in its stop position, a pole-changer operated by each signal, a stick relay having a pick-up circuit including said circuit controller and a stick circuit including its own front contact only, said stick relay being connected directly across the track rails and being thereby shunted by a train, and means for supplying track circuit current to each block including the pole-changer operated by the signal for the next block in advance, a front contact of the track relay of the block next in advance, and a front contact of said stick relay of the rear block, said front contacts of the track relay and stick relay being connected in multiple.

5. In a block signal system, blocks provided with polarized track circuits, a semaphore signal at the entrance to each block, a pole-changer operated by each signal for controlling the polarity of the track circuit current for the next block in the rear, means for interrupting the supply of current to the track circuit of a given block when its pole-changer is in the normal position and the track relay of the block next in advance is de-energized, and means governed by the presence of trains and the operation of the signal for rendering said last mentioned means ineffective.

6. In a block signal system of the type described, blocks provided with polarized

track circuits, a semaphore signal at the entrance to each block, means for interrupting the supply of track circuit current of normal polarity but not the reverse polarity when the block next in advance is occupied.

7. In a block signal system of the type described in which the track circuit current of normal polarity to each block is cut off if the block next in advance is occupied, of means for independently maintaining said supply of track circuit current of normal polarity until a train enters said block, said last mentioned means including a relay connected across the track rails and shunted by a train thereon.

8. In a railway signalling system, the combination with blocks provided with polarized track circuits, a semaphore signal at the entrance to each block, a source of current and a pole-changer operated by each signal for supplying track circuit current to the block next in the rear, of a stick relay connected across the track rails at the exit end of each block, and de-energized by the presence of a train in that block, means for energizing the stick relay of a given block if the signal of the block next in advance is in its stop position, and means for interrupting the supply of track circuit current to a given block if the stick relay of that block is de-energized and the block next in advance is occupied.

9. In a block signal system of the type described, including semaphore signals and polarized track circuits, the polarity of said track circuits being governed by pole changers operated by the signals, a circuit controller opened by the presence of a train in a block for cutting off the supply of track circuit current to the block next in the rear, and means responsive to the presence of a train in said rear block for providing a shunt around said circuit controller and thereby maintaining the supply of track circuit current independently of said circuit controller.

10. In a block signal system of the type described in which semaphore signals have

their caution indication determined by reversal of polarity by a pole-changer mechanically operated by the signal next in advance, a circuit controller in series with said pole changer and opened by the presence of a train in the corresponding block, and means including a stick relay connected across the track rails of a given block for normally shunting said circuit controller associated with the block next in advance.

11. In a block signal system of the type described in which the track circuit current of normal polarity to each block is cut off if the block next in advance is occupied, means for independently maintaining said supply of track circuit current of normal polarity until a train enters said block, said last mentioned means comprising a relay associated with the track circuit of said block and responsive to the flow of current in said track circuit.

12. In a block signal system, the combination with a track divided into blocks each having a track relay at one end and a supplemental relay at the other end, of means for cutting the track circuit current of normal polarity off of one block if the next block in advance is occupied, and means for independently maintaining said supply of track circuit current until a train enters said block including a normally closed contact of said supplemental relay.

13. In a block signal system of the type described in which the track circuit current of normal polarity to each block is cut off if the block next in advance is occupied, means for independently maintaining said supply of track circuit current of normal polarity until a train enters said block, said last mentioned means including a relay associated with that end of said block at which said track circuit current is supplied and cut off and which relay responds to the occupancy of said block.

In testimony whereof I affix my signature.

WALTER W. WENHOLZ.