Dec. 7, 1926. 1,609,324

S. S. STOLP

ELECTRIC RELAY

Filed Jan. 18, 1923

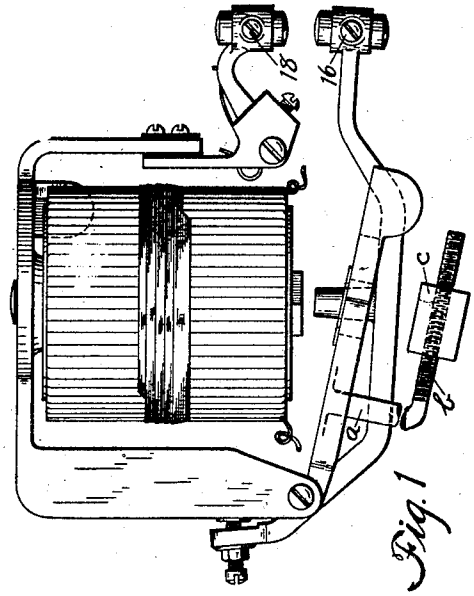


Fig. 1

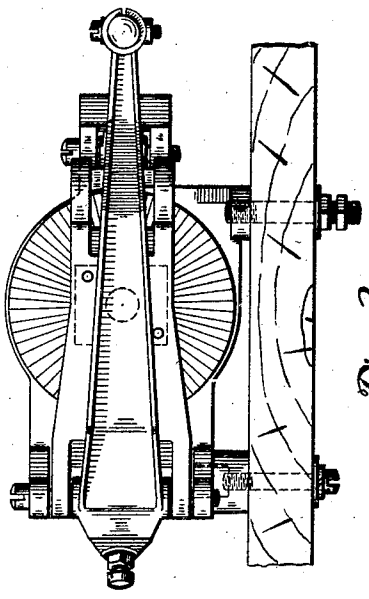


Fig. 3

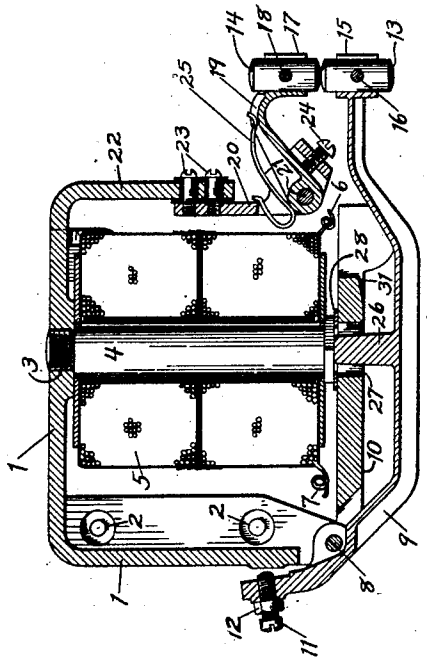


Fig. 2

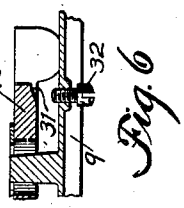


Fig. 6

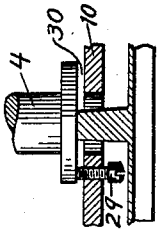


Fig. 5

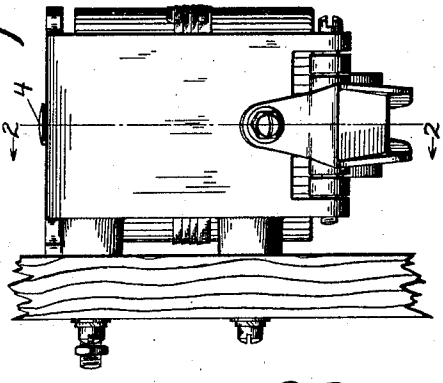


Fig. 4

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UNITED STATES PATENT OFFICE.

SAMUEL S. STOLP, OF MANSFIELD, OHIO, ASSIGNOR TO THE OHIO BRASS COMPANY, OF MANSFIELD, OHIO, A CORPORATION OF NEW JERSEY.

ELECTRIC RELAY.

Application filed January 18, 1923. Serial No. 613,511.

My invention relates to electrically operated relays.

The object of my invention is to provide a relay in which the opening of the relay or the equivalent element has a time factor in its operation.

It is very often desirable where relays are used to provide some means whereby the operation of the relay in opening or closing a circuit may be retarded as relates to the opening or closing of some other circuit, and such lapse of time may be quite accurate and dependable with respect to predetermined requirements. Therefore, I have devised a means for securing a time element in relay operation and also means for varying and adjusting the time element in operation.

My invention resides in the new and novel construction, combination and arrangement of the various parts hereinafter fully described and disclosed in the drawing.

In the drawing accompanying this specification:

Fig. 1 is a side view in elevation of my device showing the circuit closing elements in an open position, and showing means for varying the time element operation described later which may or may not form a part of the construction as desired.

Fig. 2 is a sectional view of Fig. 4 on the line 2—2 and shows the contacting elements in a closed position without the adjusting mechanism *a*, *b*, *c*.

Fig. 3 is a bottom plan view of Fig. 2 showing the device mounted upon a board or other support.

Fig. 4 is an end view of Fig. 3.

Fig. 5 is a modification of the two contact operating members showing means for varying the time element feature of my device.

Fig. 6 shows a modification later described herein.

In the preferred construction embodying my invention I employ a frame member 1 preferably constructed of magnetic material provided with threaded sockets 2 by means of which the frame may be secured to a support. Secured to the frame 1 by means of a threaded engagement 3 is a magnetic core 4 which is surrounded with the coil 5 provided with leads 6 and 7 by means of which the coil 5 may be connected to an apparatus to receive an electric current for the operation of the relay. Pivotally secured to the frame 1 by means of the pin 8 are two arms, one arm 9, which I will term the operating arm, and the other arm 10, which I will call the control arm, and which operates independently of the arm 9.

The arm 9 is provided at one end with an adjusting screw 11 and lock nut 12 by means of which the amount of movement of the arm 9 about the pin 8 may be controlled as will be readily seen from Figs. 1 and 2. To the other end of the arm 9 is secured a contact element 13 adapted to engage with a cooperating contact element 14 by means of which an electric circuit may be closed when the elements 13 and 14 are in contact. The contact 13 is secured in a socket 15 by means of a screw or pin 16 and the contact 14 is secured in a socket 17 by means of a pin or screw 18. The socket 17 forms a part of the arm 19 which is secured to a member 20 by means of the hinge pin 21. The member 20 may be secured to the member 22 of the frame 1 by means of screws 23, but in insulated relation to the frame 22. The member 20 is provided with an adjusting screw 24 which engages the hinged arm 19 for the purpose of adjusting the distance between the contacts 13 and 14 and a spring 25 maintains the arm 19 in contact with the screw 24. This arrangement of the contact 14 in connection with the pivotally mounted and spring held arm 19 permits of a better and more reliable contact between the members 13 and 14 when in their closed position. Any well known means may be used for connecting a conductor to the arm 9 and the arm 19 in order to electrically connect the members 13 and 14 to proper devices. Such leads may be connected to the screws 16 and 18 in the construction as shown, providing such leads are sufficiently flexible as not to effect the movements and operation of the arms 9 and 19.

The operating arm 9 is provided with a boss 26 which is permitted to engage with the core 4 when the relay is in the closed position in which case there is a closed magnetic circuit through the frame 1, the arm 9, the boss 26 and the core 4, as all of these parts are preferably made of magnetic material.

The control arm 10 is provided with an aperture 27 through which the boss 26 may operate freely and the upper face of the arm 10 immediately surrounding the aperture

has secured to it a disc 28 of non-magnetic material. This non-magnetic material is interposed between the operating arm 10 and the core 4, and therefore, prevents the arm 10 from sticking to the core 4 due to residual magnetism, all of which is well known in the art. There is formed practically a closed circuit through the frame 1, the arm 10 and the core 4, and the thickness of the disc 28 determines the magnetic gap in this circuit, and also controls or effects the time that the control arm 10 is held in an upward position after the current in the coil 5 has been cut off. The thinner the disc 28 the longer the control arm 10 will be held in an upward position after the current has been cut off of the coil 5 for the reason that the residual magnetism in the core 4 will have a greater attractive effect upon the control arm 10. The use of a disc 28, however, does not permit of varying the time element in which the operating arm 10 is held in an upward position and, therefore, I have shown a modification in Fig. 5 by means of which the control arm 10 may have its operation varied as desired. This modification comprises an adjusting screw 29 threadedly engaging the control arm 10 and arranged to contact with the core 4. The screw 29 is preferably made of a non-magnetic material and therefore in itself cannot adhere to the core 4, and the air gap 30 between the members 4 and 10 can be easily adjusted thereby effecting the time element operation of the operating member 10. The member 10 is provided with means 31 to engage the arm 9 as shown in Fig. 1.

In Fig. 1 I have shown a modification for varying the time element operation of the arm 10 in that I provide in connection with the arm 10 an arm *a* so arranged as not to interfere with the operation of the arm 9 and having a threaded arm *b* upon which is threadably mounted a weight *c*. By moving the weight *c* forward or back, the center of gravity about the pin 8 is varied, and the weight to be held in an upward position by the residual magnetism in the core 4 can therefore be varied, which in turn will vary the time that the control arm 10 is held in an upward position by the residual magnetism after the current has been cut off from the coil 5.

In the operation of my device the parts will presume to originally rest in the position shown in Fig. 1 and no current is flowing through the coil 5. If current is now sent through the coil 5 the core 4 will be magnetized, as is well known, and the magnetic flux set up will attract both the arms 9 and 10. The arm 9 will be in contact with the core 4 through the boss 26 and the arm 10 will be held close to, but out of actual contact with the core 4 by the non-magnetic disc 28. The contacts 13 and 14 will now be held in engagement and the spring 25 will assure a positive engagement and at the same time remove the shock between the contacts 13 and 14, and the other parts upon their engagement, which would not be the case under the blow of the contact 13 if the contact 14 were rigidly held.

If the current is now cut off of coil 5 as by opening the circuit thereto or short-circuiting the same, there will be left a certain amount of residual magnetism depending upon certain well known factors, and this residual magnetism will continue to attract and hold the arm 9 in an upward position and in engagement with the core 4. In time, however, this residual magnetism will weaken and the arm 9 will drop to the open position, but it is well known that this time element or lag in the operation of the arm 9 is not dependable as to its uniformity of action. Also the residual magnetism will be so strong as to retain the arm 9 in a closed position much longer than is desired. Therefore, I employ the control arm 10 so arranged as to mechanically engage with the arm 9 through the end portion 31 of the arm 10.

It is well known that the non-magnetic disc 28 maintaining the magnetic arm 10 from the magnetic core 4 thereby providing the equivalent of an air space between these members, that the residual magnetism in the core 4 will have very little or practically no perceptible effect in retaining the arm 10 in its upward or closed position and therefore its operation is more reliable, in that the time lag between its dropping or opening and the cutting off of the current in the coil 5 is practically nil, but is practically constant during different operations. If I were to apply a non-magnetic element to the engaging face of the boss 26 then the arm 9 would act in the same manner as just described with respect to the arm 10, but this construction would, like in the case of arm 10, give practically no time lag between the opening of the contacts 13 and 14 and the cutting off of the current in the coil 5. Therefore, I utilize the prolonged holding effect of the residual magnetism upon the arm 9 due to their direct contact, and the elimination of the holding effect of the residual magnetism upon the arm 10 after the current has been cut off from the coil 5.

It will be readily understood that if the arm 9 is in engagement with the core 4 and the arm 10 is held in an upward or closed position, and that if the current is cut off of the coil 5 that the arm 9 will still be held in an upward or closed position after the current has been cut off, and if the arm 10 drops practically immediately due to the residual magnetism having no holding effect upon the arm 10, that the arm 10 will be

dropped by the force of gravity and strike the arm 9 thereby causing the arm 9 to drop by the force of gravity and the time that the arm 9 is held in a closed position after the current is cut off from the coil 5 will be the time in which the part 31 of the arm 10 is traveling downward until it strikes the arm 9.

It will be quite apparent that with the modification shown in Fig. 5 that with a given construction the time lag in the operation of the arm 10 and hence the arm 9 can be varied. It will also be apparent that with the modification shown by the dotted lines in Fig. 1 that the same is true. It will also be evident that with a given construction as shown in Fig. 2, that if the distance between the points on the arms 9 and 10, which engage, is varied that the time lag in the opening of the contacts 13 and 14 will also be varied.

In Fig. 6 is shown a means of adjusting the contact distance between the arms 9 and 10 by means of which the lag in operation of the arm 9 may be adjusted. This modification consists of inserting an adjusting screw 32, preferably of non-magnetic metal, in the arm 9, one end of which will engage with the arm 10, and that by adjusting the screw 32, the contact distance will be varied between 31 and 9 and between 10 and 4.

It will be seen that I have made the operation of the arms 9 and 10 independent of dash pots, springs, etc. which are variable as to their reliability and prefer to depend only upon such means as are practically unchangeable for the time lag operation of the arm 9. In fact, the only variable element is possibly the residual magnetism in the core 4 and this variation would be due almost exclusively to a variation in the current flowing in the coil 5 from time to time. If, however, the arms 9 and 10 are so positioned that they are not movable away from the core 4 by gravity then it may be necessary to use springs to move the arms 9 and 10 to the open position.

As my invention may be applied to apparatus intended for various uses there are naturally various constructions, combinations and arrangements of parts necessary and such modifications will be apparent to one skilled in the art and therefore I do not wish to be limited other than by my claims.

I claim:

1. An electrically operated relay comprising in combination, a frame, current controlled magnetic means secured to the frame, an armature pivotally mounted on the frame and moved upon its pivotal point by the magnetic means to make or break engagement with a circuit closing contact and held in said position by the residual magnetism in the magnetic means and gravity controlled means adapted to impinge upon the armature after the current is cut off from the magnetic means a predetermined time to release the armature, by impact, from the influence of the residual magnetism and move it from its retained position.

2. An electrically operated relay comprising in combination, a frame, current controlled magnetic means secured to the frame, a pair of armatures pivotally mounted on the frame and moved in one direction only about a common pivotal point by the magnetic means when energized, one armature provided with means to make or break engagement with a circuit controlling contact and to engage the magnetic means and be held in engagement with the contact by the residual magnetism in the magnetic means after current is cut off from the magnetic means, the other armature arranged to engage the magnetic means when moved to one position and to engage the other armature by impact when moved to the opposite position, means interposed between the second armature and the magnetic means to prevent its being retained in engagement with the magnetic means by the residual magnetism and means to cause the second armature to impinge upon the first armature to release it from the holding influence of the residual magnetism in the magnetic means.

3. An electrically operated relay comprising a current controlled magnetic means, an armature of magnetic material pivotally mounted to move into engagement with the magnetic means when the magnetic means is energized and be held in engagement therewith by the residual magnetism in the magnetic means after the controlling current is cut off the magnetic means, and means normally engaging the armature and movable by the magnetic means out of engagement with the armature when the magnetic means is energized and movable by gravity into engagement with the armature after a predetermined lapse of time after the controlling current is cut off the magnetic means to move the armature out of engagement with the magnetic means.

4. An electrically operated relay comprising in combination, a current controlled magnetic means, a pair of elements operable by gravity in one direction and movable simultaneously in the other direction under the influence of the magnetic means and movable in the opposite direction at different times after the controlling current in the magnetic means is cut off, the element first operating impinging upon the other element after a lapse of predetermined time to move it in said direction.

5. An electrically operated relay comprising in combination, a current controlled magnetic means, a pair of armatures each movable to two positions, both movable simultaneously to one position only by the

magnetic means when current is flowing therein, and each movable to the other position by gravity at predetermined different times, means acting on one of the armatures to cause the time difference in the movement of the two armatures after current is cut off the magnetic means and means associated with the armature acting first and cooperating with the magnetic means to vary the difference in the time of operation of the two armatures.

In testimony whereof I affix my signature.

SAMUEL S. STOLP.