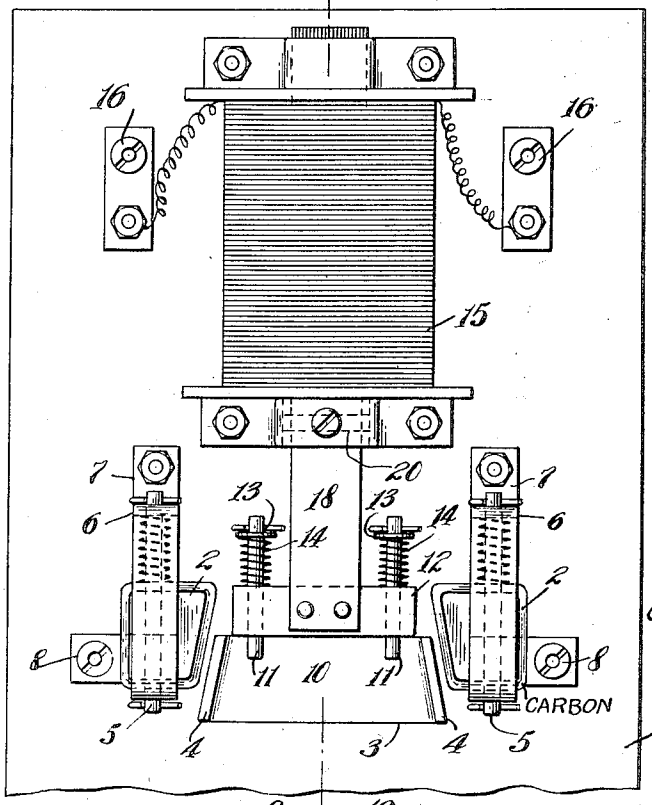
Jan. 13, 1925. 1,522,546

L. E. RICHMOND

RELAY OR SWITCH

Filed Jan. 25, 1919

FIG. 1.



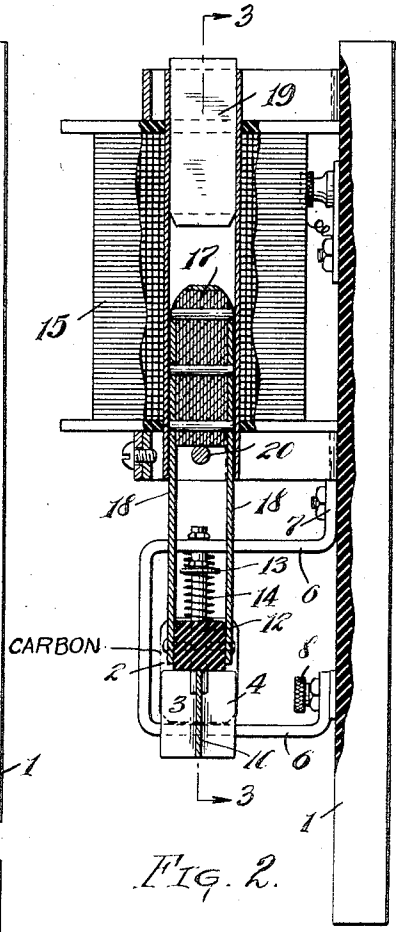


FIG. 2.

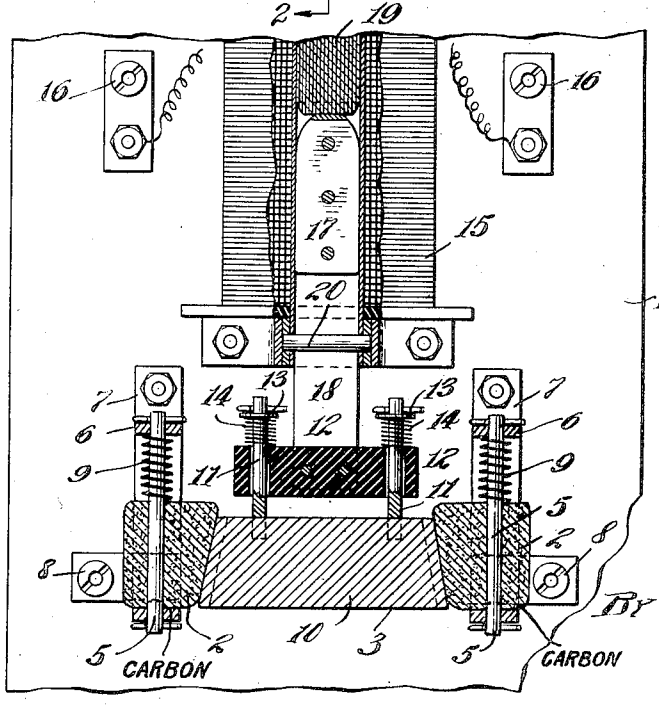


FIG. 3.

INVENTOR,
Louis E. Richmond
BY Brockett & Hyde
ATTYS.

Patented Jan. 13, 1925. 1,522,546

UNITED STATES PATENT OFFICE.

LOUIS E. RICHMOND, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AUTOCALL COMPANY, OF SHELBY, OHIO, A CORPORATION OF OHIO.

RELAY OR SWITCH.

Application filed January 25, 1919. Serial No. 273,150.

To all whom it may concern:

Be it known that I, LOUIS E. RICHMOND, citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Relays or Switches, of which the following is a specification.

This invention relates to relays or switches, and more particularly to relays or switches for controlling alternating current circuits including inductive loads. The invention is designed primarily for controlling alternating current signalling circuits including suitable signalling devices, such as bells of the construction shown in my prior patent for bells, No. 1,258,813, granted March 12, 1918, although it is, of course, suitable for controlling any kind of circuit including an inductive load, and for other purposes.

Where an alternating current circuit includes an inductive load, such as the bell coil of my prior patent, a too sudden or sharp break or opening of the circuit creates inductance in the load, the bell coil, for example. When the circuit is next closed after a short interval insufficient to allow the inductance to die away, as occurs in the quickly repeated strokes of a bell in a signalling system, the circuit closes through an arc at the relay or switch before true mechanical contact is effected at the contact surfaces in the switch. As a consequence, the high resistance of the arc impedes the current flow so that only a weak bell stroke is produced. Ordinary relays or circuit interrupters are therefore unreliable because a uniformly heavy stroke is not always secured. Furthermore, ordinary relays or circuit interrupters usually arc at the contact surfaces to such an extent as to gradually burn out and destroy the contact members.

The object of the present invention is to provide an improved relay or circuit interrupter which opens a circuit gradually or slowly as distinguished from the sharp, quick break usually found in these devices, and preferably in a manner to produce first a gradually decreasing presure between the contact surfaces and then, if desired, a progressive but relatively small sliding movement of one surface on the other, before the surfaces are completely mechanically separated, so that the wear on the surfaces is negligible and renewal is infrequent if ever necessary.

A further object of the invention is to provide a relay of this kind which can be constructed in light form and at low cost but which will, nevertheless, carry heavy loads without destructive arcing.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

The invention comprises the construction and arrangement of parts hereinafter described and claimed.

In the drawings, which represent one suitable embodiment of the invention, Fig. 1 is a front elevation; Fig. 2 is a sectional elevation on the line 2—2, Fig. 1, looking in the direction of the arrows; and Fig. 3 is a sectional elevation on the line 3—3, Fig. 2, looking in the direction of the arrows.

The relay shown in the drawings comprises a suitable base 1 made of insulating material and carrying the various parts of the mechanism. 2 indicates a pair of oppositely disposed contact members, to which the incoming and outgoing leads are connected, as will appear, and which contact members co-operate with a circuit completing bridge member 3, movably mounted for opening or closing the circuit. In the device shown in the drawings the contact members 2 are made of carbon or graphite, of hard dense compact form, while the bridge member 3, or at least the contacting portions 4 thereof may be made of copper, although the reverse arrangement, to wit, copper members 2 and a carbon member 3 is possible, and other materials may also be used.

Each of the contact members 2 is in the form of a solid block having an opening to receive a rod 5 suitably held at its ends in a bracket member 6. Each bracket member is shown as of U shape and is provided with feet 7 bolted to the base plate 1, one of the feet of each bracket being electrically connected to a binding post 8 to which the incoming or outgoing circuit lead, as the case may be, is connected. Each member 2 has limited turning motion in the frame 6 on or with the rod 5 on which it is supported, so that said members are self-adjusting to intimate and full contact with the contacting portions 4 of the bridge 3 when the latter is moved into bridging relation between the two blocks. Also, each block is held down-

wardly, or is normally moved by spring pressure in a direction toward the approaching circuit closing bridge 3, by a light compression spring 9. These springs allow slight longitudinal motion of the blocks along the rods when the circuit is closed, mainly for the purpose of lessening the impact and softening the blow in closing the circuit. The rods 5 are a fairly close fit in the holes in the frame 6 and also in the holes in the members 2, so that the members 2 are rigidly held against lateral movement, which prevents rebound effects when the bridge meets said contacts in closing the circuit, and the mehanical connection so produced is therefore maintained without a chattering condition.

The bridge 3 comprises a central plate portion 10 and the contacting wing portions 4 in planes perpendicularly thereto. Plate 10 is rigidly secured to a pair of pins or rods 11 which have sliding movement in openings in a transversely extending insulating block 12, made of bakelite, condensite, or similar insulating material. Said pins project beyond the block 12 and on their free ends are provided with abutments, such as the washers 13, so as to provide, with the top edge of the plate portion 10, separated shoulder portions between which the insulating block 12 is adapted to move. Light compression springs 14 are provided between said abutments or shoulder portions 13 and the block 12.

While the drawings show the member 3 as in the form of a bridge between two contact blocks 2 it is obvious that a circuit may be controlled by making and breaking the mechanical connection between a single block 2 and a single contacting member 4 co-operating therewith. Therefore, any suitable means may be provided for producing the proper relative motion between members 2 and 4 to secure the desired effects. The relative motion between the two contacting surfaces may be secured by moving both surfaces, but preferably by moving one of said surfaces relative to the other and at an angle thereto, preferably an acute angle, say 10°, so as to produce relatively slow or gradual meeting and separating motion between the two contact members. As illustrated, the member 3 travels back and forth along a line parallel with the rods 5, while the contacting surfaces of the blocks 2 and contacting portions 4 are inclined to said path of movement at an acute angle, approximately 10°. Therefore, when the bridge 3 is moved in the circuit closing direction, (upward in Fig. 3,) it tends to wedge in between the two blocks 2, and with increasing force tending to elevate the bridge the pressure between the contacting surfaces is increased.

Any suitable means may be provided for actuating the moving member of the switch. The operating means is preferably connected to the insulating block 12 and arranged to give said block the proper motion and impart said motion to the bridge 3 through the springs 14, which serve to limit the wedging force on the bridge. For operating the switch the drawings illustrate a coil 15 whose terminals are electrically connected to binding posts 16 which may be connected to suitable leads in a relay controlling circuit. Within said coil is a movable core 17 preferably laminated, as shown, and rigidly connected by bars or straps 18 to the transversely extending block 12. At the upper end of the core is located a rigid preferably laminated stop or abutment 19. When the relay controlled circuit is closed coil 15 is energized and attracts the core 17 toward its center, so that said core moves upwardly in Fig. 2 until it abuts the fixed stop 19. 20 indicates a cross pin or other fixed abutment which prevents the core from dropping out of the coil and limits opening movement of the switch.

Figs. 1 and 2 illustrate the open position of the relay. The movable parts are supported by the cross pin 20 on which the core 17 is supported. Springs 14 hold the bridge 3 up against the insulating block 12, or at least in an elevated position relative to said block as compared with the closed position of the relay. When the relay controlling circuit through the coil 15 is closed the core 17 moves upwardly with a very quick motion. The contacting portions 4 of the bridge 3 engage the companion inclined co-operating surfaces of the blocks 2 before the core 17 has reached the abutment 19. Consequently the core and block 12 move upwardly in advance of the bridge 3 and compress the springs 14. Bridge 3 is thus wedged in between the blocks 2 by a predetermined yielding force, depending upon the pressure of the springs 14. This pressure is made comparatively light so as to prevent the bridge from firmly wedging between the blocks and making it difficult to push the bridge out when opening the switch. The core 17 and straps 18 are a fairly loose fit in the central coil tube, and the rods 11 fit loosely in their openings in the blocks 12. Consequently, the bridge 3 is loosely supported and has a slight turning motion and can swing a limited amount in any direction. This fact, together with the turning motion of the blocks 2 on their rods 5, permits the contacting surfaces to adjust themselves to each other and secure complete and uniform contact over the entire surface area. As before stated, the blocks 2 are immovable laterally to avoid rebound effects and also have a slight yield against the pressure of springs 9 to soften or cushion the surface closing impact.

The circuit is opened by opening the control circuit to the magnet 15 which is thereupon de-energized, allowing the core 17 to drop back by gravity to its lower position shown in Fig. 2. At the instant the coil 15 is de-energized the bridge 3 is wedged in between the blocks 2 with a light pressure. Consequently, the core 17 and block 12 first move down without corresponding motion of the bridge 3 and said members 17 and 12 serve as a hammer re-enforced by the pressure of the springs 14 to produce a blow on the bridge 3 and push it out from its wedging position. The first effect on the bridge 3 is to decrease the pressure at the contacting surfaces before a mechanical break or separation is effected. Since one or more of the contacting members are made of carbon this gradually increases the resistance at the break. The next effect is to gradually separate the contacting surfaces by relative motion of one along the other and at an angle thereto. During this motion, as well as during the contrary relative movement between the contacts when the circuit is closed, there is microscopic or at least a very small relative sliding motion of one surface on the other, the pressure and mechanical contact between the surfaces gradually decreasing until finally complete mechanical separation is produced. The time interval between the first impact of the block 12 on the bridge 3 and the production of complete mechanical separation between the contact surfaces is sufficient for the surge of current to die away and therefore no inductive effect is produced by the load in the controlled circuit and no arc flashes between the contacts.

In practice it is found that after an initial period of use of the relay the carbon of the members 2 in minute quantities is driven or worked into the metal of the contacting surfaces or portions 4, so that the copper or brass of said portions 4 acquires a highly polished or glazed black surface, and the carbon blocks 2 become similarly polished. Subsequently, the relative sliding motion between the contacting surfaces is so slight that there is practically no wear whatever of said surfaces. Even if wear does occur the wedge form of the member 3 always permits it to move up between the blocks 2 to a sufficient amount to secure proper contact. When said wedge is found to move up so far as to affect the wedging pressure of said springs 14 either the pressure of said springs can be increased by inserting additional washers 13 or the two blocks 2 can be adjusted a small amount toward each other, such as by bending either or both of the frames 6 toward the other, thereby restoring the original conditions.

Notwithstanding the comparatively small size of the relay and the current contacting parts it will carry relatively high current loads. The relay shown in the drawings, for example, has a capacity of fifteen hundred watts, whereas an ordinary relay or circuit interrupter carrying fifteen hundred watts must be made of heavy bus bars and have a large area of metal at the contacting surfaces so as to distribute the arc over a wide area and réduce its destructive effect, although destructive effect in such ordinary relays cannot be wholly avoided.

What I claim is:

1. A circuit controlling switch, comprising two opposed relatively stationary members having contact surfaces inclined to each other, a co-operating bridging member movable into position between said stationary members, and a yielding mounting for said relatively stationary members including stationary pins associated therewith and permitting sliding movement therealong parallel to the direction of movement of said bridging member.

2. A circuit controlling switch, comprising two opposed relatively stationary members having contact surfaces inclined to each other, a co-operating bridging member movable into position between said stationary members, a yielding mounting for said relatively stationary members permitting slight movement thereof parallel to the direction of movement of said bridging member, and yielding operating means for said bridging member.

3. A circuit controlling switch, comprising two opposed relatively stationary members having contact surfaces inclined to each other, a co-operating bridging member movable into position between said stationary members, a yielding mounting for said relatively stationary members permitting slight movement thereof parallel to the direction of movement of said bridging member, and yielding operating means for said bridging member, each of said stationary members being rotatable about an axis parallel to the direction of movement of the bridging member to accommodate themselves thereto.

4. A switch, comprising two relatively stationary contact members having angularly disposed contacting surfaces, a bridging contact having similar angularly disposed co-operating contacting surfaces, the angular relation of the stationary contacting surfaces being sufficiently acute so that said bridging contact will wedge and stick between them, said bridging contact having separated shoulder portions, an operating bar for said bridging contact having a portion movable between said shoulder portions, and yielding means between said bar and one shoulder portion, whereby upon movement of said bar in the switch closing direction said bridging contact is yieldingly moved to wedging position and upon oppo-

site movement is positively forced from wedging position by the impact of said operating bar with the other shoulder portion.

5. A switch, comprising two relatively stationary contact members having angularly disposed contacting surfaces, a bridging contact having similar angularly disposed co-operating contacting surfaces, the angular relation of the stationary contacting surfaces being sufficiently acute so that said bridging contact will wedge and stick between them, said bridging contact being provided with a plurality of shouldered members extending substantially parallel with the direction of its movement, an operating bar for said bridging contact having a portion movable between said bridging contact and the shoulders of said members, and yielding means between said operating bar portion and said shoulders, whereby upon movement of said operating bar in one direction said bridging contact is yieldingly moved to wedging position and upon reverse movement is positively forced from wedging position by the impact of said operating bar with said bridging contact.

6. A switch, comprising two relatively stationary contact members having angularly disposed contacting surfaces, a bridging contact having similar angularly disposed co-operating contacting surfaces, the angular relation of the stationary contacting surfaces being sufficiently acute so that said bridging contact will wedge and stick between them, said bridging contact being provided with a plurality of shouldered pins extending substantially parallel with the direction of its movement, an operating bar for said bridging contract having a transverse portion slidable on said pins between the shoulders thereof and said bridging contact, and springs arranged about said pins between the shoulders thereof and the transverse portion of said operating bar whereby upon movement of said operating bar in the switch closing direction said bridging contact is yieldingly moved to wedging position and upon opposite movement is positively forced from wedging position by the impact of said operating bar with said bridging contact.

7. A switch, comprising two relatively stationary contact members having angularly disposed contacting surfaces, a bridging contact structure having two relatively movable parts, one of said parts being provided with similar angularly disposed co-operating contacting surfaces, the angular relation of the stationary contacting surfaces being sufficiently acute so that the contact carrying part of said bridging structure will wedge and stick between them, an operating means for said bridging structure connected to the part which does not have the contacting surfaces, a fixed abutment, and yielding means arranged between said abutment and said last named bridging part, whereby upon movement of said bridging part in the switch closing direction, the contacting surfaces of the other bridging part are yieldingly moved into wedging engagement with the contacting surfaces of said relatively stationary contacting surfaces and upon opposite movement of said part, the contacting surfaces of the other bridging part are positively forced from wedging engagement with the contacting surfaces of said relatively stationary members by the impact of said other bridging part therewith.

In testimony whereof I affix my signature.

LOUIS E. RICHMOND.