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SIGNALING SYSTEM FOR SINGLE TRACK RAILROADS.

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1,277,643.

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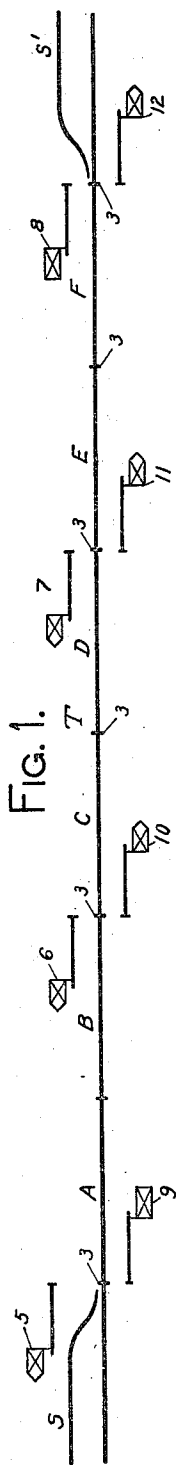

FIG. 1.

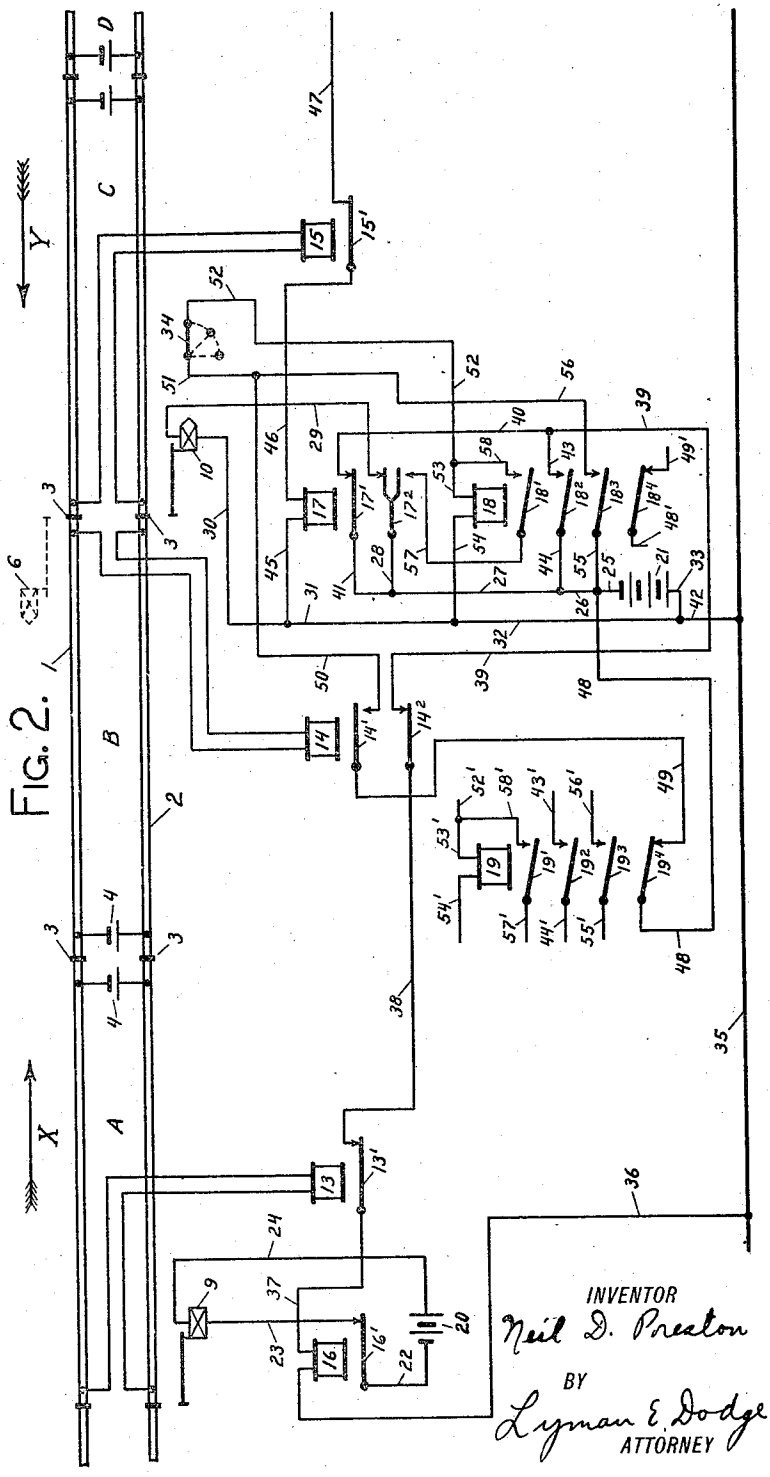

FIG. 2.

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SIGNALING SYSTEM FOR SINGLE-TRACK RAILROADS.

1,277,643. Specification of Letters Patent. **Patented Sept. 3, 1918.**

Application filed July 8, 1916. Serial No. 108,183.

To all whom it may concern:

Be it known that I, NEIL D. PRESTON, a citizen of the United States, and a resident of the city of Rochester, in the county of Monroe and State of New York, have invented a new and useful Signaling System for Single-Track Railroads, of which the following is a specification.

This invention relates to signaling systems for railroads, and more particularly to signaling systems suitable for single track railroads, and of the type commonly termed absolute permissive block signaling systems.

In the type of signaling systems for single track railroads to which this invention more particularly relates, certain signals are governed in one way by trains moving in one direction and in another way by trains moving in the opposite direction; and to accomplish this change in the character of the control of these signals according to the direction of movement of trains, a relay, commonly called a stick relay, is used. In one form of the signaling systems of this type, the stick relay associated with a signal is energized when a train traveling in the direction of traffic governed by that signal enters the track section in the rear of the signal, providing the signal is in an operated position; and this stick relay is maintained energized while and so long as the train occupies the track sections in advance of the signal and protected thereby. With this arrangement and manner of control of the stick relay, a difficulty, which will be more fully explained hereinafter, is encountered, in that the stick relay is not always energized as it should be when a fast moving short train, especially a light engine, passes the signal corresponding to that stick relay. This invention relates more especially to this type of single track signaling systems, although it is appreciated that the features of the invention may be advantageously applied to other types or forms of signaling systems.

One of the principal objects of this invention is to devise an arrangement of relays and controlling circuits therefor which will obviate the difficulty above mentioned and which will assure the proper energization of each stick relay regardless of the length of a train passing over the track and the speed at which this train is traveling, and regardless of the exact time required for the operation of the different relays or other parts which govern that stick relay.

Further objects of the invention are to improve the construction and operation of the signaling systems for single track railroads, especially in the manner and in the particulars pointed out hereinafter.

Other objects and advantages will appear as the description of the invention progresses, and the novel features of the invention will be particularly pointed out in the appended claims.

In describing the invention in detail reference is had to the accompanying drawing in which is illustrated a preferred physical embodiment of the invention, in which like reference characters designate like parts in the several views, and in which:

Figure 1 is a schematic view showing a stretch of single track between two passing sidings, and an arrangement of signals suitable for governing traffic over this stretch; and

Fig. 2 is a diagrammatic view showing an arrangement of controlling devices and electrical circuits therefor constituting a part of the signaling system schematically shown in Fig. 1.

Referring to Fig. 1, there is illustrated a stretch of single track, indicated by a single heavy line, and a passing siding S and S^1 at each end of this stretch of track. The stretch of single track is divided by insulating joints 3 in the usual manner into a number of track sections designated A, B, C, D, E and F. Each one of these track sections is provided with a track battery and a track relay as in the usual construction, and these track relays govern other relays and controlling circuits for governing the operation of these signals governing traffic over the stretch of track, a portion of these controlling circuits, together with the other relays being shown in detail in Fig. 2 and more fully described hereinafter. In Fig. 1 there are illustrated signals 5, 6, 7 and 8 for governing traffic from right to left, in the direction indicated by the arrow Y, and signals 9, 10, 11 and 12 for governing traffic from left to right, in the direction indicated by the arrow X. The signals 8 and 9 located at the right and left hand end of the stretch of single track, respectively, are of the type known as an absolute signal, whereas the other signals are of the type commonly

known as permissive signals. The characteristics of these different kinds of signals are well known in the art, and for the purpose of understanding this invention it is deemed unnecessary to further discuss the significance attached to these different types of signals, or to describe in detail wherein these signals are distinguishable, since this invention is in no wise dependent upon any particular kind of signals and may be advantageously used with light signals, as well as with the well known semaphore signals. In Fig. 1, however, the well known semaphore type of signal is shown; and in this case the absolute signals 8 and 9 are made distinguishable from the other permissive signals by reason of the fact that these absolute signals have square ended blades, while the permissive signals have pointed blades.

The general scheme of operation of the signaling system schematically shown in Fig. 1 may be briefly described as follows: The movement of a train in either direction upon the stretch of single track causes all of the signals governing traffic in the opposite direction to assume their biased stop position; that is, if a train enters the track section A while traveling in the direction indicated by the arrow X, the signals 6, 7 and 8 governing traffic in the opposite direction assume their stop position. As the train progresses along the stretch of single track these opposing signals governing traffic in an opposite direction are held in their stop position until the train passes them, that is, with a train traveling in the direction indicated by the arrow X, the signal 6 will be held in the stop position until the train has entirely passed this signal, the signals 7 and 8 being also held in the stop position in the meantime, the signal 7 will be held in the stop position until the train entirely passes this signal, and likewise the signal 8 will be held in its stop position until the train has entirely left the track section F. In this way, when a train enters the stretch of single track from either end, the entrance of any other train into said stretch at the opposite end is prevented. Furthermore, when a train enters the stretch of single track traveling in either direction, the signals governing traffic in the direction in which the train is traveling are successively caused to assume, first, a horizontal or stop position, second a diagonal or caution position and finally a vertical or clear position; that is, with a train traveling in the direction of the arrow X, the signal 9 is in the stop position while this train occupies the track sections A and B, is in the diagonal or caution position while the train occupies the track sections C and D, the signal 10 at this time being in the stop position; and when the train proceeds into the track sections E and F the signal 11 assumes its horizontal or stop position, the signal 10 its diagonal or caution position, and the signal 9 its vertical or clear position. In this way while one train is passing through the stretch of single track, another train traveling in the same direction as the first train may enter said stretch of track and be properly governed by signals. In this connection it is stated that the control of the signals to the diagonal or caution position is not shown in detail in the diagrammatic illustration in Fig. 2, since various arrangements for causing a signal to assume its diagonal or caution position when the next signal in advance is in the horizontal or stop position are well known in the art, and if illustrated in Fig. 2 will only serve to unnecessarily complicate the drawing.

In Fig. 2 of the drawing there are shown track sections A, B and C corresponding to the track sections A, B and C in Fig. 1, and controlling circuits suitable for governing the signals 9 and 10, also corresponding to the signals 9 and 10 in Fig. 1. In Fig. 2, the numerals 1 and 2 designate the track rails of the stretch of single track, the separate rail sections thereof being suitably bonded together in the well known manner, and the numeral 3 designates insulating joints interposed in the track rails 1 and 2 and serving to divide the track into the electrically isolated track sections A, B and C. At one end of each track section a track battery 4 is connected across the track rails 1 and 2; and at the other end of each track section a track relay is connected across said track rails, the track relays for the track sections A, B and C being designated 13, 14 and 15, respectively. Associated with the signal 9 is a relay 16, hereinafter termed a line relay, and associated with the signal 10 is a line relay 17. Associated with the signal 10 is another relay 18, hereinafter termed a stick relay. These different relays are each provided with armatures or contact fingers which are illustrated in the drawing conventionally. In practice, ordinarily each relay has only one armature, properly speaking, which in turn controls one or more contact fingers; but for simplicity the different contact fingers or circuit controlling members of each relay will be termed armatures, and for convenience these armatures are given the same reference characters as the corresponding relay, with distinctive exponents added thereto. Although certain relays have been designated as track relays, certain others as line relays, and certain others as stick relays, these designations are chosen merely for the sake of convenience; and it should be clearly understood that there is in practice ordinarily no essential difference in construction and operation between the relays so designated, and further

that each of these relays is of any one of the well known or ordinary types of relays used for signaling purposes.

Extending the full length of the track protected by the signaling system is an insulated conductor, commonly termed a common wire and designated 35 in Fig. 2. As is well understood by those skilled in the art of railway signaling this common wire 35 forms a part of one or more controlling circuits extending between different signal locations, and for convenience certain of the circuits hereinafter traced will be traced from the common wire 35 at one point back to this common wire at another point, it being obvious that the common wire serves to complete these circuits.

It should also be understood that while the controlling circuits for the signals 9 and 10 only are illustrated in Fig. 2, the controlling circuits for the signals 7 and 8 governing traffic in the opposite direction are the same; and furthermore that the relays and controlling circuits associated with the signals 11 and 6 are the same as those shown in Fig. 2 associated with the signal 10, and that the relays and controlling circuits associated with the signals 5 and 12 may or may not be the same as those shown associated with the signal 10 in Fig. 2, as desired. Located at the signal 9 is a battery 20 or other source of electrical energy; and at the signal 10 is located a similar battery 21. Associated with the signals 6, 7, 10 and 11 is a circuit controller designated 34 in Fig. 2, which is of any suitable construction and is illustrated conventionally; and this circuit controller is operated by the semaphore arm or its operating mechanism of the corresponding signal and is closed when that semaphore arm is in its vertical position.

Each signal is controlled by a line relay; and the controlling circuit for the signal 9, which, as explained hereinbefore, is shown such that it is suitable for controlling the signal 9 to only two positions, may be traced as follows: commencing at the battery 20, conductor 22, armature 16^1 of the line relay 16 in its upper position, conductor 23, operating mechanism of the signal 9 (not shown), and conductor 24, back to the battery 20.

The controlling circuit for the signal 10 may be traced as follows: commencing at the battery 21, conductors 25, 26, 27 and 28, armature 17^2 of the line relay 17 in its upper position, conductor 29, operating mechanism of the signal 10 (not shown), and conductors 30, 31, 32 and 33, back to the battery 21.

The controlling circuit for the line relay 16 may be traced as follows: commencing at the common wire 35, conductor 36, line relay 16, conductor 37, armature 13^1 of the track relay 13 in its upper position, conductor 38, armature 14^2 of the track relay 14 in its upper position, conductors 39 and 40, armature 17^1 of the line relay 17 in its upper position, conductors 41, 27, 26 and 25, battery 21 and conductors 33 and 42, to the common wire 35.

There is a shunt for the armature 17^1 of the line relay 17 comprising conductors 40 and 43, armature 18^2 of the stick relay 18 in its upper position, and conductors 44, 27 and 41, and this shunt is closed when the stick relay 18 is energized. From a consideration of the controlling circuit for the line relay 16 last traced, and the shunt controlled by the stick relay 18, it can be seen that when the line relay 17 is deënergized and its armature 17^1 is in its lower position, the line relay 16 will also be deënergized regardless of the fact that the track sections A and B are not occupied, provided the stick relay 18 is not energized at that time. On the other hand, when the stick relay 18 is energized and its armature 18^2 is in its upper position, the line relay 17 may be deenergized and its armature 17^1 in its lower position, and nevertheless the line relay 16 may be energized, provided the track sections A and B are not occupied at that time.

The controlling circuit for the line relay 17 may be traced as follows: commencing at the common wire 35, conductors 42, 32, 31 and 45, line relay 17, conductor 46, armature 15^1 of the track relay 15 in its upper position, conductor 47, and thence through an armature and its front point of a line relay connected to the track section D, and thence through an armature and its front contact of the line relay associated with the signal 11, which armature and front contact is shunted when the stick relay associated with the signal 11 is energized, the control circuit for the line relay 17 being controlled by the line relay and the stick relay associated with the signal 11 in exactly the same way as the controlling circuit for the line relay 16 is controlled by the line relay 17 and the stick relay 18.

The preliminary energizing or pick-up circuit for the stick relay 18 may be traced as follows: commencing at the battery 21, conductors 25 and 48, armature 19^4 of the stick relay 19 associated with the signal 6, when said armature is in its lower position, conductor 49, armature 14^1 of the track relay 14 in its lower position, conductors 50 and 51, circuit controller 34 of the signal 10 in its closed position, conductors 52 and 53, stick relay 18 and conductors 54, 32 and 33, back to the battery 21.

There are two circuits for maintaining the stick relay 18 energized, one of which may be termed the preliminary stick circuit and the other the final stick circuit. The preliminary stick circuit for the stick relay 18 may be traced as follows: com-

mencing at the battery 21, conductors 25 and 55, armature 18^3 of the stick relay 18 in its upper position, conductors 56 and 51, circuit controller 34 of the signal 10 in its closed position, conductors 52 and 53, stick relay 18, and conductors 54, 32, and 33, back to the battery 21.

The final stick circuit for the stick relay 18 may be traced as follows: commencing at the battery 21, conductors 25, 26, 27 and 28, armature 17^2 of the line relay 17 in its lower position, conductor 57, armature 18^1 of the stick relay 18 in its upper position, conductors 58 and 53, stick relay 18, and conductors 54, 32 and 33, back to the battery 21.

The armature 17^2 of the line relay 17 is preferably so constructed that when it moves to the lower position it makes contact with the conductor 57 before it breaks contact with the conductor 29, this arrangement being commonly termed a make-before-break contact. This make-before-break contact may be obtained in various ways, but is illustrated in Fig. 2 conventionally as consisting of two resilient arms, carried by the armature 17^2, the construction being such that during the downward movement of the armature 17^2, the resiliency of the upper arm maintains electrical contact with the conductor 29 until the lower arm makes electrical contact with the conductor 57, the upper arm, however, breaking contact with the conductor 29 when said armature is in its lowermost position.

Operation.

Assume that a train traveling from right to left in the direction indicated by the arrow Y enters the stretch of single track at the track section F. The shunting of the track relay connected to the track section F results in the deënergization of the line relay associated with the signal 11; and the deënergization of this line relay in turn causes a deënergization of the line relay 17, which in turn causes a deënergization of the line relay 16, whereupon all of the signals 9, 10, 11 assume their biased or stop position. While all of the controlling circuits involved in the above operation are not shown in Fig. 2, the reason why this operation occurs will be apparent when it is remembered that the controlling circuits associated with the signal 11 are exactly the same as those associated with the signal 10, and shown in detail in Fig. 2. To explain more fully, it can be seen from the controlling circuit for the line relay 16, that the controlling circuit for the line relay associated with the signal 11 is governed by the track relays connected to the track sections E and F, so that when the train first enters the track section F it interrupts the controlling circuit for the line relay associated with the signal 11, and causes the deënergization of this line relay. When the line relay associated with the signal 11 is deënergized, remembering that the line relay and the stick relay associated with this signal govern the line relay 17 associated with the signal 10 in the same way as the line relay 17 and the stick relay 18 govern the line relay 16, it can be seen that since the stick relay at the signal 11 is at this time deënergized, the deënergization of the line relay at the signal 11 interrupts the controlling circuit for the line relay 17. When the line relay 17 is deënergized and its armature 17^1 moves to its lower position, the controlling circuit for the line relay 16 is interrupted, since the stick relay 18 at this time is deënergized by reason of the fact that its pick-up circuit is broken at the armature 14^1 of the track relay 14.

From the foregoing it can be seen that when a train traveling from right to left, in the direction indicated by the arrow Y enters the stretch of single track all of the opposing signals, as the signals 9, 10 and 11 assume their biased or stop position; and during the movement of a train through the stretch of single track these signals are held in their stop position until the train passes each one in turn.

As the train in question passes through the successive track sections the signals 6, 7 and 8 are controlled in exactly the same way as the signals 9, 10 and 11 are controlled by a train moving from left to right in the direction indicated by the arrow X; and this way in which the signals 9, 10 and 11 are controlled by the train traveling in the direction indicated by the arrow X will now be described.

When the train traveling in the direction indicated by the arrow X enters the track section A, the shunting of the track relay 13 drops the armature 13^1 of this track relay and interrupts the controlling circuit for the line relay 16, whereupon the armature 16^1 of said line relay drops and interrupts the controlling circuit for the signal 9 and causes said signal to assume its biased or stop position. As the train progresses and enters the track section B, the track relay 14 is shunted, and its armature 14^2 opens another break in the controlling circuit for the line relay 16, thereby holding the signal 9 in its stop position. The dropping of the armature 14^1 of the track relay 14 closes the pick-up circuit for the stick relay 18; and as soon as the armatures of this stick relay assume their upper position, the preliminary stick circuit controlled by the armature 18^3 of said stick relay and the circuit controller 34, is established. As the train progresses and enters the track section C, the shunting of the track relay 15 and the dropping of its armature 15^1 interrupts the con-

trolling circuit for the line relay 17, thereby causing the armatures 17^1 and 17^2 of this line relay to move to their lower position.

Referring first to the controlling effect produced on the stick relay by the deënergization of the line relay 17, the armature 17^2 of said line relay in dropping, makes contact with the conductor 57 before it breaks contact with the conductor 29; and in this way the final stick circuit is established before the controlling circuit for the signal 10 is broken and before the signal 10 moves toward its biased position and opens the circuit controller 34. Referring now to the effect produced upon the line relay 16 by the deënergization of the line relay 17, it can be readily seen that while armature 17^1 of the line relay 17 interrupts one of the multiple paths by which current may be supplied to the line relay 16, the armature 18^2 of the stick relay 18, being in its upper position, closes the other multiple path, whereby, regardless of the fact that the line relay 17 is deënergized, the line relay 16 may be energized and the signal 9 caused to assume an operated position as soon as the train in question has entirely left the track sections A and B. In this connection it is noted that the signal 10 being in the horizontal or stop position, the signal 9 would, in practice, assume the caution position by reason of certain controlling circuits well known in the art, which, for simplicity, have not been illustrated in Fig. 2.

As the train progresses and enters the track section D, the signal 10 is held in its biased or stop position, and the stick relay associated with the signal 11 is picked up; then, as the train progresses into the track section E, the signal 11 assumes its stop position, and since the stick relay at the signal 11 is energized and maintained energized in the same way as hereinbefore described in connection with the stick relay 18, when the train entirely leaves the track sections C and D, the signal 10 may assume an operated position, for the same reason and in the same way as the signal 9 was able to assume an operated position when the train had entirely left the track sections A and B. As the train progresses into the track section F, the signal 11 is in its stop position; and if desired, the controlling circuit associated with the signal 12 may be so constructed that a stick relay may be used and energized at that time, although this is not essential; but in either case, after the train has entirely left the track sections E and F, the signal 11 may assume an operated position. During this movement of the train from left to right the signals 6, 7 and 8 governing traffic in the opposite direction are caused to assume their stop position and are held in this position, in the same way as hereinbefore explained in connection with a movement of a train from right to left.

Referring again to the operation of picking up and sticking up the stick relay 18, it can be seen that this stick relay will be picked up and stuck up regardless of the length of the train or of the speed at which it is traveling. To illustrate, when a train traveling from left to right, in the direction indicated by the arrow X, enters the track section B, the track relay 14 will be shunted and the pick-up circuit for the stick relay 18 will be established regardless of the length of the train or of the speed at which it is traveling. As soon as the stick relay 18 is energized and its armature 18^3 is in its upper position, the preliminary stick circuit, hereinbefore traced, is established; and consequently, regardless of the fact that the track relay 14 may be almost instantly reenergized when the train passes from the track section B into the track section C, so that there may be a brief interval of time in which the track relay 14 is energized and the line relay 17 also energized, nevertheless, the stick relay 18 remains energized, due to the preliminary stick circuit. Shortly after the train enters the track section C, the armature 15^1 of the track relay 15 will break the circuit for the line relay 17 and cause its armature 17^2 to move to its lower position; but it is apparent that it is immaterial as far as the operation of the stick relay is concerned, how much time is required for the track relay 15 and the line relay 17 to become deënergized, since the stick relay is maintained energized by the preliminary stick circuit during this time. Furthermore, regardless of the length of time required for the armature 17^2 of the line relay 17 to assume its lowermost position, it is certain that because of the make-before-break contacts hereinbefore described, the final stick circuit for the stick relay 18 will be established before the controlling circuit for the signal 10 is broken and consequently before the circuit controller 34 can move to any extent. For this reason the circuit controller 34 may be, if desired, quick acting, that is, may open instantly as soon as the controlling circuit for the signal 10 is broken; and yet this quick action of the circuit controller 34 will not interfere with the proper energization of the stick relay 18.

The advantage of the arrangement of the controlling circuit above described for the stick relay 18 may be made clearer if it is assumed that the preliminary stick circuit controlled by the armature 18^3 is absent. With this condition it can be seen that a short and fast moving train may enter and leave the track sections C and B, respectively, in such rapid succession that before there is time for the track relay 15 and the line relay 17 to become deënergized so as to

establish the stick circuit for the stick relay 18, the track relay 14 will become reënergized and raise its armature 14^1 to interrupt the pick-up circuit for the stick relay. In this connection it should be noted that relays as they are ordinarily constructed at the present time, will cause their armatures to raise much quicker than they will allow them to drop; and it is evident that this characteristic of relays only serves to accentuate the difficulty just described. It is appreciated that the difficulty just described may be remedied in other ways than by means of the arrangement of controlling circuits shown in the accompanying drawing and described hereinbefore; but a significant feature of the arrangement of the controlling circuit embodying this invention is that the proper energization of the stick relay is not made dependent in anywise upon the relative time required for the operation of certain relays. In other words, while the difficulty above mentioned might be obviated for instance by making the stick relay 18 slow acting in dropping its armatures, or by other changes in the time required for the operation of the other relays or parts, it is possible for this timing of operation to become deranged; whereas according to the arrangement of controlling circuits embodying this invention the time required to energize or deënergize any of the relays involved in the control of the stick relay 18, the time required for the signal 10 to commence its movement toward the biased position, or the time of operation of the circuit controller 34 may vary through a wide range without affecting the proper energization of the stick relay 18. Ordinarily the time required for a semaphore signal to move to its biased position will not vary appreciably and by making the circuit controller 34 such that it will remain temporarily closed after the controlling circuit for the corresponding signal, as 10, is first broken by the dropping of the armature of the corresponding line relay, it is possible to dispense with the make-before-break contacts on said armature.

The pick-up circuit for the stick relay 18, hereinbefore traced, includes the armature 19^4, in its lower position, actuated by the stick relay 19 associated with the signal 6; and in the same way the pick-up circuit for the stick relay 19 which is the same as that for the stick relay 18, includes the armature 18^4 of the stick relay 18 in its lower position. In other words, the pick-up circuit for the stick relay 18 is controlled by the stick relay 19 of the adjacent opposing signal 6, and said stick relay 18 cannot be preliminarily energized when the stick relay 19 is energized, or vice versa. The significance of this control of each stick relay by the stick relay of the adjacent opposing signal may be made clearer by explaining the operation under a special condition where this mutual control is necessary to give proper protection to train movement. Assume a train traveling from right to left in the direction indicated by the arrow Y, and assume that this train has entered the stretch of single track and has progressed until it occupies the track section B. If there is no train following this train so that the track sections C, D, E and F are not occupied, it can be seen that the signal 10 may assume its vertical or clear position; and consequently with the train under consideration in the track section B, the pick-up circuit for the stick relay 18 would be established, assuming that the control of this pick-up circuit by the stick relay 19 were absent. Then, suppose a second train also traveling from right to left in the direction indicated by the arrow Y, enters the track section F. This second train would cause the line relays associated with the signals 11 and 10 to be deënergized and said signals to assume their stop position as explained hereinbefore; and, consequently the stick circuit for the stick relay 18 could be established, it being remembered that the stick relay 18 has been energized previously by the first train on the track section B. Then, as the first train proceeds through the track sections A and B out of the stretch of single track, the line relay 16 could be energized and the signal 9 might assume its clear position, in spite of the fact that the second train is in the stretch of single track and traveling from right to left, the energization of the line relay 16 being possible, as explained hereinbefore, because the stick relay 18 is energized. Obviously, the special case above described does not afford proper protection to the second train; but in this discussion it was assumed that the control of the pick-up circuit for the stick relay 18 by the armature 19^4 of the stick relay 19 was omitted so that the above described dangerous condition can not occur in the particular arrangement of controlling circuits embodying this invention. The reason for this can be seen by noting that the stick relay 19 is energized when the first train enters the track section C, in the same way as hereinbefore explained in connection with the stick relay 18; and, consequently when this first train progresses and enters the track section B, although the track relay 14 is shunted so as to close the normally open break in the pick-up circuit for the stick relay 18, there already exists at the armature 19^4 of the stick relay 19, another break in said pick-up circuit. It should be noted that the control of the stick relay 18 by the stick relay 19 does not interfere with the proper energization of the stick relay 18 by a train traveling

from left to right, since when a train traveling in this direction enters the track section B, the stick relay 19 will be deënergized.

In the arrangement of controlling circuits illustrated in Fig. 2, the final stick circuit is shown as controlled by the armature 17^2 of the line relay 17, and the pick-up circuit for said stick relay is shown as controlled by the circuit controller 34; but it is apparent that said armature 17^2 and said circuit breaker 34 are subjected to the same controlling influence, namely, the line relay 17, and consequently may be used interchangeably, if desired. Thus, if occasion requires, the circuit controller 34 may be replaced by an armature on the line relay 17, one such occasion, which may be mentioned, being that in which light signals instead of semaphore signals are used. Other modifications, rearrangements and alterations in the particular embodiment of the invention illustrated might be made without departing from the invention, and consequently I do not wish to be restricted to the details of construction and arrangements of parts and circuits shown and described.

Although I have particularly described the construction of one physical embodiment of my invention, and explained the operation and principle thereof; nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a circuit controller governed by a predetermined portion of said stretch and closed when that portion of the stretch is occupied; another circuit controller governed by another portion of said stretch and open when that latter portion is occupied; a stick relay; a pick-up circuit for said stick relay including in series said circuit controllers; coöperating contacts operated by the relay itself and closed when that relay is energized; a preliminary stick circuit for said stick relay including said another circuit controller and said coöperating contacts; a final stick circuit governed by said relay and having two normally open breaks therein; means governed by said stick relay for closing one of said breaks when that relay is energized; means for closing the other normally open break so long as said another portion of said stretch of track is occupied; and means for signaling governed by said stick relay.

2. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a circuit controller governed by a predetermined portion of said stretch and closed when that portion is occupied; another circuit controller governed by another portion of said stretch of track and open when that portion is occupied; a stick relay; a controlling circuit for said relay including in series both of said circuit controllers; coöperating contacts operated by said relay and closed when said relay is energized; another controlling circuit for said relay including in series said coöperating contacts and said another circuit controller; means for maintaining said relay energized after it has been energized so long as said another portion of the track is occupied; and means for signaling governed by said stick relay.

3. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a stick relay; a pick-up circuit for said relay; a preliminary stick circuit for said relay governed by the relay itself; a final stick circuit for said relay governed by the relay itself; means controlled by the track circuit sections of a predetermined portion of said stretch of track for establishing said circuits in immediate succession in the order named, each succeeding circuit being established prior to the interruption of the next preceding circuit; and means for signaling governed by said stick relay.

4. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a signal having a biased position and an operated position and governing traffic over said stretch; a circuit controller subjected to the same controlling influence as said signal and closed when said signal is in its operated position; a relay governed by a portion of the stretch of track protected by said signal; a second circuit controller governed by the track circuit section next in the rear of said signal; a stick relay; a pick-up circuit for said relay including in series both of said circuit controllers; coöperating contacts operated by said stick relay and closed when it is energized; a preliminary stick circuit for said relay including in series said coöperating contacts and said first mentioned circuit controller; other coöperating contacts operated by said stick relay and closed when that relay is energized; a final stick circuit for said stick relay including said last mentioned cooperating contacts and having a normally open break therein; means controlled by said first mentioned relay for closing said normally open break; and means for signaling governed by said stick relay.

5. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a signal having an operated position and a biased position and

governing traffic over said stretch; a circuit controller subjected to the same controlling influence as said signal and closed when said signal is in its operated position; a stick relay; a controlling circuit for said stick relay including said circuit controller; means governed by a track circuit section adjacent to said signal for closing said controlling circuit; coöperating contacts operated by said stick relay and closed when it is energized; another controlling circuit for said stick relay including said coöperating contacts and said circuit controller; means for maintaining said stick relay energized after it has been initially energized so long as the portion of track protected by said signal is occupied; and means for signaling controlled by said stick relay.

6. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a slow acting circuit controller governed by the track circuits of a portion of the stretch and closed when that portion is not occupied; a stick relay; an energizing circuit including said circuit controller and the back point of the track relay of a track section adjacent to said portion; a shunt for said back contact which is closed when said stick relay is energized; and means for maintaining said stick relay energized after it has been initially energized so long as said portion of the track is occupied.

7. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a normally closed line circuit controlled by the track circuits of a predetermined portion of the stretch; a stick relay; an energizing circuit for said stick relay controlled by said line circuit and a predetermined track circuit adjacent to said portion of the stretch, said energizing circuit being established when said predetermined track circuit is occupied and said line circuit closed; and two stick circuits for said relay controlled by the relay itself, said stick circuits having their continuity separately dependent upon the line circuit being respectively closed and broken.

8. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a line circuit controlled by the track circuits of a portion of said stretch; a stick relay; a circuit controller governed by said line circuit and closed when said portion of the stretch is not occupied; a preliminary stick circuit for said relay including said circuit controller; another circuit controller governed by said line circuit and closed when said portion of the stretch is occupied; and a final stick circuit for said stick relay including said another circuit controller.

9. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a first circuit controller and a second circuit controller governed by a track circuit and respectively opened and closed when the track circuit is occupied; a stick relay; an energizing circuit for said stick relay including the first circuit controller and governed by another track circuit; a stick circuit for said stick relay including the second circuit controller; and means for maintaining said stick relay temporarily energized after it has been initially energized until said second circuit controller is closed.

10. In a signaling system for railroads, in combination: a stretch of track divided into track circuit sections; a normally closed line circuit controlled by the track circuits of a portion of said stretch; a normally closed circuit controller and a normally open circuit controller governed by said line circuit and respectively opened and closed when said line circuit is broken by the presence of a train on said portion of the stretch; a stick relay; an energizing circuit for said relay including said normally closed circuit controller; a stick circuit for said relay including said normally open circuit controller; and means controlled by said normally closed circuit controller and by the stick relay itself for maintaining said stick relay energized after it has been initially energized until said stick circuit is established by the closing of the normally open circuit controller.

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