T. M. FREEBLE.

ELECTRIC SIGNALING SYSTEM FOR RAILWAYS.

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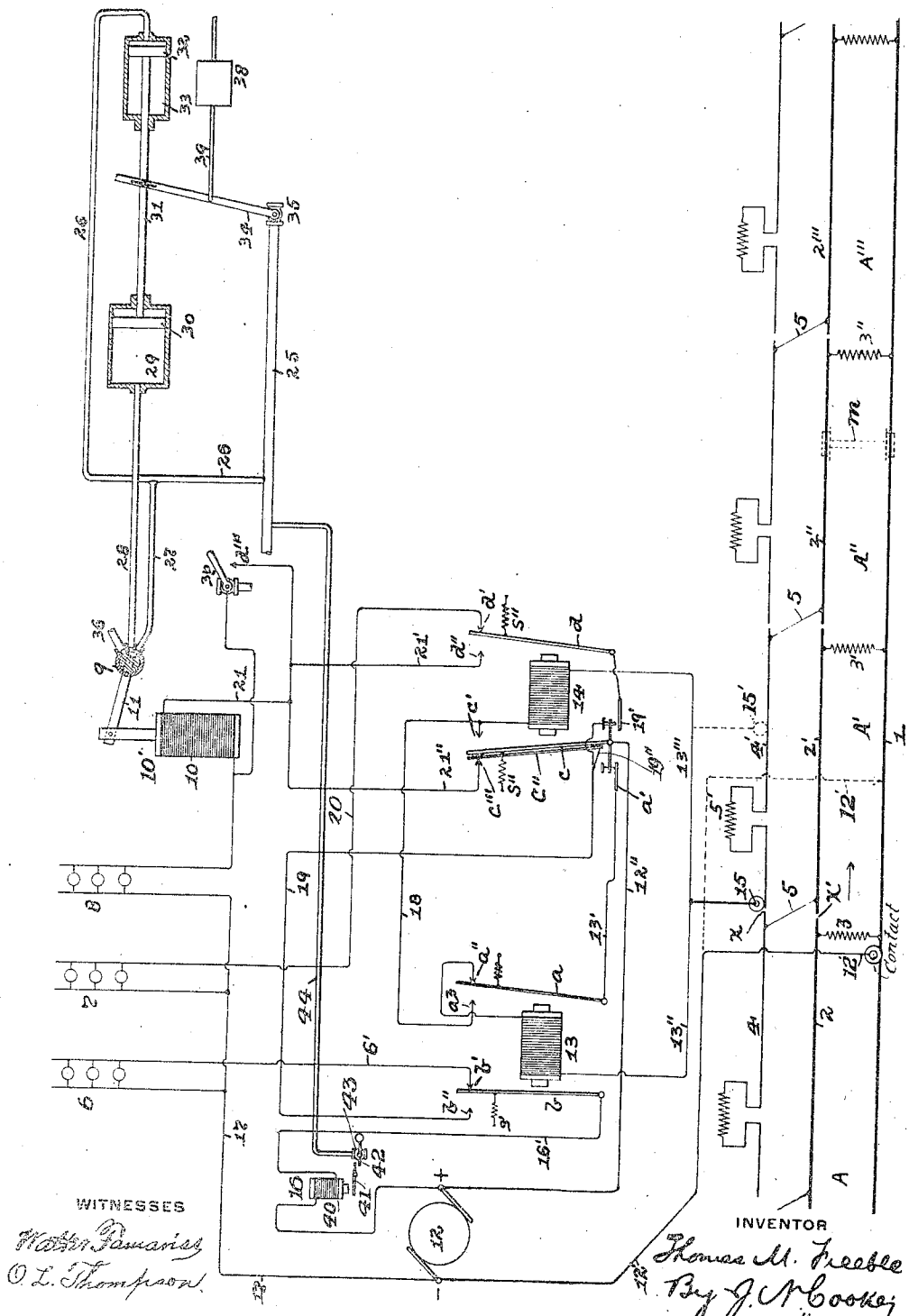

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ELECTRIC SIGNALING SYSTEM FOR RAILWAYS.

999,444. Specification of Letters Patent. Patented Aug. 1, 1911.

Application filed June 21, 1909. Serial No. 503,510.

To all whom it may concern:

Be it known that I, THOMAS M. FREEBLE, a resident of Rochester, in the county of Beaver and State of Pennsylvania, have invented a new and useful Improvement in Electric Signaling Systems for Railways; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to electric signaling systems for railways, and particularly to that class known as cab signal systems such as is disclosed in U. S. Letters Patent granted to me on October 6, 1908, No. 900,273, wherein signals are operated in the locomotive or car, the movements of which are to be controlled and regulated.

The object of my invention is to provide a simple and effective system wherein the signals are shown to the engineer or operator of the motive power and also to provide a system wherein the train is automatically reduced in speed when the danger signal is shown. It also provides a short signal circuit and therefore requires but a small amount of power supply to operate it.

To enable others skilled in the art to which my invention appertains to construct and use my improved electric signaling system, I will describe the same more fully, referring to the accompanying drawing, in which the figure illustrates diagrammatically my improved system and the various signals and mechanism operated thereby.

My invention generally stated, consists in a signal system wherein the rails themselves are used as conductors of the signal circuits and a third conductor or rail is used as will more fully appear hereinafter.

In the drawing, the numeral 1 indicates a continuous rail which may continue throughout the whole system or section, the same being normally insulated from the rail sections 2 which compose the other rail of the system, and each of such sections 2 constitutes a block. Each of the block sections 2 are connected to the continuous rail 1 by a resistance 3 and also to a section of the sectional third rail or conductor 4, as at 5, while each of said sections 4 has a resistance located within its length, as shown at 5'. Each of the sectional conductors 4 are connected by wire 5 to the rail section 2 and in the block in advance thereof for a purpose more fully to be described hereinafter.

The signaling and automatic safety devices are placed in the cab of the locomotive, car or other device for being operated over the system and consists of the three lamp signals, 6, 7 and 8, which are respectively the white, green and red signals, and an automatically operated brake valve 9 which is operated by the solenoid 10' through lever 11, while the solenoid coil 10 thereof is normally in series with the red lamp 8. The other devices consist in the generator 12 and the circuit controlling magnets 13 and 14. One pole of the generator 12 is grounded to the rail 1 through the wire 12', while the other, or preferably the positive pole thereof normally passes through the magnet 13 by wires 12'', contact a', 13', armature lever a, contact a'', and from magnet 13 to trolley 15 by wire 13'', while the trolley 15 engages with the third rail or sectional conductors 4, as shown.

Each of the magnets 13 and 14 are double pole magnets, each pole being designed to attract an armature lever, and the armature levers a and b are designed to be operated by the magnet 13, while the levers c and d are operated by the magnet 14. The lever b is normally operated to close the circuit to the white signal lights 6 when the track is clear, that is, when the two blocks ahead are unoccupied, as is usual in practically all signal systems at present in use. The circuit for operating the magnet is as follows:—from the positive pole of generator through wire 12'', contact a', wire 13', lever a, contact a'', to magnet 13, thence to trolley 15 by wire 13'' to third rail section 4', through its resistance 5', connecting wire 5 to track section 2'', and thence through resistance 3'' to the continuous rail 1, from whence it returns to generator 12 through wire 12'. When the current from generator is thus forced to travel through both the resistances 5' and 3'', the current through the magnet 13 is only sufficient to hold up the armature lever b, making contact at b' through the white or clear signal lights 6 as follows:—from positive pole of generator 12 through safety 16, wire 16', lever b, contact b', wire 6' to lamps 6, and thence by wire 17 to negative pole of generator 12. If, however, a train or car occupies the second block ahead as indicated by the dotted lines at m, the circuit will be shunted through the

car trucks and cut out the resistance 3''. This will cause a greater current to pass through the magnet 13 and will momentarily close the circuit through contact a^3 and lever a. At this time the circuit will momentarily divide and a portion will pass through said contact a^3, and wire 18 to complete the circuit through the magnet 14 through wire 13''' to trolley, causing the lifting of lever c, which will immediately make contact at c' and close the circuit through said lever c to magnet 14, as follows:—from generator 12 by wire 12'', lever c, contact c' to magnet 14, thence by wire 13''', to trolley 15, third rail 4' through resistance 5', track section 2'', short circuit m, continuous rail 1, and wire 12' back to other pole of generator. At such time, the contacts a' and a'' are opened, and magnet 13, deënergized and both levers a and b drop by the tensions of their springs away from contacts a^3 and b'. In this position with contact c' closed, the lamp circuit is completed through the green lamps 7, as follows:—from generator through safety 16, wire 16', lever b, contact b'', wire 19, contact 19', lever d, contact d', wire 20 to lamp 7, and wire 17, back to generator. With resistance 5' still in the track circuit, the current through magnet 14 is not sufficient to throw the lever d, but if the locomotive should advance into the next block, as indicated by dotted lines 12' and 15', before the car at m leaves the block A'', the trolley 15 would pass the resistance 5' in third rail 4', as shown by dotted lines at 15', so that no resistance other than the magnet 14 itself will be in the track circuit of generator 12, and sufficient current will then pass through magnet 14 to throw lever d, breaking the contact d', and consequently the circuit through lamp 7, and making contact at d'' through solenoid 10 by wire 21, 21', and thence through red signal lamps 8 and wire 17 to generator. By this means not only the red signal lamps are lighted, but the solenoid 10 is also energized to operate the brake valve 9 for a purpose more fully to be described hereinafter.

The safety device 16 comprises the solenoid 40 which normally operates when the lamp circuit is complete to hold the armature lever 41 up against the pole of the magnet, the opposite end of the lever 41 acting to depress the free end of a weighted lever 42 on the air valve 43, said air valve being connected by the pipe 44 to the train pipe as shown. As long as the lamp circuit is complete through any of the signal lamps, 6 and 7, the valve 43 will be closed and the brakes will not be affected thereby, but in case of accident to the lamp circuit or if for any reason the lamp circuit should be open, then the lever 41 would drop, allowing the weighted end of valve lever 42 also to drop, thus setting the brakes. Thus it will be seen that if the two blocks in front of a train are clear, the white signal lamps 6 will be in circuit by reason of the resistance 3'' and 5' being in circuit with magnet 13, and consequently allowing only a small current to pass therethrough and lifting the lever b and making contact b' to lamps 6. If, however, the second block in front of the train is occupied, the current is short circuited through the trucks, as indicated at m, and the resistance 3'' cut out, thus delivering a stronger circuit to magnet 13, lifting lever a, and making momentary contact at a^3, to energize magnet 14, which in turn makes contact at c' by reason of the lifting of lever c, which will then hold itself in circuit through the making of contact at c', while the levers b and a immediately drop back by reason of the breaking of contact a'' momentarily, and the circuit through magnet 13 then remains open by reason of the breaking of contact a' which will remain broken until magnet 14 is deënergized. The making of contact 19' on lever c completes the circuit through green signal lamps 7, as previously described, and such lamps will remain lighted as long as the second block ahead is occupied or until train advances to the next block ahead, which is the next block behind the train at m. At such time the trolley 15 will advance beyond resistance 5', as shown at 15', cutting out resistance 5' from the operating circuit and the consequent increase current in magnet 14 will lift the lever d, breaking contact d', which will open circuit through lamps 7 and by making the contact d'', will close the circuit through red signal lamps 8 and through solenoid 10, which is in circuit therewith, and operate valve 9 to automatically set the brakes. As the train at m moves on and clears the block A'', the resistance 3'' will be thrown in and lever d will drop back, making contact at d', to green signal lamps 7, and breaking contact d'' through lamps 8 and solenoid 10, and consequently releasing the brakes. So also, when the trains again reach the same relative positions as at first described, both resistances 3'' and 5' being added to the track circuit, the magnet 14 will not be sufficiently energized to hold up lever c which will drop back, thereby breaking contact at c' and closing circuit at a' and completing circuit through magnet 13 at low tension, which will lift lever b, and make contact at b' through white signal lights 6, at which time the lights 7 will be extinguished by reason of the breaking of contact 19'. It will be noticed that the trolley 15 is sufficiently in advance of the grounding at 12' so that the trolley will pass the gap x in the third rail before the ground 12' passes the gap x' in the main rails. This is neces-

sary, as otherwise the circuit would be momentarily completed through the trucks of the locomotive or car from ground rail 1 to sectional rail 2′, thence by wire 5, third rail and trolley 15 to magnet 13, thereby cutting out all resistance and immediately throwing signals red, and setting the brakes. The gap x might, however, be placed sufficiently behind gap x' to accomplish this result.

It will be understood that the resistances 3, 3′, etc., are much greater than the resistances 5′. In practice the resistance 3′ is twice as great as 5′, the resistance 3′ being sufficient to so reduce the strength of current through magnet 13, that lever a will not be affected and therefore will not break the contact at d', and the white lights will be lighted after the trolley has passed the resistance 5′ in third rail 4′ unless the resistance 3″ is cut out, as indicated by truck m. It will be seen, therefore, from the foregoing that the resistance 5′ is only for the purpose of operating to show the green signal lights when current is shunted, as at m, and before the trolley passes the smaller resistance 5′.

In case of accident to the track circuit at any time, as for instance, a wash-out or other break which would cause a break in the track circuit, both the magnets 13 and 14 would be deënergized and all the levers would drop back and the lamp circuit would be completed through the red signal lamps 8 and brake operating solenoid 10 as follows, through safety 16 from positive pole of generator by wire 16′, lever b, contact b'', wire 19 and branch 19″ to insulated contact strip c'', carried by lever c and insulated therefrom as shown, through contact c''', wires 21″ and 21 to and through solenoid 10 and lamps 8, and thence by wire 17 to negative pole of generator. It will thus be seen that I not only provide against collisions, but also accidents due to breaks in the track or faulty track circuits.

The brakes are set through the operating of valve 9 by solenoid 10 through the following mechanism. The train pipe 25 supplies air through pipes 26 and 27 to the valve 9, through which and pipe 28, air is normally admitted to cylinder 29 back of piston 30 therein, which piston is connected by rod 31 to piston 32 in cylinder 33, and such latter cylinder is of smaller diameter than the cylinder 29, so that when air is admitted to cylinder 29 due to the normal position of valve 9, the lever 34 will be held in position to close valve 35 in train pipe 25. If, however, the valve 9 is operated by solenoid 10 in the manner previously described, said valve will assume a position to connect the pipe 28 to the exhaust 36 to release the pressure against piston 30, so that the pressure passing through pipe 26 to cylinder 33 will cause said piston to force rod 31 to the left to open valve 35 and set the brakes throughout the train in the usual well known manner.

The valve 37 is the usual air valve for setting the brakes, and when it is operated by the engineer, which he should do as soon as signal lamps 8 are lighted, the contact d''' is closed and the circuit through solenoid 10 is cut out. When operating the valve 37 in the ordinary manner, as when the engineer desires to slow down or bring the train to a stop, the closing of contact d''' does not affect the lamp circuit unless contact d'' has been automatically closed by the operation of the track circuits.

38 indicates an automatic register of any approved type which is operated by the movement of lever 34 by link 39.

It will be understood from the foregoing description that the levers a and d resist the attractive force of magnets 13 and 14 respectively, to a much greater degree than the levers b and c, and this may be accomplished in any convenient manner, as by making the springs s and s'' of much greater tension than the springs s' and s'''.

I do not desire to limit myself to the precise construction herein shown and described, as it is obvious that certain changes may be made without departing from the spirit of my invention or sacrificing any of its advantages, as for instance, two generators may be used; the one for the track circuit; and the other for the lamp circuit, while a battery or two separate batteries may be substituted for the generator.

Having now fully described my invention, what I desire to claim, is:—

1. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, a series of signals carried by a vehicle moving on the conductors, electrically operated mechanism carried by said vehicle to operate said signals, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, and a partial circuit connected with said mechanism and said contacts.

2. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with an opposite section of the other conductor of an adjacent block, a resistance

in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, a series of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, electro-magnetic means carried by said vehicle to operate said signals, and a partial electrical circuit for said electro-magnetic means connected to said contacts and said partial circuit being normally completed through the continuous conductor and a section of each of the sectional conductors.

3. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, said latter resistance being greater than said first named resistance, a series of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, electro-magnetic means carried by said vehicle to operate said signals, and a partial circuit for said electro-magnetic means operating through said contacts, said partial circuit being normally completed through the continuous conductor and a section of each of the sectional conductors.

4. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, said latter resistance being greater than said first named resistance, a set of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, an electro-magnet carried by said vehicle, a partial circuit for said electro-magnet connected to said contacts, said partial circuit being normally completed through the continuous conductor and a section of each of the sectional conductors, means normally operated by said electro-magnet for displaying said set of signals, a second set of signals carried by said vehicle, and means operated by said electro-magnet when the greater resistance is cut out for displaying said second set of signals.

5. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, said latter resistance being greater than said first named resistance, a set of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, an electro-magnet carried by said vehicle, a partial circuit for said electro-magnet connected to said contacts and including a source of energy, said partial circuit being normally completed through the continuous conductor and a section of each of said sectional conductors, means normally operated by said electro-magnet for displaying said set of signals, a second set of signals and a second electro-magnet, means operated by the first electro-magnet when the greater resistance is cut out for connecting said second electro-magnet in circuit with the contacts and source of energy, means operated by said second electro-magnet when so energized for displaying said second set of signals, a third set of signals, and means operated by the second electro-magnet when both resistances are cut out for displaying said third set of signals.

6. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, said latter resistance being greater than said first named resistance, a set of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, an electro-magnet carried by said vehicle, a partial circuit for said electro-magnet connected to said contacts and including a source of energy, said partial circuit being normally completed through the continuous conductor and a section of each of said sectional conductors, means normally

operated by said electro-magnet for displaying said set of signals, a second set of signals and a second electro-magnet, means operated by the first electro-magnet when the greater resistance is cut out for connecting said second electro-magnet in circuit with the contacts and source of energy, means operated by said second electro-magnet when so energized for displaying said second set of signals, a third set of signals, means operated by second electro-magnet when both resistances are cut out for displaying said third set of signals, a brake operating solenoid in series with said third set of signals, and all of said devices being adapted to be governed by a second vehicle being operated upon said system.

7. In an electrically operated block signal system, a continuous conductor, two sectional conductors having breaks opposite each other dividing the same into blocks and one of said conductors being electrically connected with the opposite conductor of an adjacent block, a resistance in each section of one of said sectional conductors, a resistance connecting the continuous conductor with each section of the other of said sectional conductors, said latter resistance being greater than said first named resistance, a set of signals carried by a vehicle moving on the conductors, a pair of contacts carried by said vehicle and engaging with the continuous conductor and the sectional conductor having the interposed resistance, an electro-magnet carried by said vehicle, a partial circuit for said electro-magnet connected to said contacts and including a source of energy, said partial circuit being normally completed through the continuous conductor and a section of each of said sectional conductors, means normally operated by said electro-magnet for displaying said set of signals, a second set of signals and a second electro-magnet, means operated by the first electro-magnet when the greater resistance is cut out for connecting said second electro-magnet in circuit with the contacts and source of energy, means operated by said second electro-magnet when so energized for displaying said second set of signals, a third set of signals, means operated by second electro-magnet when both resistances are cut out for displaying said third set of signals, a brake operating solenoid in series with said third set of signals, and a brake setting device in the signal circuit adapted to be operated when any signal circuit is broken.

In testimony whereof, I, the said THOMAS M. FREEBLE, have hereunto set my hand.

THOMAS M. FREEBLE.

Witnesses:

GERTRUDE KREMER,

J. M. COOKE.