April 1, 1941. J. E. WILLING 2,237,278

RELAY

Filed May 31, 1940

FIG. 1.

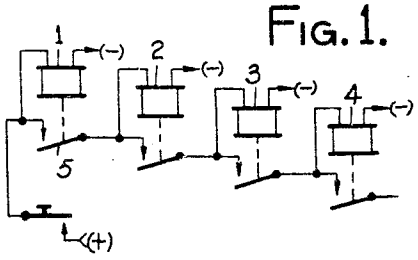


FIG. 4.

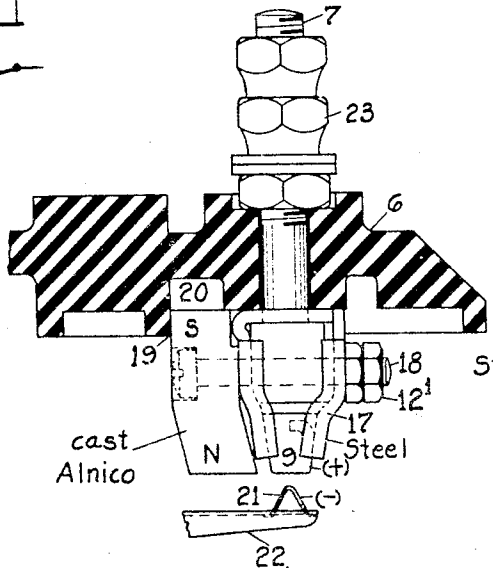


FIG. 5.

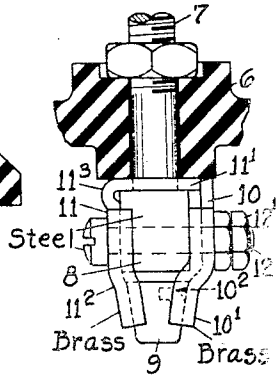


FIG. 2. FIG. 3.

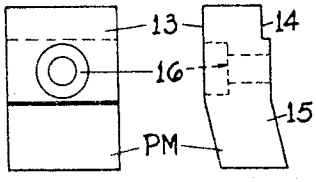


FIG. 8.

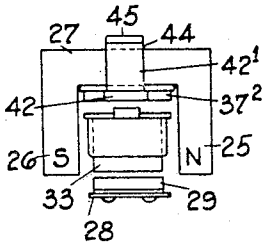


FIG. 9.

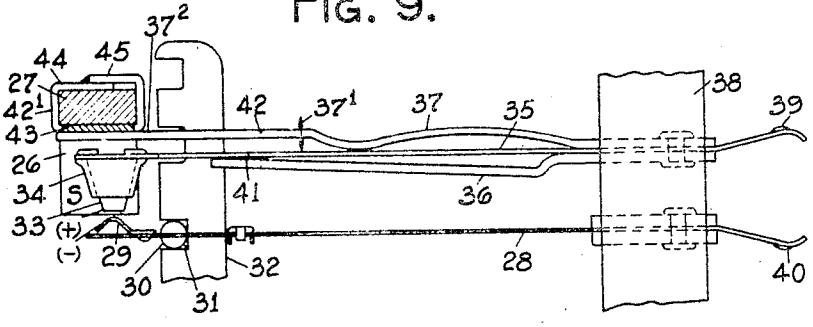


FIG. 6.

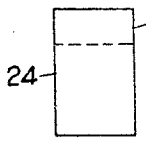
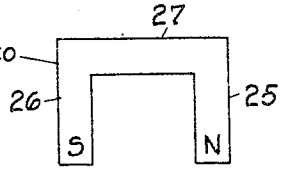


FIG. 7.



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2,237,278

RELAY

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Application May 31, 1940, Serial No. 338,036

12 Claims. (Cl. 200—147)

This invention relates in general to electric relays, particularly as used in railway operation, and has more particular reference to magnetic blowout means for permitting the relay contacts to carry relatively large currents without undue harm to the contact points.

In the operation of railways a large number of relays is used in connection with controlling switches and signals, and in various dispatching systems, and so-called centralized traffic control systems, and entrance-exit (NX) systems, and until recently, these relays were in general not required to carry very large currents. Recently, however, in many cases, due to changes in circuiting and controls, the relays are called upon to carry relatively large currents, and thereby to unduly shorten the useful life of the contacts, unless they be made substantially heavier, or are provided with protective means. The relays employed have, in many cases, become of standard types, and it is very desirable to be able to equip these relays already in use with a protective means, as well as to follow the established constructions of relays, and still be able to conveniently and economically equip these new relays of standard types with a protective means.

In accordance with the above and other objects, it is proposed in accordance with the present invention, to provide convenient and effective magnetic blowout means of size and weight and form to economize in readily equipping relays already in service with a protective means as well as to manufacture new relays of established types, and include such protective means.

More specifically, it is proposed to provide permanent magnets of material which can be very highly magnetized and which retains its magnetism very strongly, that is, which has a high coercive force and of a relatively small size, and weight, so that they can be readily applied to relays of established construction at a minimum of expense and without material change in the relay constructions.

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

Fig. 1 is a schematic view of a relay circuit particularly benefited by the protective means of this invention.

Fig. 2 is an end elevation of a first form of magnet in accordance with the invention.

Fig. 3 is a side elevational view of the magnet of Fig. 2.

Fig. 4 is a fragmentary view of a relay of the "type K" form, with the magnet in place.

Fig. 5 is a fragmentary view of the relay before being equipped with the magnet.

Fig. 6 is a side elevational view of a second form of magnet in accordance with this invention.

Fig. 7 is an end elevational view of the magnet of Fig. 6.

Fig. 8 is an end view of the magnet of Fig. 7 as applied to a relay of the "type B" form of relay.

Fig. 9 is a side elevational view of a portion of a relay with the magnet of Fig. 7 in place.

Referring now to the drawing and first to Fig. 1, there is here shown a circuit such as used in many present day centralized traffic control systems and entrance-exit systems, wherein large currents must be carried by relay contact points and hence these contacts need protection such as the present invention can give.

In Fig. 1 is shown a plurality of relays 1, 2, 3 and 4, each of which, except the first, is energized through a front point of the preceding one, and all of which receive energy from a single source in a multiple chain manner. Thus, it is seen that contact finger 5, and front point, of relay 1, must carry the current for energizing relays 2, 3, 4, in multiple. Accordingly, in the case where sufficient relays are employed in this connection, the current passing through a contact finger and front point may be as high as 40 or 50 amperes, or even more

Also, in the case of the control of switch machines and other relatively heavy current consuming machines, with relays largely replacing levers in the control circuits, the relay contacts are called upon to carry relatively heavy currents.

In order to protect the contacts from burning and pitting when they are breaking heavy currents, the arc which is drawn is blown out by magnetic means. While magnetic blowouts are generally known, it is only recently that material has been available which can be highly enough magnetized, and which will retain its magnetism with such great persistence, as to permit the use of a small and compact enough permanent magnet as to fit in the space and on the supports available in various existing relay structures, and still be strong enough magnetically to accomplish its blowout function. Any material can be used which is available or be-

comes available, such as the one known commercially as "Alnico," which is an alloy of aluminum and nickel, and can be magnetized to a strength of from 10 to 15 times as great as can ordinary good grade magnetic steel, and requires an extremely high coercive force to destroy the magnetism.

A form of relay known as the "Type K," in general as disclosed in Patent No. 1,824,130, granted September 22, 1931, is in large use, and is manufactured in large quantities. As shown in Fig. 5, in a fragmentary form, this relay includes a top plate 6 of insulating material through which passes a binding post stem 7, carrying at its inner end a steel nut 8 for furnishing a support for the fixed front contact.

The front contact 9 is formed of suitable material, such as carbon, impregnated with silver, and is held in position against or adjacent the lower end of nut 8, by contact carriers 10 and 11. The contact carrier 10 is a strip-like member having a lower inturned end 10^1, carrying an inwardly projecting stud 10^2, which fits into a socket in contact 9, so as to hold it firmly in place.

The other contact carrier 11, includes a horizontal strip member 11^1 and a vertical strip-like portion 11^2 with the lower end inwardly turned to grip contact 9, the portions 11^1 and 11^2 being connected by an outward bend 11^3.

Passing through the contact holders 10 and 11 and through the nut 8 is a bolt 12, which is suitably secured in place by nuts 12^1 whereby to hold the front contact member in a rigid, assembled position on the top plate 6.

Referring now to the Fig. 4, there is here shown the same type of relay with the permanent magnet applied thereto. As shown in Figs. 2 and 3, the permanent magnet PM comprises a small compact piece of "Alnico," which is very strongly magnetized. The piece of magnetic material is of a form to readily fit into place on the relay front contact so as to constitute the desired magnetic blowout. In end elevation, as in Fig. 2, it is rectangular in form, while in side elevation, as in Fig. 3, it can be seen that there is an upper rectangular portion 13 having an inner upper corner cut away, as at 14, while the lower portion of the magnet bends inwardly, as at 15, to form a slight angle with the upper portion 13. This magnet is drilled, and countersunk, as at 16, to receive a bolt, like the bolt 12 of the existing relay structure.

As shown in Fig. 5, to apply the permanent magnet to the relay of this type, the bolt 12 is withdrawn, and the straight contact holder 10, which is made of brass, or other nonmagnetic material, is replaced by a holder of exactly the same shape and size, 17, but made of steel or other suitable magnetic material. A bolt 18, differing from bolt 12 only in being longer, is then employed to clamp the magnet in place, as shown, no other changes in structure being necessary to accomplish the desired purpose.

As seen in Fig. 4, when in place on the relay, the cutout portion 14 on the inner upper corner permits the upper outer corner 19 to bear against the edge of a socket 20, in the relay top 6, while the curved portion 11^3 of contact holder 11 fits into cutout portion 14, which snugly receives it. The inner, vertical face of the magnet bears against the vertical portion or leg 11^2, of contact holder 11, while the inturned portion of the magnet is positioned at an angle to closely follow the inturned portion of the vertical part of contact carrier 11.

In this manner, the small compact but very strong permanent magnet can be assembled on this existing type of relay, by the mere use of a longer connecting bolt, and the substituting for the brass contact carrier, a steel one of exactly the same size and shape. Thus, existing relays already in use, can be readily equipped with this protective means and new relays can be supplied with it, without changing the old manufacturing process, or construction, or the cast of production to any great extent.

The magnetic circuit for the flux causing the blowout function passes from the lower end of the magnet across the front end of the front contact, up the contact holder 17, and across the bolt 18, back to the magnet, accompanied, of course, by some little leakage flux.

The circuit to be controlled passes from the front fixed contact 9 to the movable contact 21, which is carried by contact finger 22, and thus the arc, which is drawn when the contacts are opened, and which is vertical, and in the plane of the paper, is blown out, either away from the observer, or towards him, and in a plane at substantially right angles to the paper, depending upon the relationship of the polarity of the circuit controlled, and of the magnetic flux.

It has been found by experience that the magnet should be positioned with its north pole at the lower end, so that lines of flux pass from the lower end of the magnet, to the right, to the lower end of contact carrier 17, and that the circuit to be controlled should have its positive side connected to the fixed contact 9, by any usual means, such as the binding post 7, and nuts 23. With this relationship of flux and current flow, the arc is blown out towards the observer in a plane at substantially right angles to the paper.

Although the theory underlying the same has not been proven, to be entirely satisfactory, it has been found by experience that if the circuit is poled in the opposite direction, so that the arc blows out, away from the observer, the blowout effect is very much diminished. For example, a current of from 40 to 50 amperes, can readily be broken without any damage to the contacts when the arc is blown toward the observer, but when the polarity is such that it is blown in the other direction, currents exceeding 8 to 10 amperes causes considerable burning and pitting of the contacts.

Referring now to Figs. 6 and 7, there is here shown a second form of magnet for use with a different form of relay. This magnet 24, in side elevation, is rectangular in form, while in end elevation, it is in the form of an inverted U with legs 25 and 26, and a back yoke 27.

This form of magnet is made of the same material as that described above, that is, of "Alnico," or the like, and hence can exert a very strong magnetic effect and still be small, light, and compact. It is of a form to be used on the "type B" relay, and its application to such a relay involves only minor changes.

As shown in Figs. 8 and 9, in a fragmentary form, the "type B" relay is of the telephone type, such, for example, as disclosed in patent application Ser. No. 253,383, filed January 28, 1939, in the name of J. F. Merkel. This type of relay, as shown in the drawing, involves a movable contact finger 28 having a contact member 29 of

silver or other suitable material, and carries a roller or the like 30, received in a slot 31, of a pusher 32, of insulating material, such as suitable fiber, whereby, when the pusher is moved by the relay armature, the finger 28 with its contacts 29 is moved.

The movable contact 29 cooperates with a fixed contact 33 of any suitable material, such as metal impregnated carbon, carried in a cup 34 mounted on a fixed contact finger 35, having a usual stop plate 36 bearing thereagainst, and a usual pressure plate 37 cooperating therewith. The contact fingers, with their various plates, are molded, as units, in Bakelite or the like, in the form of a finger unit 38, as is usual in this type of relay, with the fingers extending to the rear, as at 39 and 40, for cooperation with a plug connecting means.

The fixed contact finger 35 has a slot 41, through which pusher 32 can freely move, and in the existing form of relay, the pressure plate 37 terminates at the line 37^1 short of the pusher, whereby, if the pusher be moved upwardly the movable contact finger 28 causes the movable contact 29 to engage with fixed contact 33 and complete a desired circuit, and when the pusher moves downwardly, this circuit is broken.

In applying the protective blowout means to this type of relay the pressure plate 37 is extended forwardly, as shown, to have a portion 37^2, slotted as at 42, to allow the pusher 32 to pass freely therethrough. This extension on the pressure plate either can be added to an existing pressure plate by any suitable means or an entirely new contact finger assembly, together with its block 38, with the proper arrangement of contact fingers, can be supplied and attached to the existing relay structure.

The magnet employed with this type of relay, of the inverted U shape, is placed across the end of pressure plate 37, with its legs 25 and 26 passing to either side of the fixed contact, and terminating substantially midway of the gap between the fixed and movable contact members, whereby flux passing across between the ends of the two legs, passes through the gap in which an arc is drawn when a circuit is broken. The magnet is fastened in place by means of a flexible ribbon 42^1 of metal or the like, welded lengthwise to the pressure plate as at 43, and then bent up and around the top of the magnet, as at 44 and 45, to there have its ends soldered together, to securely hold the magnet in place with its legs straddling the fixed contact 33.

From an inspection of Fig. 9, it can be seen that the magnetic flux will cause the arc produced by opening the contacts to be blown either to the right or the left, and in the plane of the paper. Since pusher 32 might be injured by this arc, if broken towards it, and contact finger 28 might cause the arc to be prolonged, without breaking, the magnet is positioned with its poles as shown, and the circuit is poled, as indicated by the symbols (+) and (−), so as to cause the arc to be blown to the left, as viewed in Fig. 9; that is, to be blown away from pusher 32.

As with the form first described, it has been found with this "type B" form of relay, equipped with the blowout permanent magnet, that currents of relatively large sizes, as 40 to 50 amperes, can be safely handled without undue damage to the contacts, whereas without such blowout means, currents merely a fraction of this, causes serious pitting and burning in a very short time.

If a movable contact and back point be employed in connection with the fixed contact, in the pile-up of fingers in this "type B" form of relay, it is found that the magnet, positioned as shown, will produce a relatively satisfactory blowout operation. However, if desired, the magnet in this case can be made with somewhat longer legs so as to substantially center its magnetic field at the unoperated level of the movable contact finger.

In the foregoing, there has been described, in two forms, permanent magnets formed of highly magnetizable, and very retentive material, which are of a shape, size, and weight, which permits them to be readily, and economically placed in position on existing forms of relays, now being manufactured in quantity, and which are already in use, in large quantities, without any material change in the relay structure, or any material added expense in so equipping the relays.

The above rather specific description of two forms which this invention can assume, has been given solely by way of example, and is not intended in any manner whatsoever in a limiting sense. Modifications and variations in details are intended to be covered by the present application, insofar as they are not specifically excluded therefrom, by the appended claims.

Having described my invention, I now claim:

1. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm being against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt passing through the contact holders and the head for clamping the fixed contact in place, a movable contact associated with the fixed contact, and a very strong permanent magnet of material having very high retentivity, clamped by the bolt against said side arm, with the face of the magnet contacting throughout with the side arm, and the lower end of the magnet terminating substantially at the level of the end of the fixed contact, to thus form a magnetic blowout.

2. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm bearing against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt passing through the contact holders and the head for clamping the fixed contact in place, a movable contact associated with the fixed contact, and a very strong permanent magnet of material having very high retentivity, clamped by the bolt against said side arm, with the face of the magnet contacting throughout with the side

arm, and the lower end of the magnet terminating substantially at the level of the end of the fixed contact, to thus form a magnetic blowout, the angled holder having an outwardly projecting loop joining its two arms, and a cavity in the inner face of the magnet snugly receiving the loop.

3. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder of magnetic material bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm bearing against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt of magnetic material passing through the contact holders and the head for clamping the fixed contact in place, a movable contact associated with the fixed contact, and a very strong permanent magnet of "Alnico" having very high retentivity clamped by the bolt against said side arm, with the face of the magnet contacting throughout with the side arm, and the lower end of the magnet terminating substantially at the level of the end of the fixed contact, to thus form a magnetic blowout.

4. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder of magnetic material bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm bearing against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt of magnetic material passing through the contact holders and the head for clamping the fixed contact in place, a movable contact associated with the fixed contact, and a very strong permanent magnet of "Alnico" having very high retentivity clamped by the bolt against said side arm, with the face of the magnet contacting throughout with the side arm, and the lower end of the magnet terminating substantially at the level of the end of the fixed contact, to thus form a magnetic blowout, the angled holder having an outwardly projecting loop joining its two arms, and a cavity in the inner face of the magnet snugly receiving the loop.

5. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder of non-magnetic material bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder non-magnetic material having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm bearing against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt passing through the contact holders and the head for clamping the fixed contact in place, a movable contact associated with the fixed contact, a strong permanent magnet having a face to match the said side arm of the angled contact holder and drilled to receive a bolt of the diameter of said bolt, and magnetic blow-out adapting means, including, a long bolt of magnetic material to replace the first said bolt, and a contact holder of magnetic material, and identical in shape and size with the non-magnetic plane holder, to replace the latter.

6. In a relay, in combination, a top plate, a stud passing through the plate, a head on the inner end of the stud, a plane contact holder bearing against one side of the head and extending beyond the head and turned inwardly thereof, an angled contact holder having a flat arm receiving the stud and positioned between the inner face of the top plate and the top of said head, and a side arm bearing against the opposite side of the head and extending beyond the head and turned inwardly thereof toward the other contact holder, a fixed contact adjacent the bottom face of the head and positioned between the inturned ends of the contact holders, a bolt passing through the contact holders and the head for clamping the fixed contact in place, and a very strong permanent magnet, of material having very high retentivity, clamped by the bolt against said side arm, with the face of the magnet contacting throughout with the side arm, and the lower end of the magnet terminating at substantially the level of the end of the fixed contact, to thus form a magnetic blowout, and a socket in the inner face of the top plate, the outer face of the magnet, at its upper end bearing against the inner face of the plate socket.

7. In a relay, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger intermediate its ends and extending therefrom to overlie the fixed contact, a very strong permanent magnet of material of high retentivity, in the general form of a U, carried by the pressure plate with its legs straddling the fixed contact and extending toward, and terminating just short of, the movable contact, to thus constitute a magnetic blow-out means.

8. In a relay blowout means, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger intermediate its ends and extending therefrom to overlie the fixed contact, a very strong permanent magnet of material of high retentivity, generally in the form of a U, carried by the pressure plate with its legs straddling the fixed contact and extending toward, and terminating just short of, the movable contact, and means fastening the magnet to the pressure plate, comprising, a ribbon of flexible metal welded to the pressure plate intermediate its own ends and between the base of the U and the plate, the ends of the ribbon being tightly wrapped around the said base and soldered together.

9. In a relay blowout means, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger

intermediate its ends and extending therefrom to overlie the fixed contact, a very strong permanent magnet of material of high retentivity, in the form of a U, carried by one end of the pressure plate with its legs straddling the fixed contact, and extending toward, and terminating just short of, the movable contact, said contact fingers and pressure plate having their ends remote from the magnet molded in an integral piece of insulating material to constitute a finger assembly unit.

10. In a relay magnetic blowout, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger intermediate its ends and extending therefrom to overlie the fixed contact, a very strong permanent magnet of material having high retentivity, generally in the form of a U, carried by one end of the pressure plate with its legs straddling the fixed contact and extending toward, and terminating short of, the movable contact, and means fastening the magnet to the pressure plate, comprising, a ribbon of flexible metal welded to the pressure plate intermediate its own ends and between the base of the U and the plate, the ends of the ribbon being tightly wrapped around the said base and soldered together, said contact fingers and pressure plate having their ends remote from the magnet molded in an integral piece of insulating material to constitute a finger assembly unit.

11. In a relay blowout means, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger intermediate its end and extending therefrom to overlie the fixed contact, a very strong permanent magnet of material having high retentivity, generally in the form of a U, carried by the pressure plate, with its legs straddling the fixed contact and extending toward, and terminating just short of, the movable contact, a fibre contact finger pusher operatively connected to the movable contact finger inwardly of the movable contact, the magnet and the circuit through the two contacts being so poled as to cause the arc to be blown away from the said pusher.

12. In a relay blowout means, in combination, a movable contact finger, a movable contact thereon, a fixed contact finger, a fixed contact thereon and cooperating with the movable contact, a pressure plate bearing against the fixed contact finger intermediate its end and extending therefrom to overlie the fixed contact, a very strong permanent magnet of high retentivity material, in the general form of a U, carried by the pressure plate and with its legs straddling the fixed contact and extending toward, and terminating just short of, the movable contact, means fastening the magnet to the pressure plate, comprising, a ribbon of flexible metal welded to the pressure plate intermediate its own ends and between the base of the U and the plate, the ends of the ribbon being tightly wrapped around the said base and soldered together, said contact fingers and pressure plate having their ends remote from the magnet molded in an integral piece of insulating material to constitute a finger assembly unit, and a fibre contact pusher operatively connected to the movable contact finger inwardly of the movable contact, the magnet and the circuit through the two contacts being poled as to cause the arc to be blown away from the said pusher.

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