F. L. DODGSON.

RELAY.

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1,216,420. Patented Feb. 20, 1917.

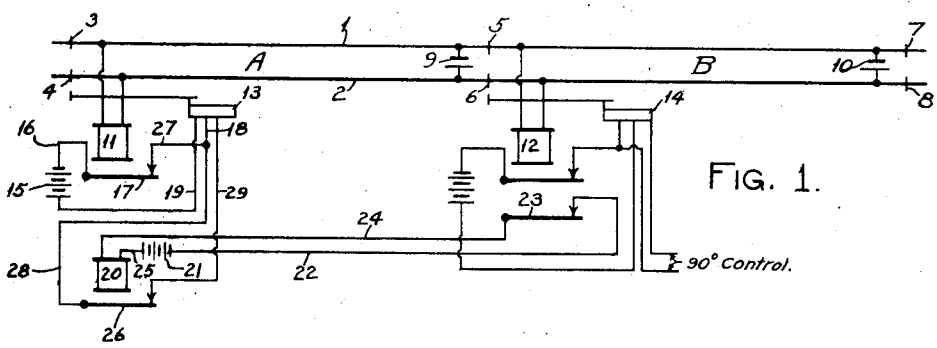


FIG. 1.

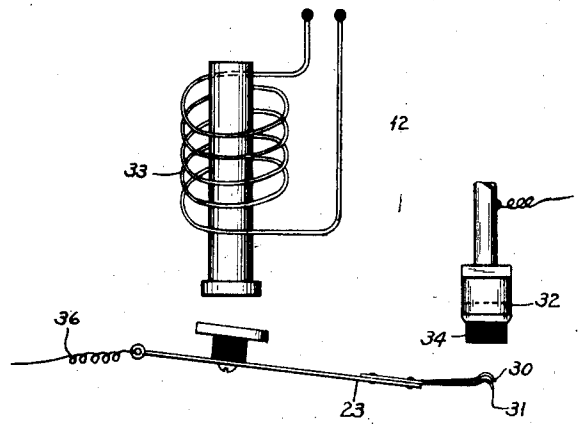


FIG. 2.

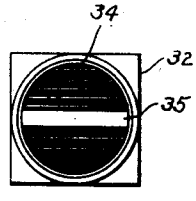


FIG 3

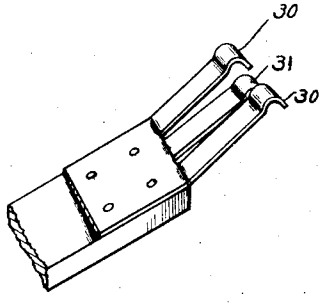


FIG. 4

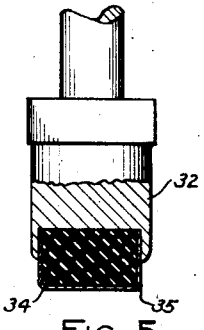


FIG. 5

WITNESSES:

George T. Whitney.

Sophie Levin

INVENTOR

Frank L. Dodgson,

BY

Lyman E. Dodge

ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK L. DODGSON, OF ROCHESTER, NEW YORK, ASSIGNOR TO GENERAL RAILWAY SIGNAL COMPANY, OF GATES, NEW YORK, A CORPORATION OF NEW YORK.

RELAY.

1,216,420. Specification of Letters Patent. **Patented Feb. 20, 1917.**

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To all whom it may concern:

Be it known that I, FRANK L. DODGSON, 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 Relay, of which the following is a specification.

My invention is directed particularly to the solution of difficulties encountered in certain forms of electric signaling systems for railways, wherein comparatively long line wires are necessary for the purpose of inter-relating two or more block sections. A signal system of the form in question necessitates the use of an electric relay having the relay contacts in circuit with comparatively long line wires. Moreover, the voltage and strength of controlling currents most adaptable for railroad signal circuits require, on account of various conditions, that the separation between the relay contacts when in open position be small. In practice this separation is commonly a few hundredths of an inch.

Under these conditions, difficulties have been met due to the line wires becoming charged with static electricity and due to static discharges occurring between the relay contacts. These discharges not only pitted or roughened the contact surfaces of the relay, but in some instances, due to static discharges from the line wires to and through the relay coil and thence to the ground, the relay contacts would become closed by the passage of the electric discharge through the relay coil and the passage of the heavy discharge at the same time would cause the fusing of the metal relay contacts together and prevent their separation. The result would be that a safety indication would be given when a danger signal should properly be indicated.

In order to overcome the fusing of the relay contacts together, the use of carbon or graphite contacts has been resorted to, making one or both of the relay contacts of such material, so that there could be no chance of the contacts being fused together in closed position. But owing to the comparatively high resistance of carbon or graphite contacts in such relays, and to the resultant high resistance interposed in the long line wires when the line circuit is closed at the carbon contacts of the relay, the efficiency of the line circuit has been very much reduced and has necessitated the use of higher voltages on the line wires and larger line current in practical operation than would otherwise be necessary.

The object of my invention is to overcome all of these difficulties and insure high efficiency of the line circuit, and likewise insure keeping the relay contacts in good operating condition and prevent the possibility of the relay contacts becoming fused together.

My invention will be understood from the following description and accompanying drawings, in which Figure 1 is a diagram of a portion of a railway signaling system to which my invention is particularly applicable; Fig. 2 is a schematic representation of a relay device embodying my invention forming part of the system represented by Fig. 1, the proportions and distances being exaggerated for clearness of explanation; Fig. 3 is an enlarged bottom plan view of a fixed contact post of the relay; Fig. 4 is an enlarged top perspective view of a relay contact arm, and Fig. 5 is an enlarged view, partly in section, of a fixed contact post of the relay.

Referring to Fig. 1, the two rails 1, 2 of a railway track are divided into electrically isolated sections A and B by means of insulating joints 3, 4, 5, 6, 7 and 8. At one end of each of the block sections is a battery 9 and 10 respectively, connected across the two rails. At the other end of each of the sections a relay 11 and 12 respectively is connected across the rails. Each block section including the battery, relay coil and rails form a local closed track circuit section.

The entrance of a car or train on either of the sections, by reason of the wheels and axles forming a shunt path for the battery current, will cause a deënergization of the respective relay 11 or 12. The relays 11 and 12 control the signals 13 and 14 respectively. When the relays are energized, the respective signals are moved from a normal biased position to an operative position. In this instance, there are two operative positions, one the 90° position shown in Fig. 1, indicating clear and the other operative position, the 45° position, indicating caution, whereas the zero or biased position indicates danger.

When relay 11 is deënergized by presence of a train in section A, the signal 13 falls

to zero or danger position, because the supply of energy from the battery 15 controlling the operation of the signal 13 is cut off by the falling of the relay armature 17; similarly the deënergization of relay 12 due to presence of a train in section B will cause signal 14 to assume the danger position. It is desirable, however, that these signals should be controlled not only by the section immediately ahead of a signal, but also by the conditions existing in the block section ahead of the next signal; thus signal 13 should assume a danger position when a train is in section A, a caution or 45° position when a train is in section B and no train in section A, and should assume a safety or 90° position when no train is in either section A or section B. This may be accomplished by causing the energization or deënergization of relay 12 to affect the signal 13. In the form shown the relay 12 is shown provided with an additional armature 23 and contacts connected to line wires 22 and 24 which have in circuit another relay 20 and source of energy as battery 21. The relay 20 has armature 26 which is held in closed position when the relay 20 is energized and falls to open position when relay 20 is deënergized. The armature 26 is in circuit with controlling mechanism of the signal 13. This mechanism forms no part of my present invention and is a type well known and need not be described here in detail. It is sufficient for present purposes to appreciate that the presence of a train in section A by deënergization of relay 11 causes the armature 17 to fall and open the circuit of the mechanism of signal 13 so that this signal assumes the danger position in all cases when a train is in section A; and when a train is in section B, the falling of armature 23 results in the falling of armature 26 so that the signal mechanism of signal 13 operates only to cause signal 13 to move to the 45° or safety position with no train in section A; and when the train passes to the right out of section B, the armature 23 is raised to closed position causing armature 26 to be brought also to closed position, which action then causes the signal mechanism of signal 13 to be moved from the 45° position to the 90°, or clear position, showing that no train is in either block section. In the same way signal 14 may be controlled by conditions in section B and in the section ahead of section B.

It is apparent that the above system requires the use of line wires 22, 24 which may be over a mile or more in length. By reason of these line wires being connected to relay contacts of the relay 12 and the very small distance separating the contacts in practice when in open position, the conditions arise as described in a preceding statement, causing difficulties as above referred to. As above stated, static charges especially in some localities become so great on line wires 22 and 24 that discharges occur from these wires through the relay contacts and also across various air gaps of the relay and pass to and through the coil of relay 12 to the rails and ground. Such discharge often causes armature 23 to be improperly raised at the time of such discharge through the coil of relay 12 and the simultaneous passing of the discharge through the relay contacts has caused them to fuse together when such contacts were of metal and thereby resulted in giving a false indication to signal 13, with the presence of a train in section B. Even when the contacts do not become fused together, their surfaces may become so roughened or pitted as to interfere with the proper operation and efficiency of the relays. With carbon contacts for the relays, the efficiency of the circuit is very much reduced due to the high resistance of the contacts; also such contacts by continued use become less effective and require frequent attention and repair.

My present invention greatly improves the reliability, durability and efficiency of the above described railway signal system by introducing in combination therewith an improved form of contacts in the relays. In Figs. 2 to 5 the contacts of the relay 12, which are connected to line wires 22 and 24 are indicated. The coil of relay 12 is indicated at 33 surrounding the core and causing the armature to be raised when coil 33 is energized. The armature 23, or rather the current carrying part secured to the armature, is shown as having connected therewith at its outer end a metallic plate having integral therewith and extending outwardly therefrom the contact fingers 30, 30 and 31. The two outer fingers 30 are bent in relation to the metal finger 31 so as to have a somewhat higher position as indicated in Fig. 2. The fixed contact of the relay is indicated as being made up of a metallic head or holder 32 carrying at its lower end a block or button of carbon, graphite or other refractory conductive material 34 having a relatively high resistance. Across the lower face of this contact of relatively high resistance extends a strip 35 of metal, the ends of which are turned upwardly in engagement with the sides of the block 34, the two parts being held in place by the flange of holder 32, this flange being spun around the block 34 and ends of strip 35 so as to firmly clamp and hold them. The metal strip 35 is located on the block 34 so as to be opposite and extend in the same direction as the metal finger 31 of the relay. The metal contacting portions may be faced with silver or platinum to assist in preserving good metallic contact faces.

The result of this construction is that when the relay contacts are in open position, the outside fingers 30 are nearer to the fixed contact than is the finger 31, as indicated in Fig. 2; and when the relay closes, the fingers 30 will make contact with the bottom face of the block 34, before the finger 31 engages the metal strip 35. When the relay contacts are in fully closed position, the finger 31 is in firm engagement with the metal strip 35, giving a direct metallic circuit from the line wire 24 to the metal holder 32 of the fixed contact and thence to the line wire 22. It will also be understood that in the opening and closing of these relay contacts, there is a slight sliding of the contacts due to the fingers 30, 31 being yieldable, which tends to secure good contact engagement and to keep the contact surfaces in good condition.

With my invention, it will be understood that the difficulties previously encountered from static discharges from the line wires 22, 24 are avoided, or their effects so minimized as to prevent interruption with the proper operation of the signal system. Thus when the relay contacts are in open position, any discharge between the relay contacts will occur wholly between fingers 30 and the contact block 34 by reason of their being nearer together than the finger 31 to the metal strip 35, which serves to protect the contact surfaces of the latter parts; and when any static discharge from the line wires 22, 24 causes a momentary closing of the relay contacts, the fingers 30, by reason of their being the first to come near and to engage the fixed contact, serve to carry the static discharge to the block 34. The finger 31 and contact 35 are thereby protected or shielded from such discharge, or excessive current flow. The contacts 30 and block 34 likewise are not seriously affected by such discharge, nor do they become fused together, on account of the contact block 34 being of carbon, graphite or other refractory material. In case of very heavy discharges or heavy current flow which could not properly be carried by the relay contacts, the pig-tail 36 will melt and open the circuit, its carrying capacity being such as to thus act to protect the relay contacts in such instances. Moreover, while thus avoiding difficulty from static discharges or other current flow, the relay when closed secures low contact resistance giving an all metal path through the contacts as above stated. This insures an increased efficiency in the circuit comprising the line wires 22, 24 and a saving of energy as well as insuring reliable operation and durability.

My invention may be embodied in various forms of construction without departing from the scope thereof.

What I claim is:—

1. In a relay, in combination: a refractory relatively high resistance conductive button; a metallic ribbon located on the face of said button; a contact arm having a plurality of fingers, the end of one of said fingers lying in a plane different from that of the other fingers; a pivot for said contact arm, said pivot, button and contact arm being so positioned that when the relay is deënergized one of the contact fingers is nearer to the button than one of the other contact fingers is to the metallic ribbon.

2. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts having a contact face partly of metal and partly of refractory conductive material and the other of said contacts having contacting portions of metal respectively spaced from said portions of the other contact by different distances when in open position and the metal to metal engaging parts having the greater separation in open position.

3. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts having a contact face partly of metal and partly of refractory conductive material and the other of said contacts having a plurality of metal fingers respectively spaced from said portions of the other contact by different distances when in open position and the metal to metal engaging parts having the greater separation in open position.

4. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts having a contact face partly of metal and partly of refractory conductive material and the other of said contacts having a plurality of metal fingers integral with each other and respectively spaced from said portions of the other contact by different distances when in open position.

5. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts comprising a block having a contact face partly of refractory conductive material and partly of metal and the other of said contacts having metal contacting fingers adapted to engage respectively with said two face portions, the finger engaging the metal face portion being spaced therefrom by a greater distance than the finger engaging the face portion of refractory material when the parts are in open position.

6. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts comprising a block of refractory conductive material, part of its face having a metal strip and the other of said contacts having metal contacting fingers adapted to engage respectively with a face portion of the refractory material and said strip, the finger

engaging said strip being spaced therefrom by a greater distance than the finger engaging the face portion of said refractory material when the parts are in open position.

7. In a relay, a controlling coil, and contacts the closing and opening of which is controlled by said coil, one of said contacts comprising a block of refractory conductive material and a metal strip across the middle portion of said block and the other of said contacts having metal contacting fingers integral with each other and adapted to engage respectively with said strip and the face of said block on opposite sides of said strip, the finger engaging said strip being spaced therefrom at a greater distance than the fingers engaging the face of said block.

8. In a relay, a controlling coil, and contacts the opening and closing of which is controlled by said coil, the fixed contact comprising a block of refractory conductive material and a metal portion, a metal holder for said refractory material and metal portion, said holder embracing and contacting with both said block and metal portion, and the movable contact having one contacting portion thereof spaced from said metal portion a greater distance than another contacting portion of said movable contact is spaced from the contact face of said refractory material when the parts are in open position.

9. In a relay, a controlling coil, and contacts the opening and closing of which is controlled by said coil, the fixed contact comprising a block of refractory conductive material and a metal strip extending across the face of said block and sides thereof, a metal holder for said block and strip, said holder embracing and contacting with said block and strip, and the movable contact having one contacting portion thereof spaced from said metal portion a greater distance than another contacting portion of said movable contact is spaced from the contact face of said refractory material when the parts are in open position.

10. In a relay, a controlling coil, and contacts the opening and closing of which is controlled by said coil, the fixed contact comprising a block of refractory conductive material and a metal portion, a metal holder for said refractory material and metal portion, said holder embracing and contacting with both said block and metal portion, and the movable contact having a plurality of metal fingers integral with each other, and adapted to respectively engage the face of said block and said metal portion the finger engaging said metal portion being spaced therefrom at a greater distance than the finger engaging the face of said block when the parts are in open position.

11. In a relay, a controlling coil, and contacts the opening and closing of which is controlled by said coil, the fixed contact comprising a contacting portion of refractory conductive material and a contacting portion of metal and the movable contact comprising a plurality of contacting metal fingers integral with each other and adapted to engage respectively with said portions of the fixed contact, the finger engaging the metal portion being spaced therefrom by a distance greater than the distance between the finger engaging the portion of refractory material when the parts are in open position.

FRANK L. DODGSON.

Witnesses:
CHARLES F. ESTWICK,
SOPHIE LEVIN.