April 21, 1936. J. E. WILLING 2,038,094

RAILWAY SIGNALING SYSTEM

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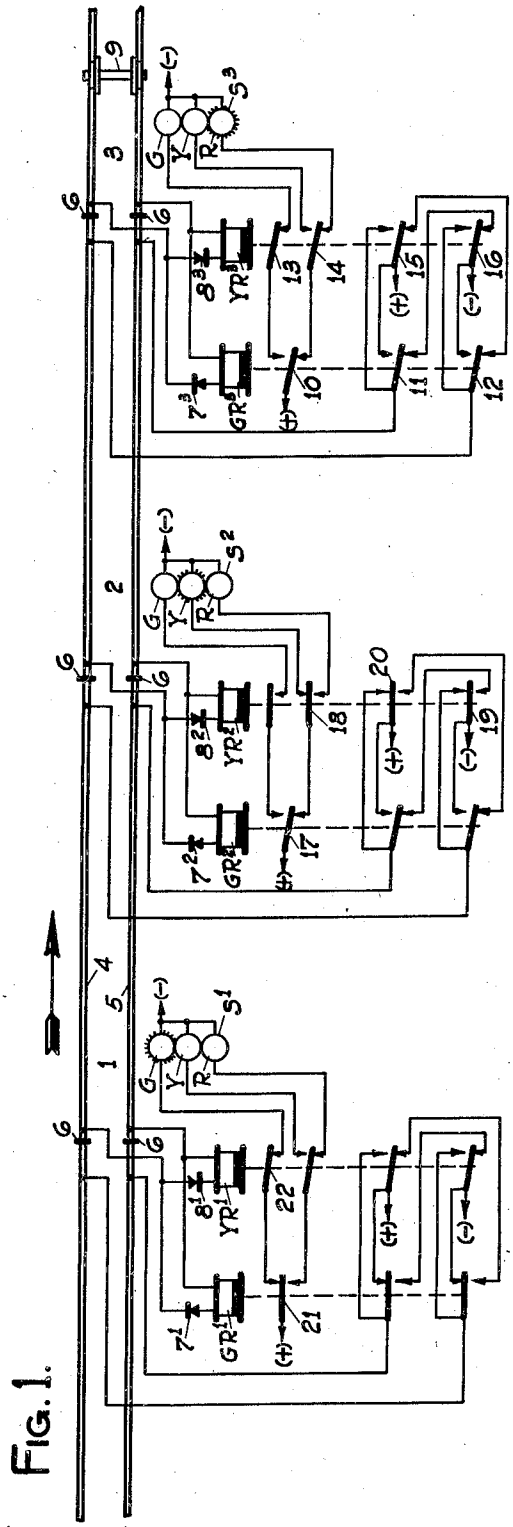


FIG. 1.

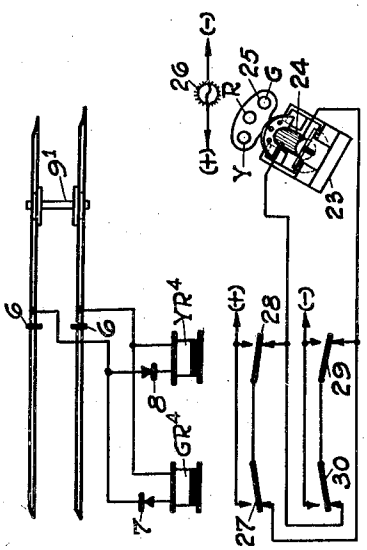


FIG. 2.

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RAILWAY SIGNALING SYSTEM

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3 Claims. (Cl. 246—45)

This invention relates in general to a railway signaling system, and has more particular reference to a signaling system employing polarized track circuits.

In signaling systems it is desirable that there should be no flash of the red signal, upon a change from yellow to green, for example, and vice versa, and with a usual polarized track circuit employing a polar relay giving a red indication when deenergized, and giving yellow and green when energized with reverse and normal polarities respectively, for example, on changing from yellow to green, or the reverse, a flash of the red occurs.

This flash of the red can be overcome by using a polar relay having a neutral contact which is sustained in energized position during reverse of the current in the polar relay, by means of a winding energized by the inductive reaction due to the change of the direction of flow of current in the main winding; as for example in relays of the retained polar neutral type, of the character disclosed in the patent to Larson, 1,852,210 granted April 5, 1932. Such relays however are dependent for proper functioning upon inductive action, and when shunting, instead of opening, of a circuit, is depended upon, this inductive reaction may be too weak for practical purposes unless an unsafely high voltage be employed across the track rails, to thereby cause an undue expenditure of energy and possibly faulty response to a train shunt.

With the above and other considerations in mind, it is proposed, in accordance with the present invention, to provide a system employing direct current retarded or slow release relays associated with rectifiers, whereby to impart to them polar characteristics. More specifically, it is proposed, for each usual track relay, to employ two track relays properly connected to rectifiers so as to control the signals along the wayside, for example, in accordance with the traffic conditions, and prevent any flashing of the red, and furthermore to prevent any "kick-off" of signals in the rear, in absolute-permissive-block signaling systems, as is well understood by those well versed in this particular art.

Furthermore, the new arrangement provides battery shunting characteristics since it is unnecessary to employ such high inter-rail voltages as is necessary for other relays, such as retained polar neutral relays, as referred to above.

Further objects, purposes and characteristic features of the present invention will appear as the description progresses, reference being made to the accompanying drawing showing, solely by way of example, and in no manner in a limiting sense, two forms which the invention can assume. In the drawing:—

Fig. 1 of the drawing shows, in a wholly diagrammatic manner, one form which this invention can assume.

Fig. 2 is a fragmentary diagrammatic view of a modified form of the invention.

Referring now to the drawing, and first to Fig. 1, there is here shown track rails **4** and **5**, separated into insulated track sections **1**, **2** and **3** by usual insulating joints **6**.

Since the apparatus at the entrance to each block, travel being in the direction of the arrow, is identical, the same reference characters with distinguishing exponents are employed for designating the various devices associated with each block.

At the entrance to each block is a wayside signal S, which in this particular case is shown as a three-indication separate unit light signal having the indications G, Y and R for respectively indicating clear, caution and danger. Connected across the entrance end of each block are two relays GR and YR which together constitute a polar responsive track relay means, these two relays being connected in multiple across the track rails, with a rectifier **7** in series with the relay GR and a rectifier **8** in series with the relay YR, which rectifiers can be of any usual or desired character, as for example a copper-oxide rectifier. These rectifiers are so poled that with one polarity, as normal, on the track rails, one only of the two relays is energized, and with the reverse polarity on the rails, the other only of these two relays is energized, as will appear more clearly in the following description.

This track relay means constituted by the two relays GR and YR at the entrance to each block, controls the wayside signal S, and controls the application of track circuit energy to the block immediately to the rear thereof.

Represented in block **3** by wheels and axles **9**, is a vehicle, whereby to make block **3** an occupied block.

The invention can perhaps be best understood by a brief description of the conditions of the various blocks as shown in the drawing, due to the occupancy of block **3**, and the non-occupancy of blocks **1** and **2**.

With block **3** occupied by the vehicle **9**, track circuit energy is shunted away from the track relays GR^3 and YR^3 whereby these two relays both

release their contact fingers 10, 11, 12, 13, 14, 15, and 16 respectively.

With relays GR^3 and YR^3 de-energized an energizing circuit for the signal indication R is completed which includes contact finger 10 and back point, contact finger 14 and back point and indication R, whereby to set up a danger or stop indication at the entrance to the occupied block 3.

Also, with relays GR^3 and YR^3 de-energized, a circuit is set up to apply current of a particular polarity, which can be conveniently termed reverse polarity, to the block 2 immediately to the rear of the occupied block 3, this circuit including the positive terminal of a source of energy, contact finger 15 and back point, contact finger 12 and back point, rail 4, relay YR^2, rail 5, contact finger 11 and back point, and contact finger 16 and back point, to negative. It will be observed that with positive energy applied to the rail 4, the rectifier 8^2 permits current to pass through it, and hence energize relay YR^2, but with this polarity, the rectifier 7^2 prevents any appreciable amount of current from reaching relay GR^2, whereby the relays GR^2 and YR^2, connected across the entrance end of the block 2, are respectively de-energized and energized.

The signal S^2 at the entrance to block 2, therefore, displays a yellow or caution signal through an energizing circuit including contact finger 17 and back point of GR^2, contact finger 18 and front point of YR^2 and the signal unit Y.

With the track relays GR^2 and YR^2 at the entrance to block 2 in the positions just described, track circuit energy of the opposite polarity, to that applied to block 2, is applied to block 1 and this can be conveniently termed energy of normal polarity. The circuit through which this energy of normal polarity is applied to the rails of block 1 includes contact finger 20 and front point of relay YR^2, track rail 5, relay GR^1, track rail 4, and contact finger 19 and front point of YR^2.

It will be observed that with normal polarity of energy applied to the rails, block 1 rectifier 8^1 prevents any appreciable amount of energy passing through the relay YR^1, but the rectifier 7^1 permits free passage of current through the relay GR^1. Thus, with GR^1 energized and YR^1 de-energized, a circuit is completed for the clear or G indication of signal S^1, which includes contact finger 21 and front point of GR^1, contact finger 22 and back point of YR^1, and the signal indication G, thus to indicate that block I has at least one unoccupied block ahead of it.

As will be obvious from the drawing, the track relays at the entrance to block 1 control energy to the block to the rear of block 1 so as to place energy of normal polarity on this block, to cause the signal at the entrance to such block to indicate green or clear, G.

It will be observed that the circuit arrangement for each pair of track relays, for placing energy on the block to the rear, is so arranged that with both of the relays deenergized, energy of reverse polarity is placed on the block to the rear, but with any other arrangement, such as both relays energized, or with either of the two relays alone energized, energy of normal polarity is placed on the block to the rear.

Should either of the rectifiers 7 or 8, when operating as a blocking means for the flow of current through its particular relay, become defective so as to allow sufficient current to pass through its relay to pick up the relay at a time when the relay should be de-energized, then the two relays will be energized at the same time. However with the circuit arrangement as shown and described, no signal energizing circuit is completed with both of the relays GR and YR energized and accordingly a dark signal will result thus protecting against false, clear or caution indications due to defects in the rectifiers.

If desired, there can be supplied a warning signal energized through the front points of the two relays GR and YR in series, with the warning signal retarded in any desired manner as by being inherently slow to respond to current or by means of a thermal element or the like, whereby to prevent the warning signal from responding to current supplied to it during the short period of time when the two relays are both up upon a change from clear to caution or the reverse, under proper operative conditions existing in the system.

These track relays GR and YR are designed to be slow to release, upon being de-energized, and this can be accomplished, if not inherently slow enough, in any one of a number of ways, as, for example, by supplying each with a short circuited low resistance inductive winding whereby, when the polarity of energy applied to a pair of such relays is reversed, the relay which is newly connected to receive energy, picks up its contact fingers before the companion relay releases its contact fingers, whereby both relays are never de-energized except in case of the block being occupied. This results, accordingly, in never having a condition for setting up a red indication except in an occupied block, and thereby absolutely prevents any flashing of the red signal upon a change from yellow to green or vice versa.

A further advantage of this arrangement of track relays is that a very quick shunting effect is produced, presumably due to the fact that a rectifier has a critical point of voltage above which it breaks down and below which it offers an exceedingly large resistance, whereby, when a relay is shunted, the voltage across the relay is reduced to a figure below the break-down point of the rectifier and thus the shunt results in practically an open circuit for that relay.

With this arrangement of relays it has been found that no trouble is experienced in obtaining good shunting characteristics even under adverse weather conditions, and when very light cars are under consideration.

Referring now to Fig. 2, there is here shown a circuit arrangement for operating a searchlight type signal. This signal includes a motor element comprising a field member 23 which can be either a permanent magnet, or an electro-magnet, (but is here shown, for simplicity, as a permanent magnet), and an armature 24 which can be supplied with current of either normal or reverse polarity, whereby to cause the armature to move its spectacle 25, from its de-energized biased position in which it is shown, to one or the other of its extreme positions. The spectacle carries colored light transmitting means R, G and Y which can thus be selectively placed to cooperate with a single light source 26, energized in any usual or desired manner.

When the relay GR^4 is energized, and the relay YR^4 is de-energized, energy of normal polarity is placed on the armature 24 through a circuit including contact 27 and front point, contact 28 and back point, the armature 24, contact 29 and back point, and contact 30 and front point, whereby to position the G aperture in front of the light source 26 to give a green or proceed indication.

With relay YR^4 energized and relay GR^4 de-energized, energy of reverse polarity is placed on armature **24** through a circuit including contact finger **28** and front point, contact **27** and back point, armature **24**, contact **30** and back point, and contact **29** and front point to thereby position the spectacle **25** to give a yellow or caution indication.

When the armature **24** is de-energized, the spectacle is biased to a position to give the R, or danger indication. When both of the relays GR^4 and YR^4 are de-energized, energy is cut off of the armature **24** as is obvious from the drawing, thus giving an R indication, in an occupied block.

Furthermore, when both of the relays are energized, energy likewise is cut off of the armature **24** to thus give R or danger indication. In this type of signal, in passing from Y to G, or vice versa, a flash of the red necessarily occurs, but this is only momentary, unless the two relays GR^4 and YR^4 are both up for a substantial period of time, or are both down for a substantial period of time. Thus, a red signal indicates either an occupied block, or a defective rectifier under caution or clear conditions, to place the system on the side of safety, upon any failure. Hence, in this form, it is desirable that the relays be adjusted with regard to release time so that the one that is up shall not release until just before the other one picks up, and furthermore, shall not stay up an appreciable time after the other one is picked up. Thus the relays may not necessarily be provided, as shown in the drawing, with means to make them slow to release.

The above rather specific description of two embodiments of the present invention, has been given solely by way of illustration, and is not intended, in any manner whatsoever, in a limiting sense. Obviously, this invention can assume many different physical forms, and is susceptible of numerous modifications, and all such forms and modifications, are intended to be included by this invention, as come within the scope of the appended claims.

Having described my invention, I now claim:—

1. In a railway signaling system, in combination with a track block, two neutral relays connected across one end of the block, rectifier means associated with the relays to impart polar characteristics thereto, the relays being slow to release, a plural aspect signal jointly controlled by the relays and having a most restrictive, and a plurality of less restrictive, indications, the most restrictive indication being energized through back points of both relays, to thus prevent flash of the most restrictive on passing from one to another of the less restrictive, indications, no signal circuit being completed with both relays in attracted position, whereby to give a warning dark signal upon rectifier failure.

2. In a railway signaling system, in combination, an isolated track block, two slow release neutral relays connected in series with each other and in multiple across one end of the block, a rectifier in series with each relay and each poled oppositely to that of the other, and a plural aspect signal having each aspect controlled jointly by the two relays, the signal having clear, caution and danger indications with the danger indication energized only when both relays are de-energized, each of the other two indications being energized when one only of the relays is energized, whereby a dark signal occurs when both relays are energized.

3. In a railway signalling system, in combination, an isolated track block, two neutral relays connected in series with each other and in multiple across one end of the block, a rectifier in series with each relay and each poled oppositely to that of the other, and a plural aspect signal having each aspect controlled jointly by the two relays, the signal having clear, caution and danger indications with the danger indication energized only when both relays are de-energized each of the other two indications being energized when one only of the relays is energized, whereby a dark signal occurs when both relays are energized.

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